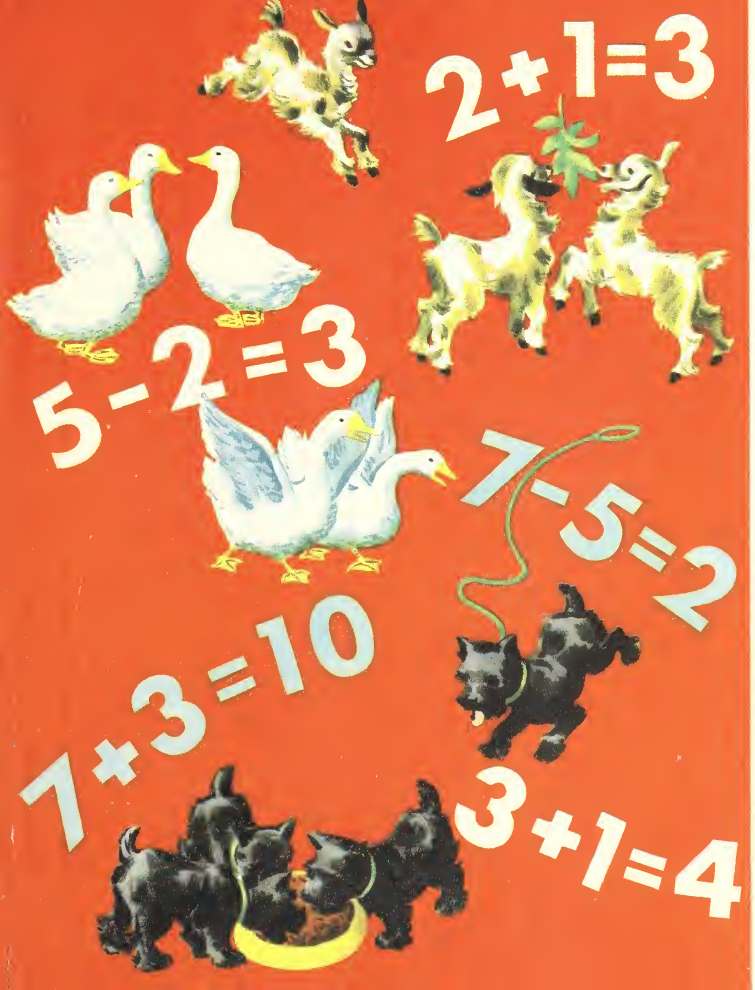
Numbers in Action

TEACHER'S EDITION

7-3=



CURRICULUM FOUNDATION SERIES

Numbers in Action

by Maurice L. Hartung

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CHICAGO, ATLANTA, DALLAS, NEW YORK

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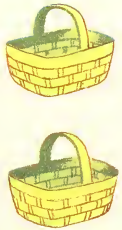
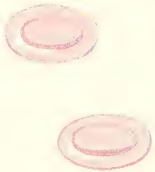
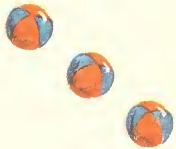
SEE MATERIAL BEGINNING ON PAGE 141 FOR A SUMMARY OF THE CONTENTS AND INFORMATION ABOUT THE USE OF THIS BOOK.



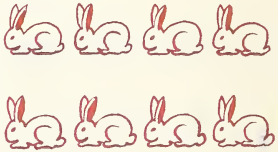
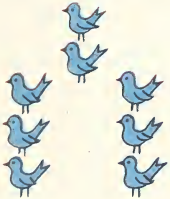


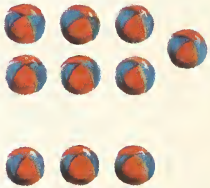




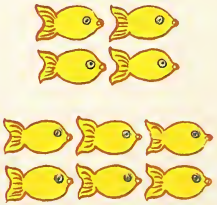




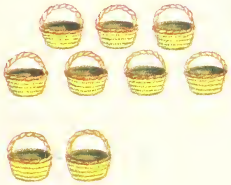
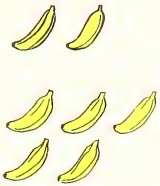
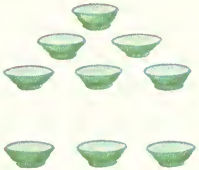



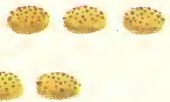








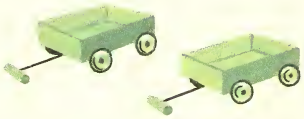




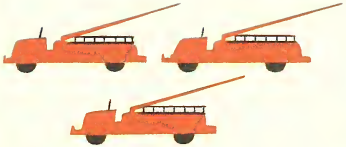


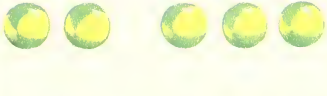


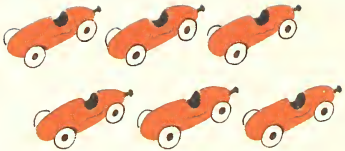


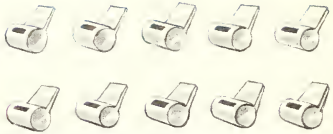

one	two	three	four	five	six	seven	eight	nine	ten
1	2	3	4	5	6	7	8	9	10











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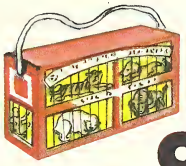

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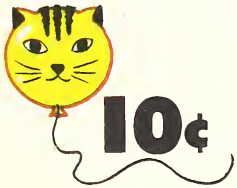

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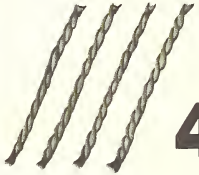
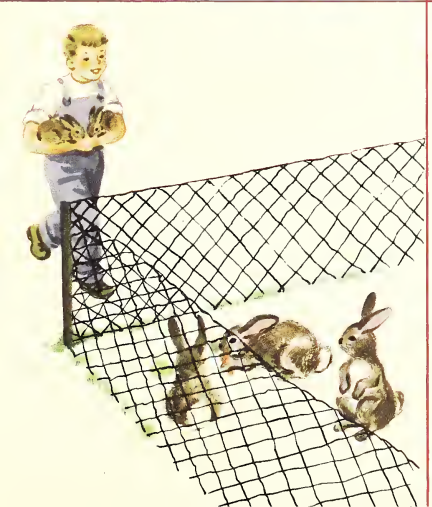
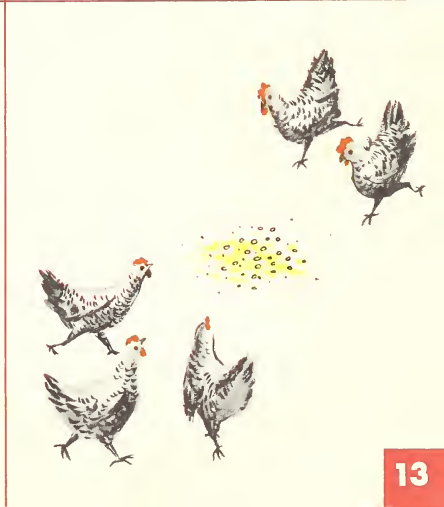


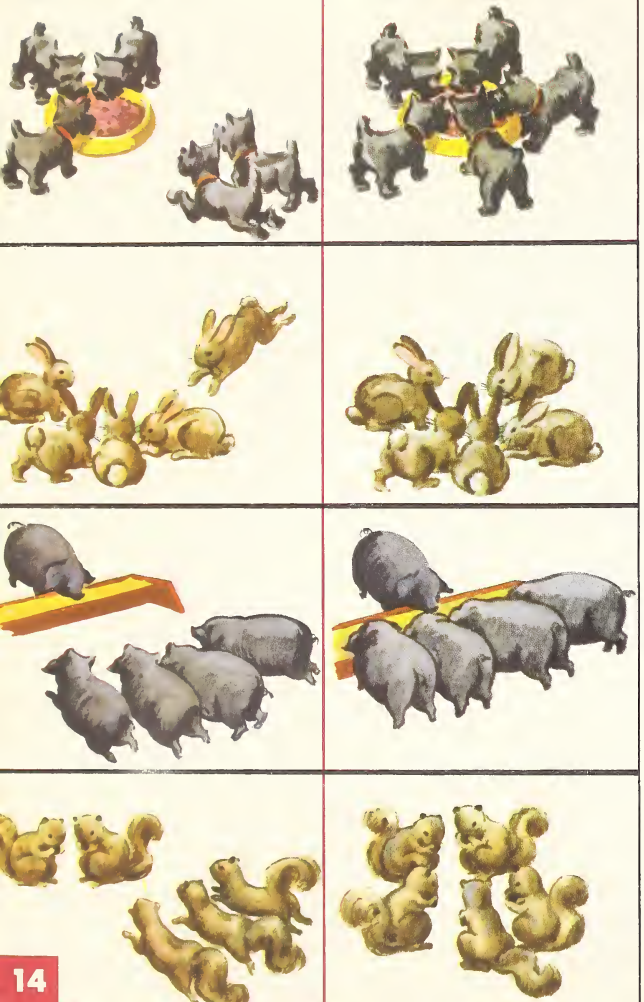
4¢

10¢

7¢





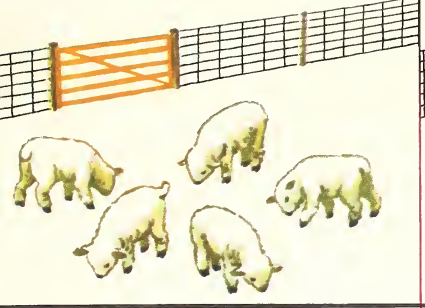


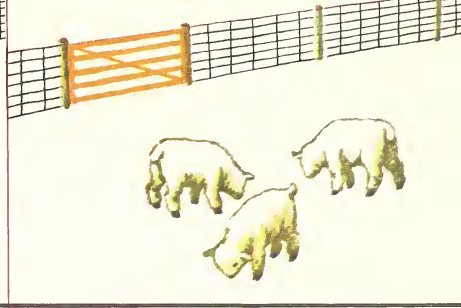
3 dogs are eating.
2 more dogs are running to eat.
Then 5 dogs will be eating.
3 dogs and 2 dogs are 5 dogs.
3 dogs plus 2 dogs are 5 dogs.

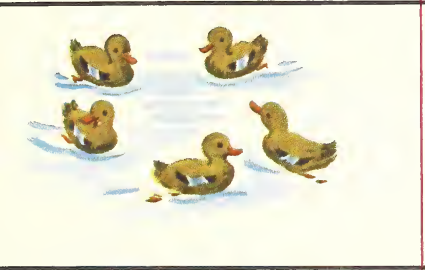
4 rabbits are in the yard.
1 more rabbit is running into the yard.
Then 5 rabbits will be in the yard.
4 rabbits and 1 rabbit are 5 rabbits.
4 rabbits plus 1 rabbit are 5 rabbits.

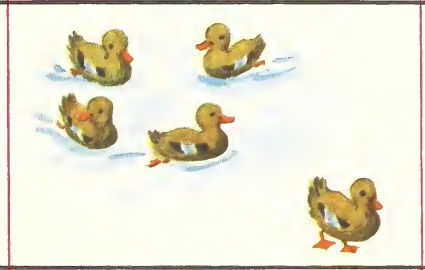
1 pig is eating.
4 more pigs are running to eat.
Then how many pigs will be eating?
1 pig and 4 pigs are 5 pigs.
1 pig plus 4 pigs is 5 pigs.

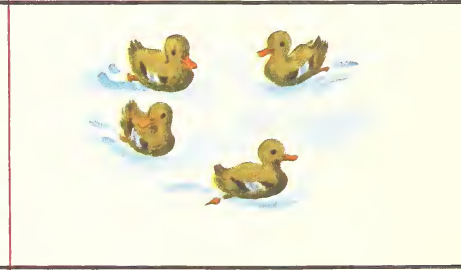
2 squirrels are eating.
3 more squirrels are running to eat.
Then how many squirrels will be eating?
2 squirrels and 3 squirrels are 5 squirrels.
2 squirrels plus 3 squirrels are 5 squirrels.

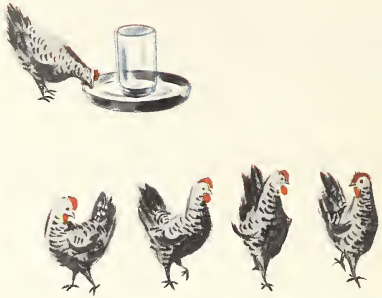






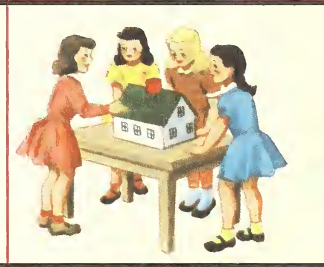






5 boys were playing ball.
3 boys are going away.
Then 2 boys are left to play ball.
5 boys minus 3 boys are 2 boys.

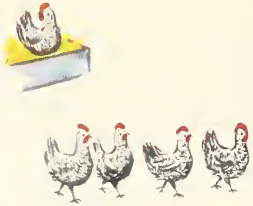
5 girls were playing house.
1 girl is going away.
Then 4 girls are left to play house.
5 girls minus 1 girl are 4 girls.



5 dolls were in the yard.
Carol took 2 dolls into the house.
Then how many dolls were in the yard?
5 dolls minus 2 dolls are 3 dolls.

5 toy cars were in the yard.
A boy took away 4 of the toy cars.
Then how many toy cars were in the yard?
5 cars minus 4 cars are 1 car.









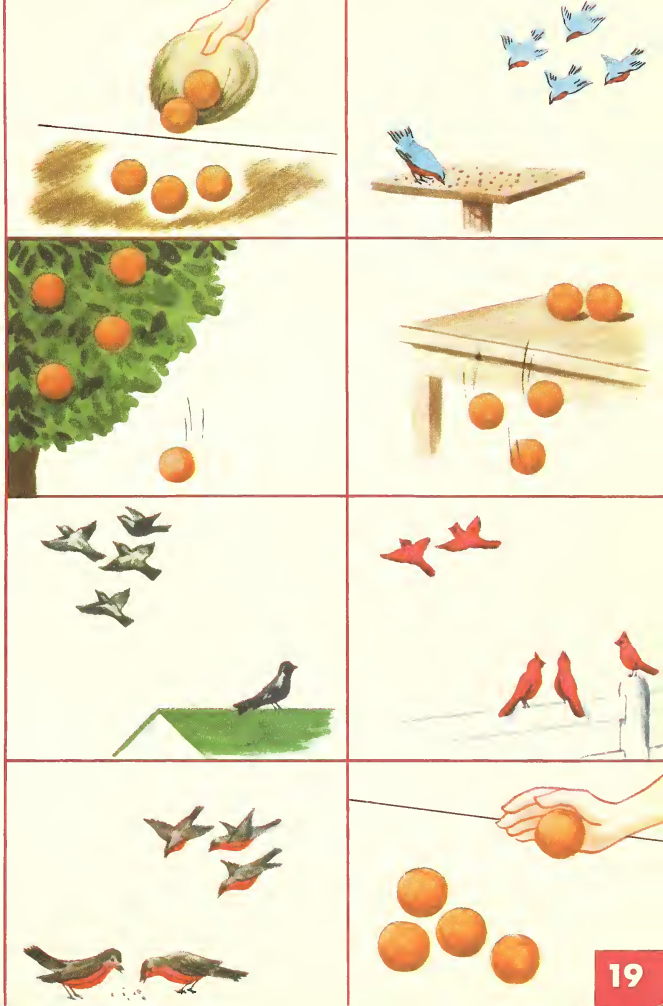


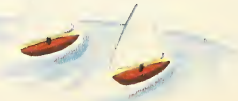





A 3 oranges plus 2 oranges are ▒ oranges.
B 5 birds minus 2 birds are ▒ birds.
C 1 bird plus 4 birds is ▒ birds.
D 5 oranges minus 3 oranges are ~~~~
E 4 oranges plus 1 orange are ~~~~
F 5 birds minus 4 birds are ~~~~
G 2 birds plus 3 birds are ~~~~
H 5 oranges minus 1 orange are ~~~~

A 4 chickens plus 1 chicken are ~~~~
B 5 pigs minus 2 pigs are ▒ pigs.
C 5 kittens minus 4 kittens are ~~~~
D 2 chickens plus 3 chickens are ~~~~
E 5 dogs minus 1 dog are ▒ dogs.
F 5 kittens minus 3 kittens are ~~~~
G 3 pigs plus 2 pigs are ~~~~
H 1 dog plus 4 dogs is ▒ dogs.
I 5 chickens minus 3 chickens are ~~~~
J 2 dogs plus 3 dogs are ~~~~
K 1 pig plus 4 pigs is ~~~~
L 5 chickens minus 4 chickens are ~~~~





2 children are playing in the yard.
1 more child is running to play.
Then how many children are playing?
2 children plus 1 child are 3 children.

1 child has some apples.
2 children are running for some apples.
Then how many children have apples?
1 child plus 2 children is 3 children.

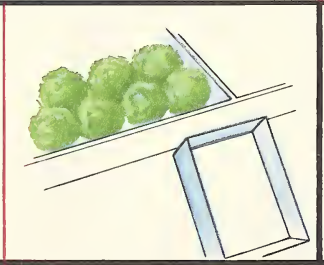
Don has 3 boats.
He is going to put 1 boat away.
Then how many boats are left?
3 boats minus 1 boat are 2 boats.

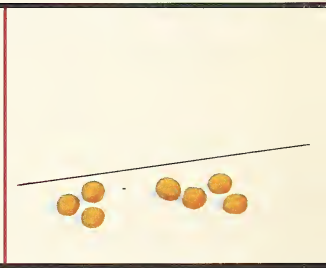
3 dogs were playing with Billy.
2 of the dogs are running to play with Don.
Then Billy will have ▬ dog to play with.
3 dogs minus 2 dogs are 1 dog.

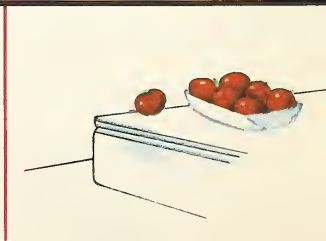
2 girls plus 1 girl are ▬ girls.

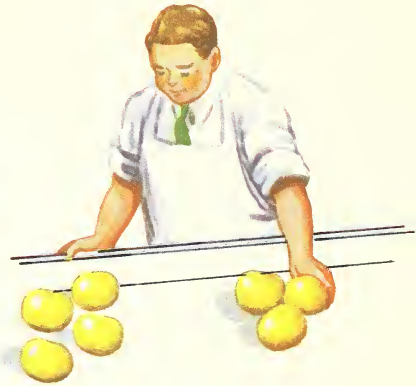
3 bottles minus 1 bottle are ▬ bottles.

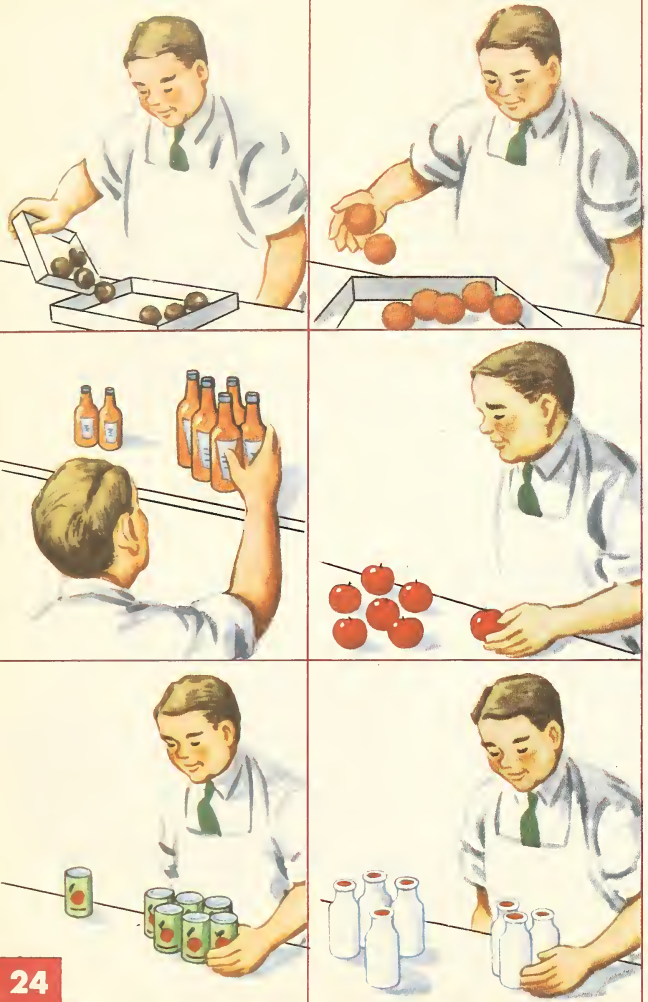
1 boy plus 1 boy is ▬ boys.











How many cookies are in the big box?
How many more are going into this big box?
Then how many cookies will be in the box?
3 cookies and 4 cookies are 7 cookies.
3 cookies plus 4 cookies are ▬ cookies.

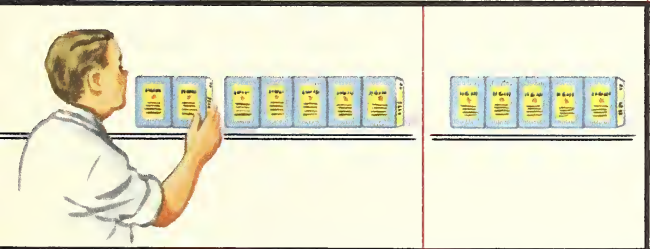
How many oranges are in the box?
How many more are going into the box?
Then how many oranges will be in the box?
5 oranges and 2 oranges are 7 oranges.
5 oranges plus 2 oranges are ▬ oranges.

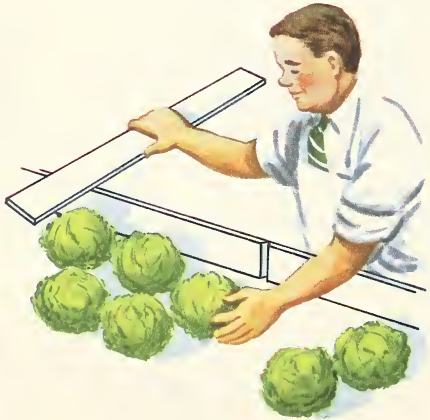
2 bottles and 5 bottles are 7 bottles.
2 bottles plus 5 bottles are ▬ bottles.

6 apples and 1 apple are 7 apples.
6 apples plus 1 apple are ~~~~

1 can and 6 cans are ▬ cans.
1 can plus 6 cans is ~~~~

4 bottles and 3 bottles are ▬ bottles.
4 bottles plus 3 bottles are ~~~~





How many boxes are there in all?
How many boxes is the man taking away?
How many boxes will be left?
7 boxes minus 2 boxes are ▒▒ boxes.

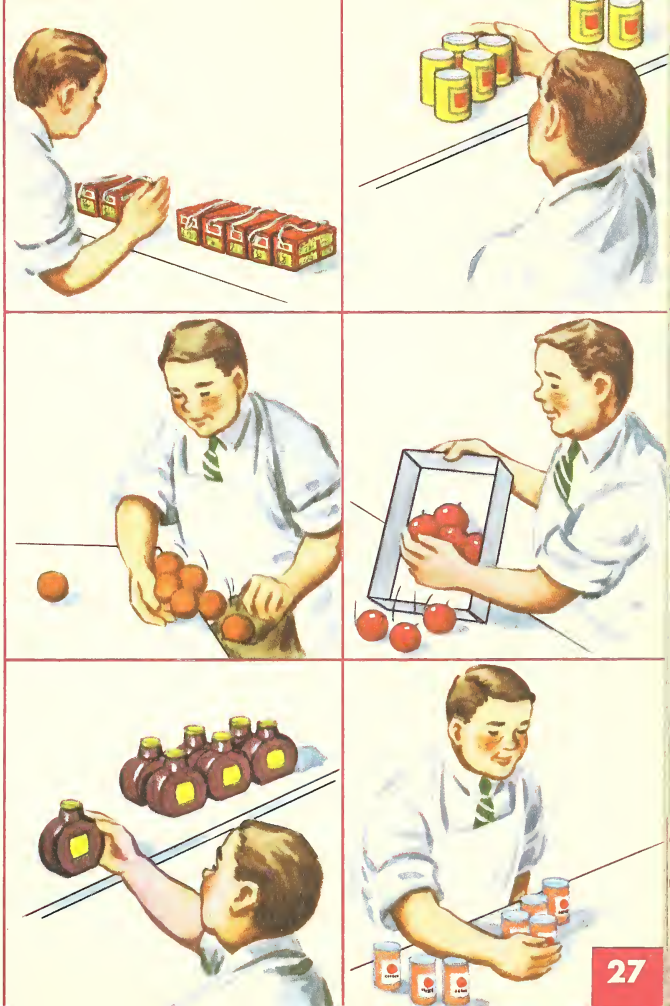
How many cans are there in all?
How many cans is the man taking away?
How many cans will be left?
7 cans minus 5 cans are ▒▒ cans.

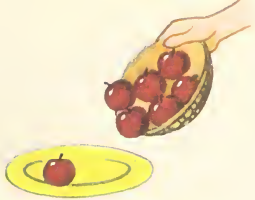
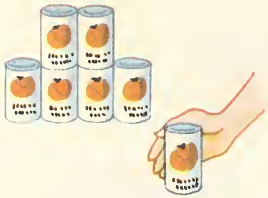
How many oranges are there in all?
How many oranges is the man taking away?
How many oranges will be left?
7 oranges minus 6 oranges are ~~~~

How many apples are there in all?
How many apples is he taking from the box?
How many apples will be left in the box?
7 apples minus 3 apples are ~~~~

7 bottles minus 1 bottle are ~~~~

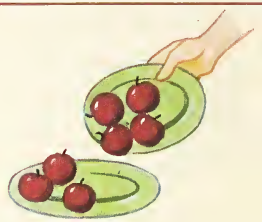
7 cans minus 4 cans are ~~~~

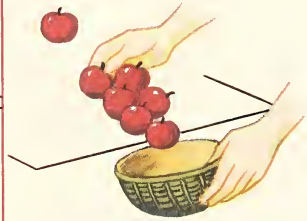
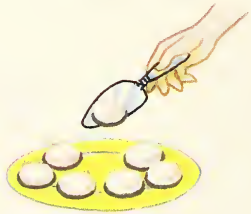


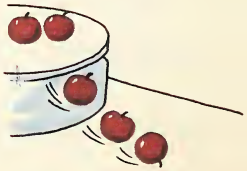






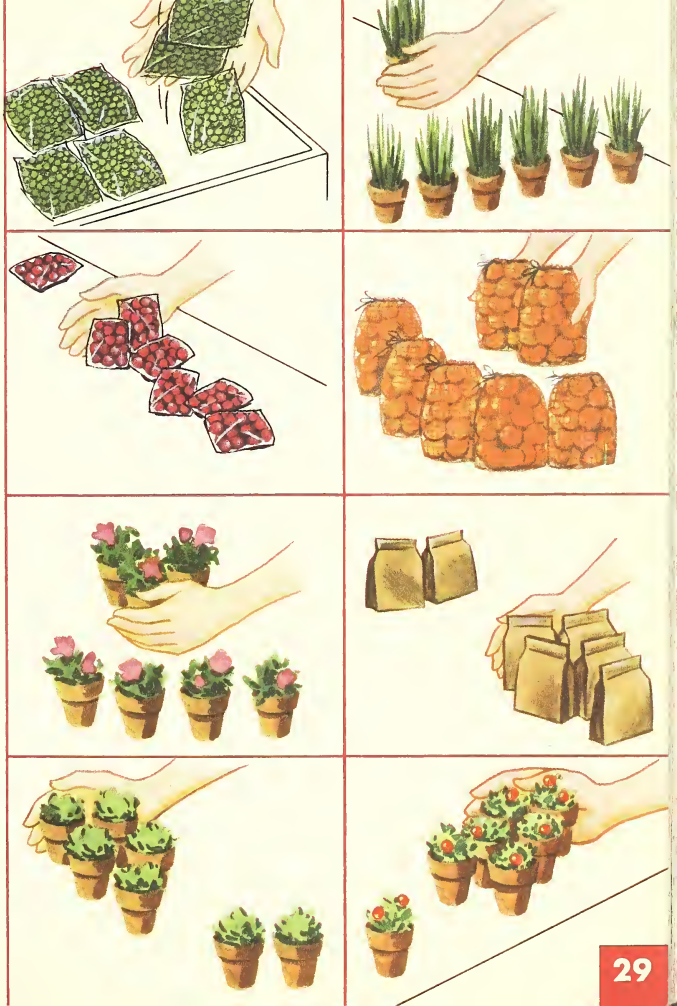





A 7 bags minus 5 bags are ▒ bags.
B 4 bags plus 3 bags are ▒ bags.
C 7 plants minus 1 plant are ~~~~
D 5 bags plus 2 bags are ▒ bags.
E 1 plant plus 6 plants is ~~~~
F 2 plants plus 5 plants are ~~~~
G 7 bags minus 6 bags are ~~~~
H 7 plants minus 3 plants are ▒ plants.

A 7 cans minus 4 cans are ▒ cans.
B 3 apples plus 4 apples are ▒ apples.
C 7 cookies minus 2 cookies are ~~~~
D 3 bottles minus 2 bottles are ~~~~
E 1 cookie plus 2 cookies is ▒ cookies.
F 5 apples minus 3 apples are ~~~~
G 6 cookies plus 1 cookie are ▒ cookies.
H 2 bottles plus 3 bottles are ▒ bottles.
I 5 cans plus 2 cans are ▒ cans.
J 7 cookies minus 5 cookies are ~~~~
K 7 bottles minus 3 bottles are ~~~~
L 1 apple plus 6 apples is ~~~~



How many girls are standing at the store?
How many more girls are going to the store?
Then how many girls will be at the store?
3 girls plus 4 girls are 7 girls.
3 girls+4 girls are 7 girls.
3 plus 4 is 7.
3+4 is 7.

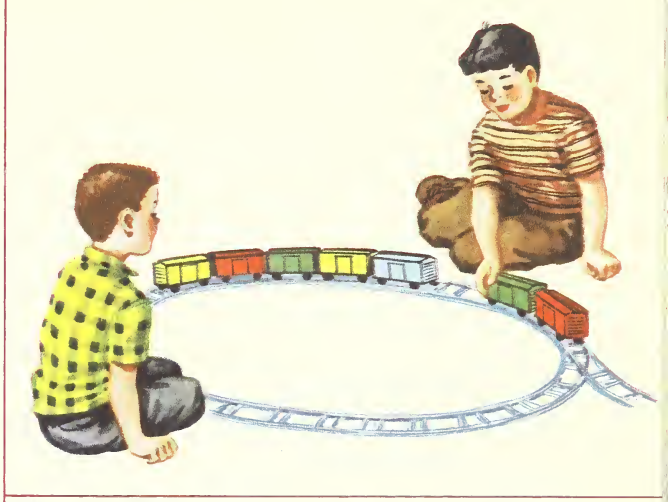
How many boys are standing in the yard?
How many boys are running into the yard?
Then how many boys will there be?
2 boys plus 3 boys are 5 boys.
2 boys+3 boys are 5 boys.
2 plus 3 is 5.
2+3 is 5.

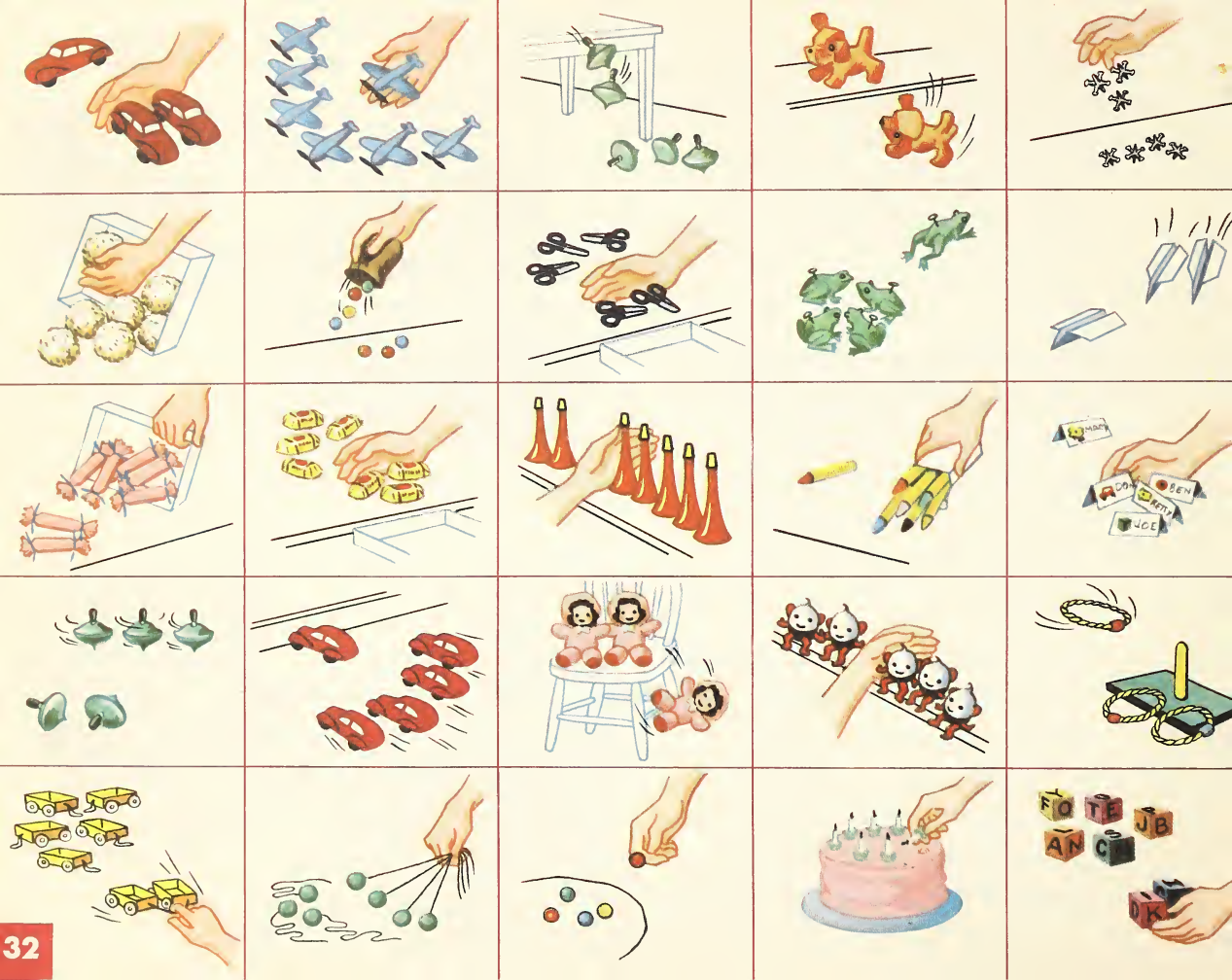
A 5+2 is ▒
B 2+1 is ▒
C 1+6 is ▒
D 4+3 is ▒
E 4+1 is ▒
F 2+5 is ▒
G 1+1 is ▒
H 3+2 is ▒
I 6+1 is ▒
J 1+2 is ▒
K 2+5 is ▒
L 1+4 is ▒
M 6+1 is ▒
N 2+1 is ▒

How many cars do the boys have?
How many cars is Don taking away?
How many cars will be left?
7 cars minus 2 cars are 5 cars.
7 cars−2 cars are 5 cars.
7 minus 2 is 5.
7−2 is 5.

How many girls are there in all?
How many girls are going away?
How many girls will be left?
5 girls minus 3 girls are 2 girls.
5 girls−3 girls are 2 girls.
5 minus 3 is 2.
5−3 is 2.

A 5−4 is ▒
B 7−1 is ▒
C 3−2 is ▒
D 7−6 is ▒
E 7−3 is ▒
F 3−1 is ▒
G 5−1 is ▒
H 5−2 is ▒
I 3−1 is ▒
J 7−4 is ▒
K 5−1 is ▒
L 7−5 is ▒
M 5−3 is ▒
N 7−6 is ▒




MARY
DAN
BEN
BETTY
JOE
F O
T E
J B
A N
C
D K

A 1+1 is 2.
B 1+2 is 3.
C 2+1 is 3.
D 1+4 is 5.
E 4+1 is 5.
F 2+3 is 5.
G 3+2 is 5.
H 1+6 is 7.
I 6+1 is 7.
J 2+5 is 7.
K 5+2 is 7.
L 3+4 is 7.
M 4+3 is 7.

A 2−1 is 1.
B 3−1 is 2.
C 3−2 is 1.
D 5−1 is 4.
E 5−2 is 3.
F 5−3 is 2.
G 5−4 is 1.
H 7−1 is 6.
I 7−2 is 5.
J 7−3 is 4.
K 7−4 is 3.
L 7−5 is 2.
M 7−6 is 1.

A 4+1 is ▭
B 1+6 is ▭
C 2+5 is ▭
D 3+4 is ▭
E 2+3 is ▭
F 5+2 is ▭
G 1+2 is ▭
H 3+2 is ▭
I 5−3 is ▭
J 3−1 is ▭
K 7−5 is ▭
L 5−4 is ▭
M 3−2 is ▭
N 7−3 is ▭
O 5−2 is ▭
P 7−4 is ▭

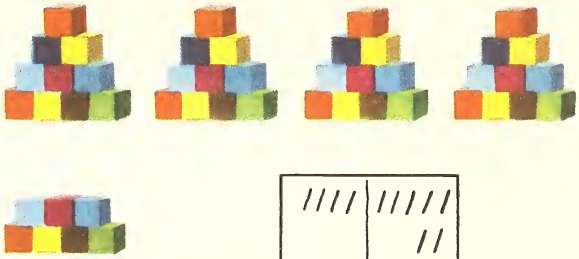
A Two boats plus one boat are ▭ boats.
B 5 balls minus 2 balls are ▭ balls.
C 2 oranges plus 5 oranges are ~~~~
D 3 kittens plus 2 kittens are ▭ kittens.
E Seven cows minus four cows are ▭ cows.
F 5 pigs minus 4 pigs are ~~~~
G Seven bags minus six bags are ~~~~
H 3 chickens plus 4 chickens are ~~~~
I 5 baskets minus 3 baskets are ~~~~
J One box plus four boxes is ▭ boxes.
K Seven birds minus two birds are ~~~~
L Four books plus three books are ~~~~
M 2 squirrels plus 3 squirrels are ~~~~
N Seven dolls minus five dolls are ▭ dolls.
O 3 bottles minus 1 bottle are ▭ bottles.
P Six children plus one child are ~~~~
Q Five wagons plus two wagons are ~~~~
R 4 plants plus 1 plant are ▭ plants.
S Three apples minus two apples are ~~~~
T Seven rabbits minus three rabbits are ~~~~
U Five men minus one man are ▭ men.
V 1 child plus 2 children is ~~~~

How many rabbits are eating?
How many rabbits are running to eat?
Then how many rabbits will be eating?
5 rabbits plus 2 rabbits are ~~~~~
Add 5 rabbits and 2 rabbits.
Then you have 7 rabbits.

A	Add 5 and 2.	5+2 is ▒
B	Add 3 and 1.	3+1 is ▒
C	Add 1 and 1.	1+1 is ▒
D	Add 4 and 3.	4+3 is ▒

How many dogs are there in all?
How many dogs are running away?
Then how many dogs will be left?
5 dogs minus 1 dog are ~~~~~
Subtract 1 dog from 5 dogs.
Then you have 4 dogs.

E	Subtract 1 from 5.	5−1 is ▒
F	Subtract 2 from 7.	7−2 is ▒
G	Subtract 1 from 3.	3−1 is ▒
H	Subtract 5 from 7.	7−5 is ▒

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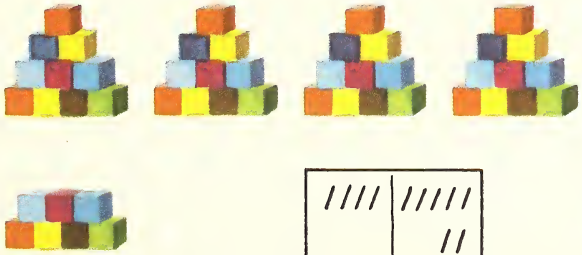


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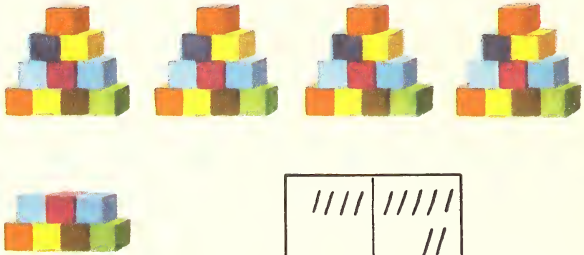

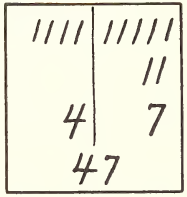
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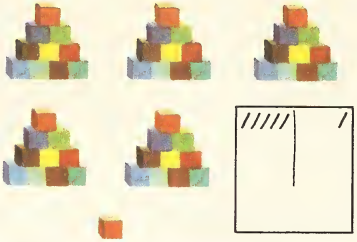

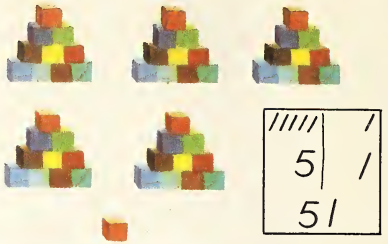
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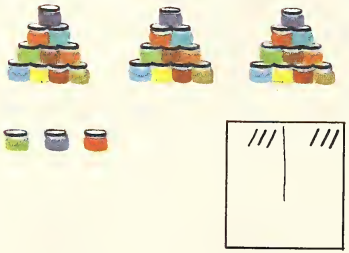

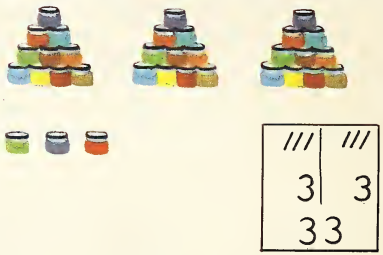
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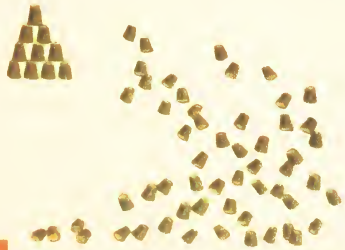

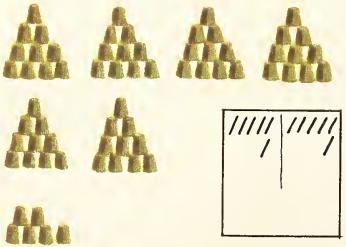

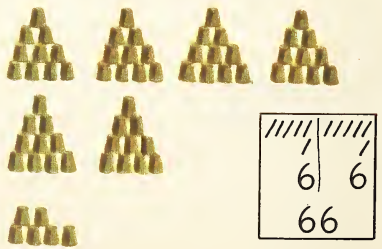
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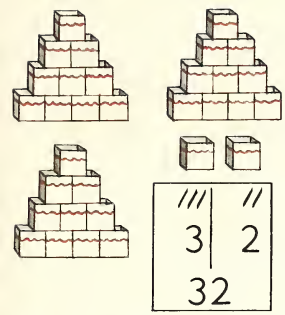
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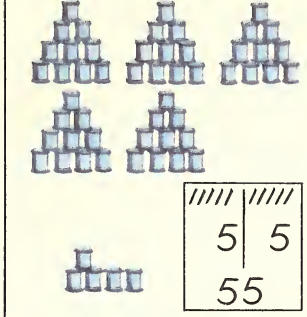
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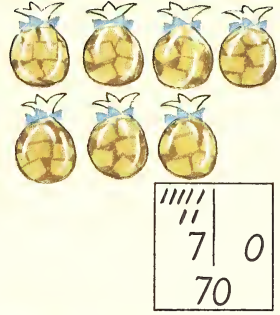
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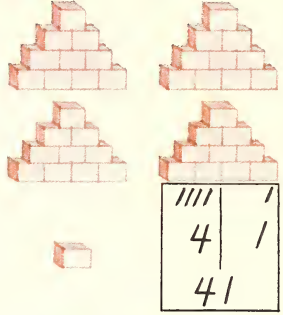
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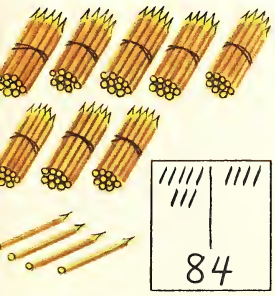
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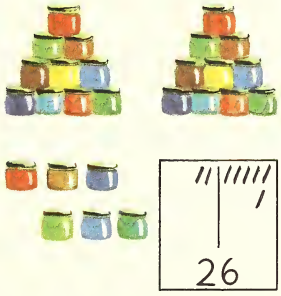
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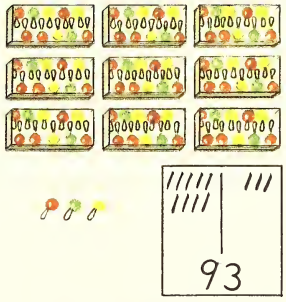
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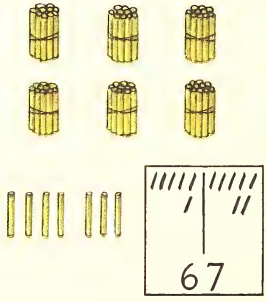
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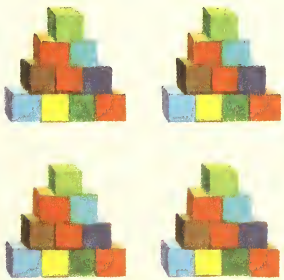

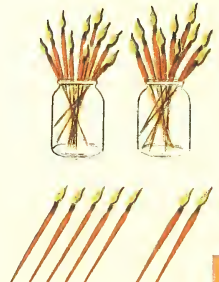

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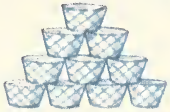

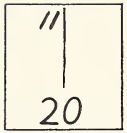

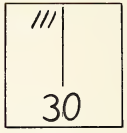

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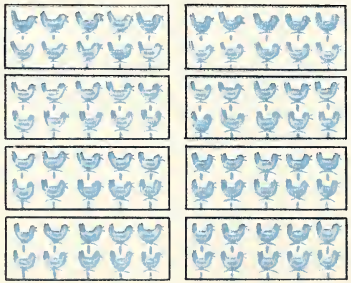

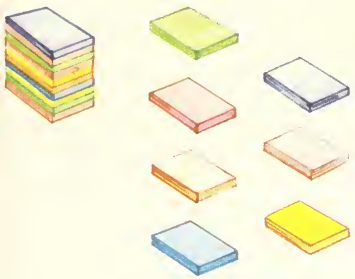

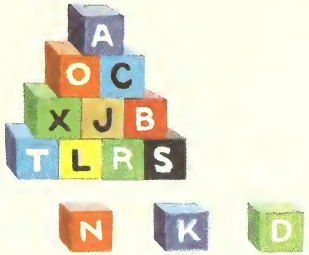

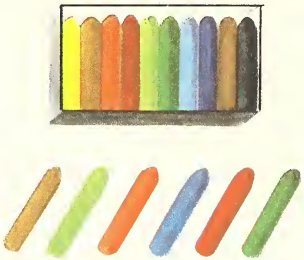

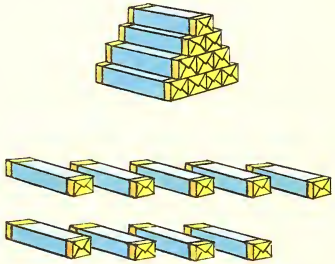

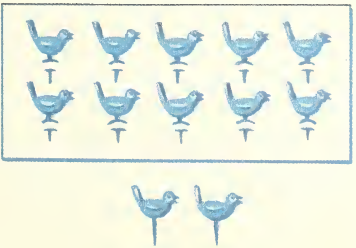

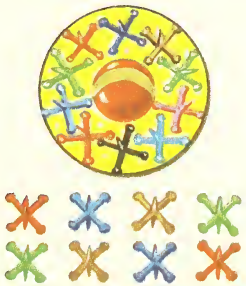

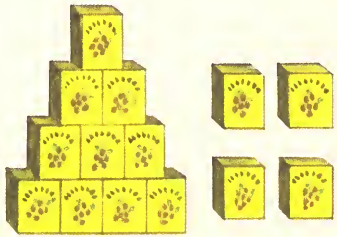

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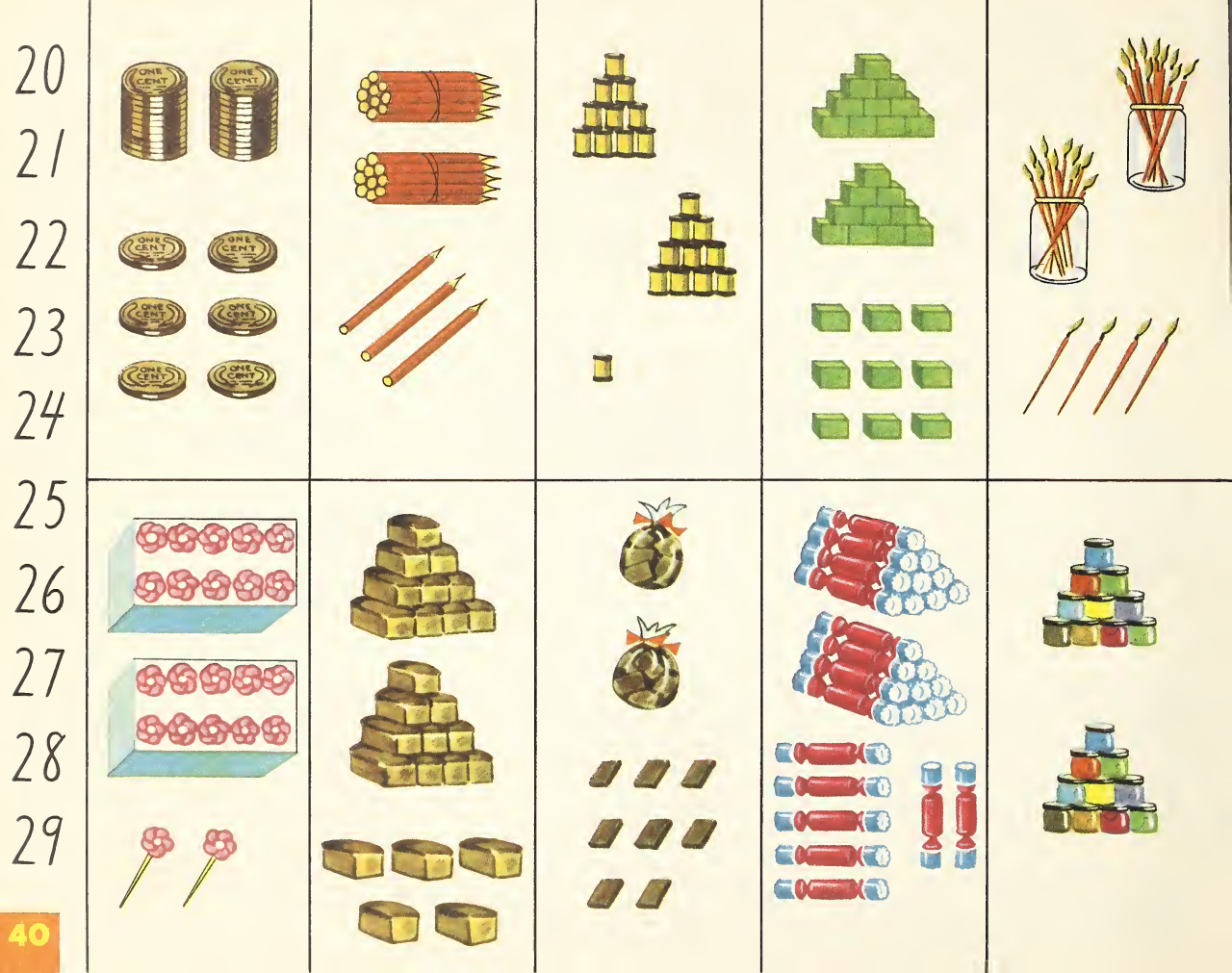
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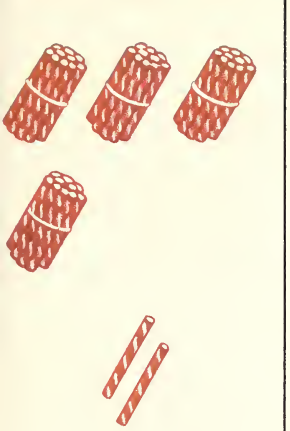

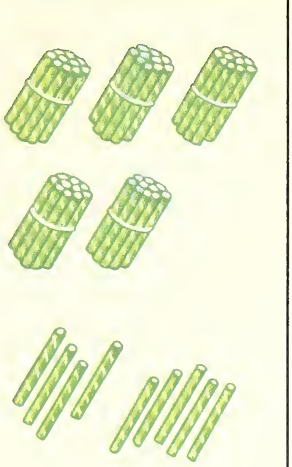

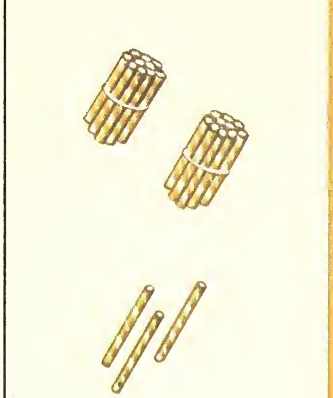

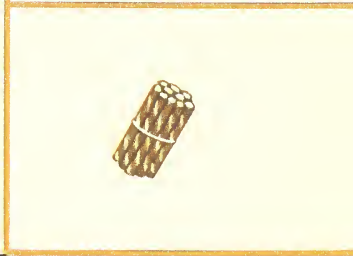

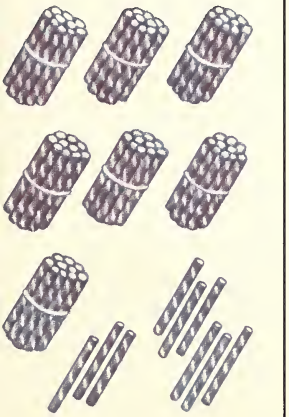

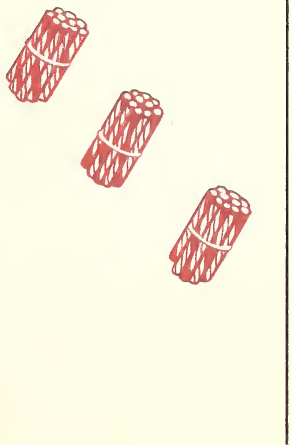

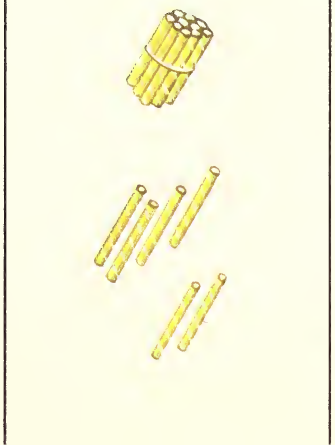

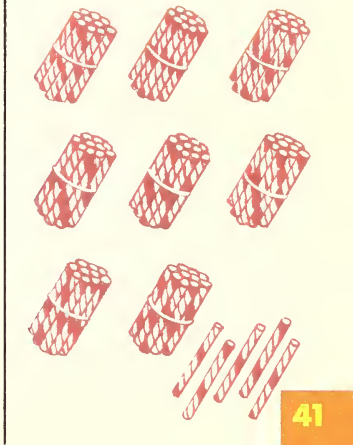

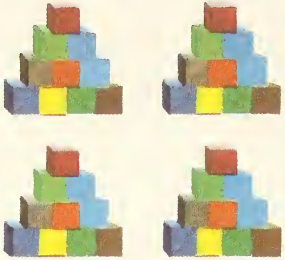

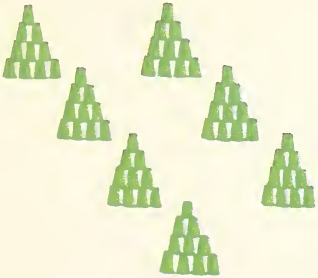

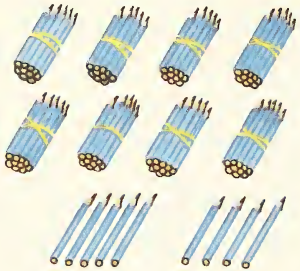

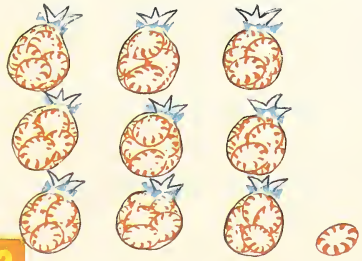

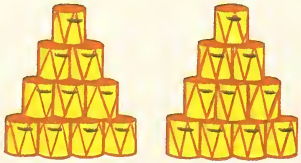


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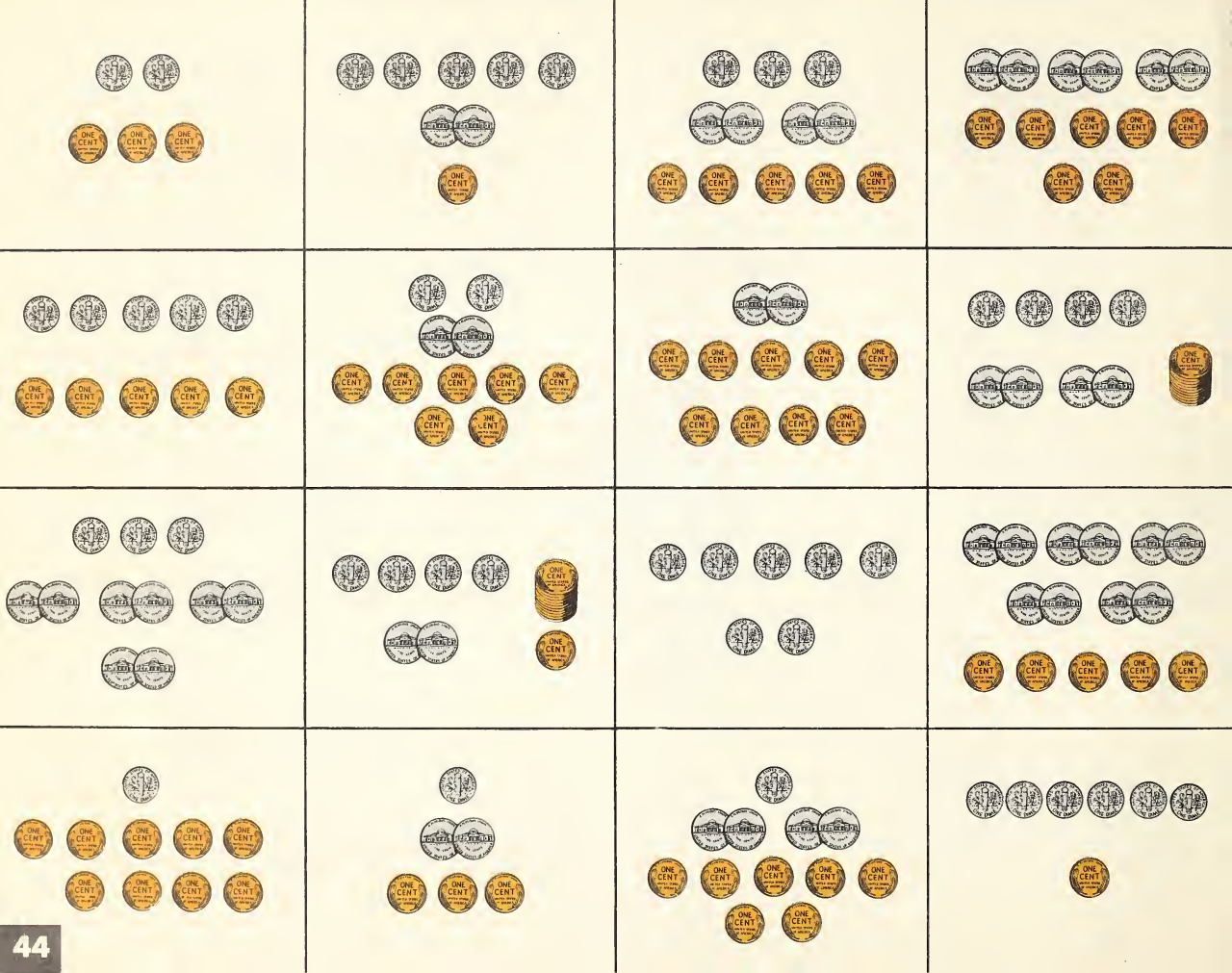


A Don has ▬¢.

B Carol has ▬¢.

C Has Carol more money than Don?

D Tom has ▬¢.

E Ellen has ▬¢.

F Has Tom more money than Ellen?

G Has Tom less money than Ellen?

H Has Ellen more money than Tom?

I Ellen is taking ▬¢ away.

J Ellen will have ▬¢ left.

K Will Ellen have less money than Tom?

L Nancy has ▬¢.

M Billy has ▬¢.

N Has Nancy more money than Billy?

O Has Billy less money than Ellen?

P Has Tom less money than Don?

Q Don and Carol have ▬¢ in all.

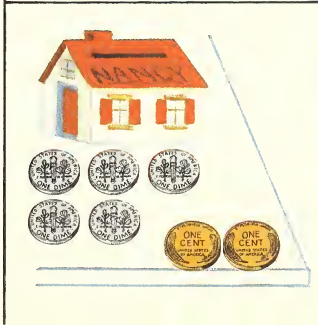
R Tom and Ellen have ▬¢ in all.

S Don, Carol, and Ellen have ▬¢ in all.

T Ellen and Nancy have ▬¢ in all.

U Don and Tom have ▬¢ in all.

V In all there are ▬¢ in pennies.



Carol has made 4 snowmen.
How many snowmen has Don made?
How many snowmen are there in all?
4 snowmen plus 2 snowmen are ~~~~~
4 plus 2 is ▬ 4+2 is ▬

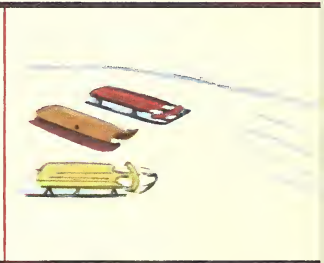
How many sleds do the boys have?
How many sleds are there for the girls?
How many sleds are there in all?
3 sleds plus 3 sleds are ~~~~~
3 plus 3 is ▬ 3+3 is ▬

How many children are on the sled?
How many children are running to the sled?
5 children plus 1 child are ~~~~~
5 plus 1 is ▬ 5+1 is ▬

2 snowballs plus 4 snowballs are ~~~~~
2 plus 4 is ▬ 2+4 is ▬

3 boys plus 3 boys are ~~~~~
3 plus 3 is ▬ 3+3 is ▬

1 boy plus 5 boys is ~~~~~
1 plus 5 is ▬ 1+5 is ▬



How many sleds has Don made?
How many sleds is Don taking away?
How many sleds will be left?
6 sleds minus 3 sleds are ~~~~
6 sleds minus 3 sleds equal ▒ sleds.
6 minus 3 is ▒ 6−3 equals ▒

How many pictures has Ellen made?
How many pictures is Ellen taking away?
How many pictures will be left?
6 pictures minus 1 picture are ~~~~
6 pictures minus 1 picture equal ~~~~
6 minus 1 is ▒ 6−1 equals ▒

6 pictures minus 2 pictures equal ~~~~
6 minus 2 is ▒ 6−2 equals ▒

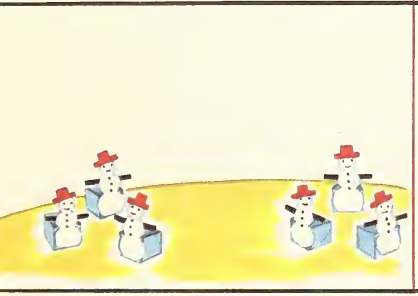
6 snowmen minus 5 snowmen equal ~~~~
6 minus 5 equals ▒ 6−5 equals ▒

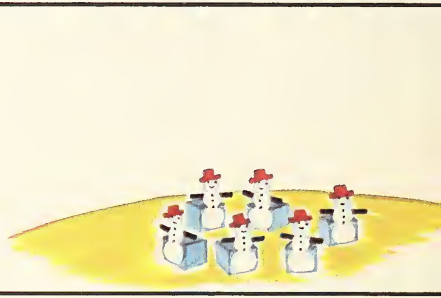
6 sleds minus 4 sleds equal ~~~~
6 minus 4 equals ▒ 6−4 equals ▒

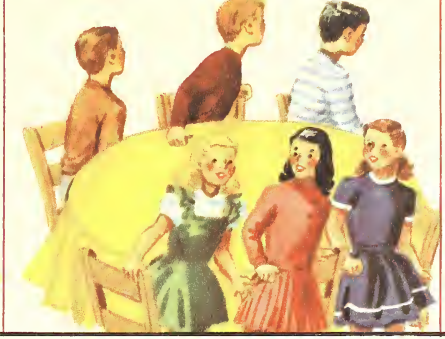
6 pictures minus 2 pictures equal ~~~~
6 minus 2 equals ▒ 6−2 equals ▒

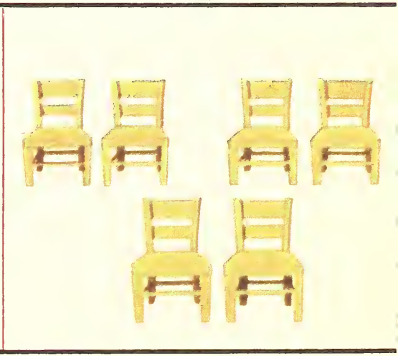


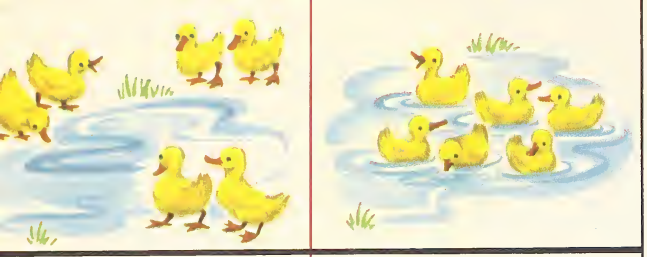


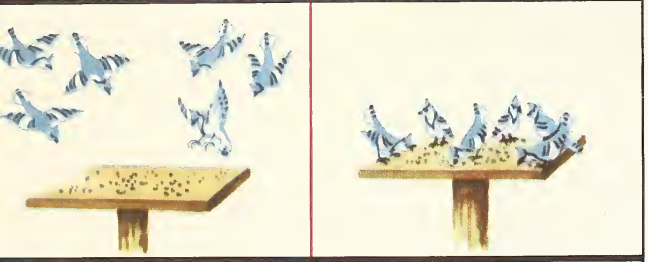



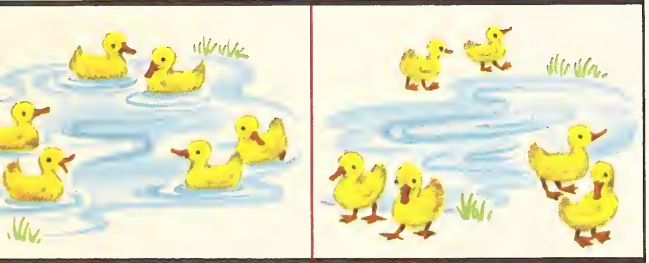


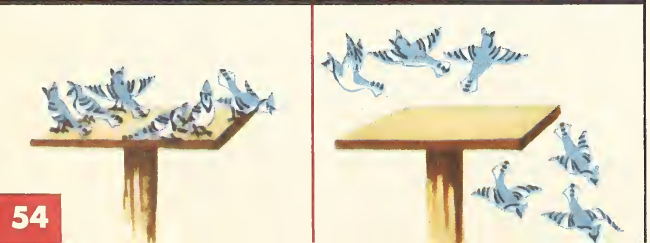












The ducks are going to the pond in groups.
How many groups of ducks are there?
How many ducks are in each group?
Now how many ducks are in the pond?
3 groups of 2 ducks equal 6 ducks.

The birds are flying to eat.
How many groups of birds are there?
How many birds are in each group?
Now how many birds are eating?
2 groups of 3 birds equal 6 birds.

How many ducks are in the pond?
They are going from the pond in groups.
How many ducks are in each group?
How many groups of ducks are there?
6 ducks equal 3 groups of 2 ducks each.

How many birds are there in all?
The birds are flying away in groups.
How many birds are in each group?
How many groups of birds are there?
6 birds equal 2 groups of 3 birds each.

How many chickens are eating?
How many more chickens are running to eat?
Then how many chickens will be eating?
4 chickens plus 2 chickens equal ~~~~~
4 chickens+2 chickens=6 chickens
4 plus 2 equals 6. 4+2=6

How many rabbits are there in the yard?
How many rabbits are running away?
How many rabbits will be left in the yard?
5 rabbits−3 rabbits=▒ rabbits

The birds are flying in threes.
2 groups of 3 birds each=▒ birds
2 threes=▒

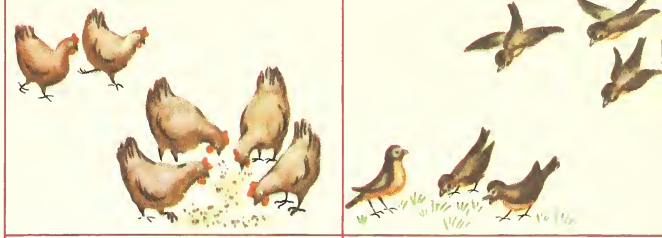
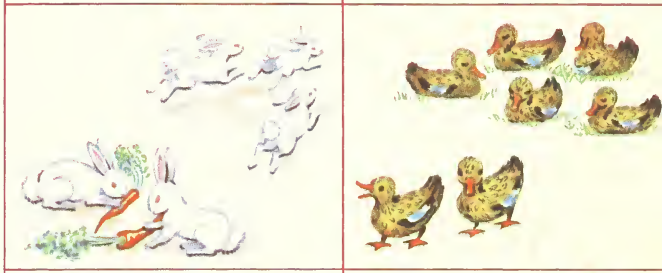
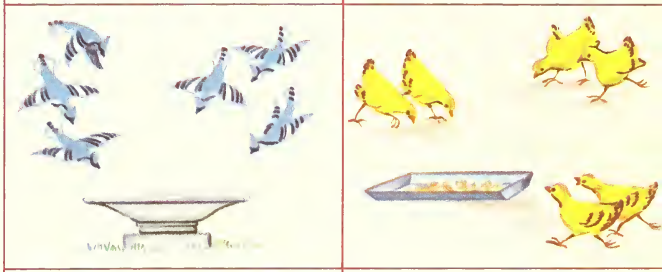
The ducks are going from the pond in twos.
6 ducks=▒ groups of 2 ducks each
6=▒ twos

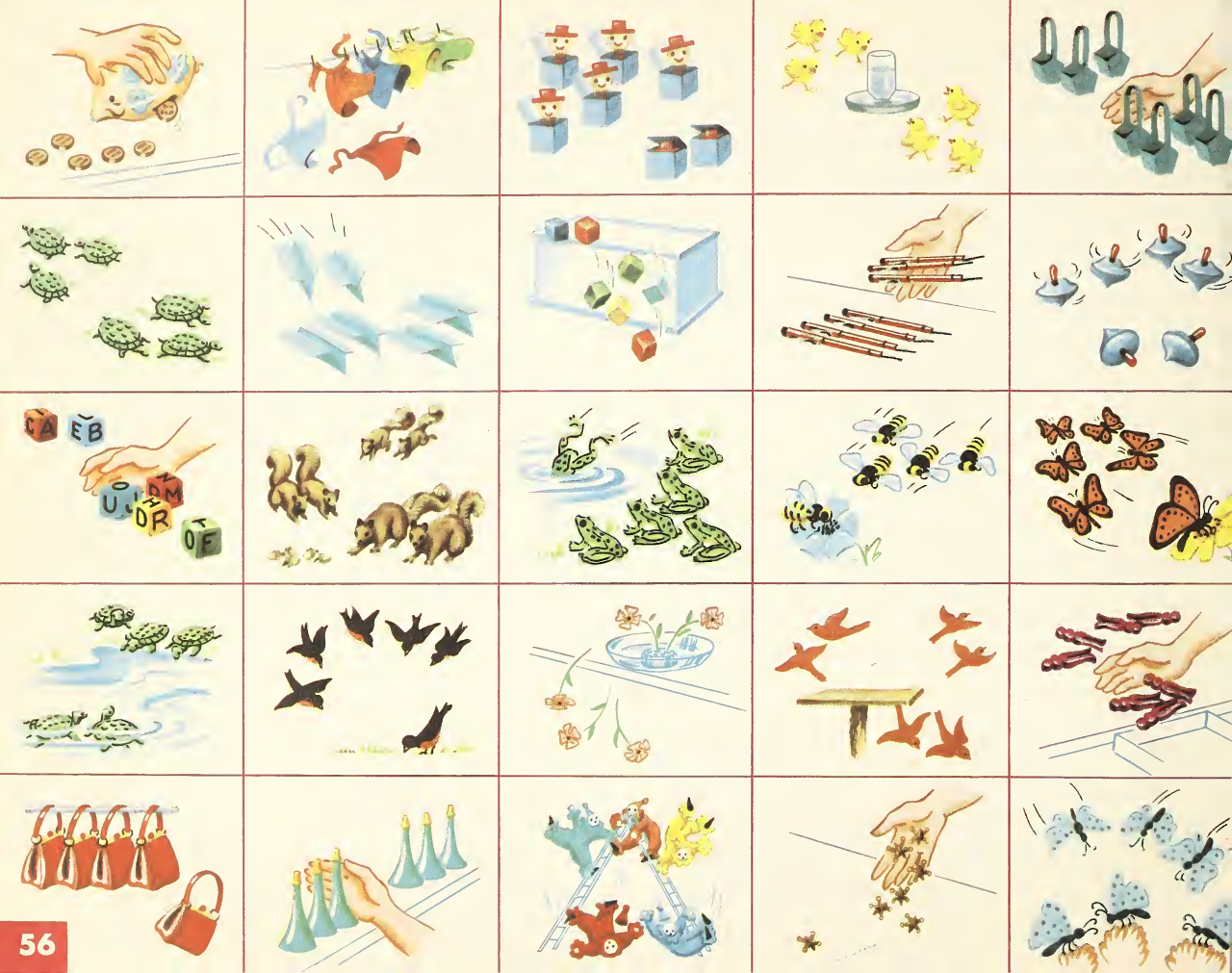
3 birds+3 birds=▒ birds 3+3=▒

7 ducks−2 ducks=▒ ducks 7−2=▒

3 groups of 2 chickens each=▒ chickens

6 rabbits=▒ groups of 3 rabbits each



CA
EB
OR
OF

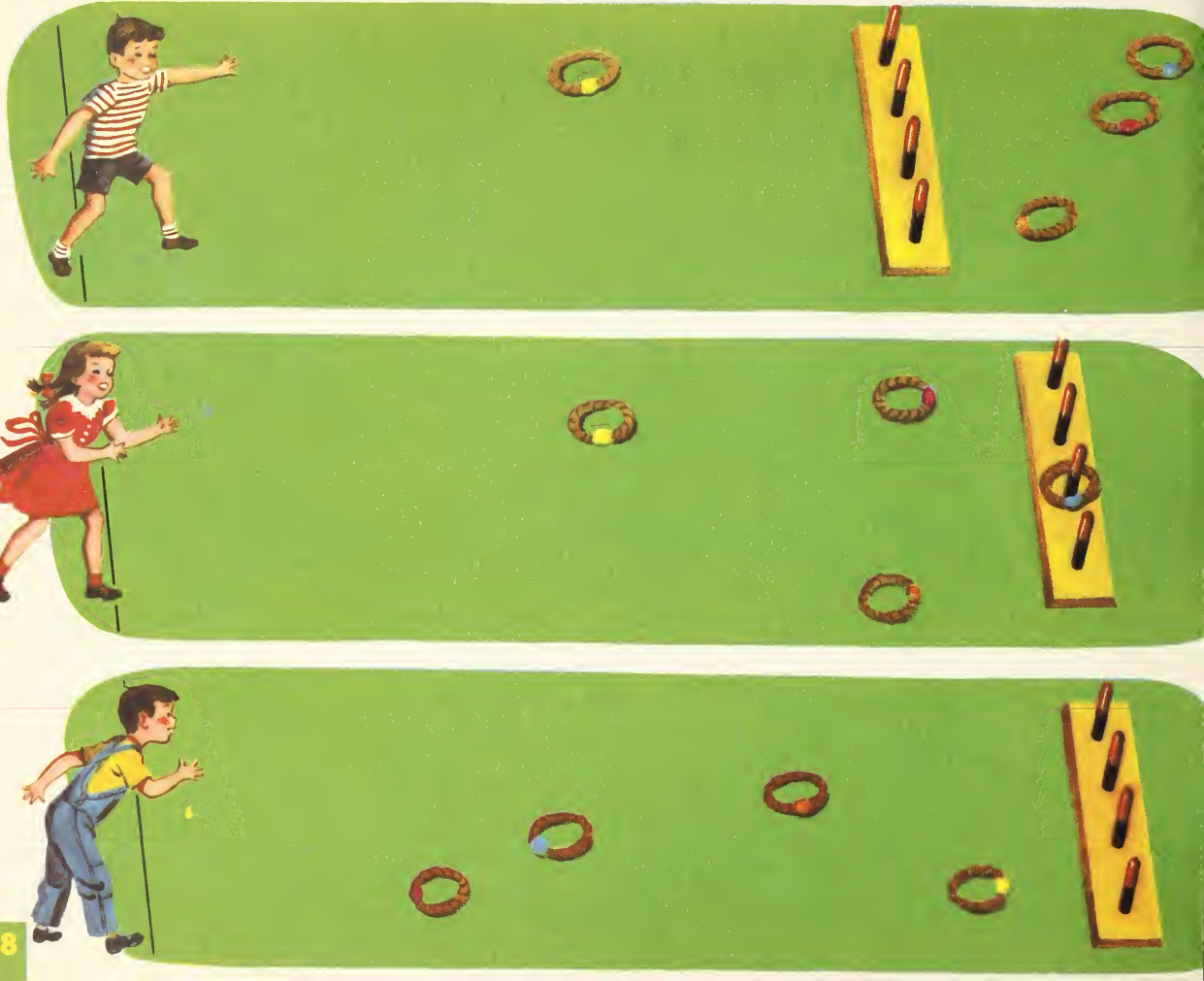
A 1+1=2
B 1+2=3
C 2+1=3
D 1+4=5
E 4+1=5
F 2+3=5
G 3+2=5
H 1+5=6
I 5+1=6
J 2+4=6
K 4+2=6
L 3+3=6
M 1+6=7
N 6+1=7
O 2+5=7
P 5+2=7
Q 3+4=7
R 4+3=7

A 2−1=1
B 3−1=2
C 3−2=1
D 5−1=4
E 5−2=3
F 5−3=2
G 5−4=1
H 6−1=5
I 6−2=4
J 6−3=3
K 6−4=2
L 6−5=1
M 7−1=6
N 7−2=5
O 7−3=4
P 7−4=3
Q 7−5=2
R 7−6=1

A 3 twos=6
B 2 threes=6
C 6=3 twos
D 6=2 threes

A Five minus three equals ▭
B 4 plus 2 equals ▭
C Two plus three equals ▭
D 5 minus 2 equals ▭
E 6 minus 3 equals ▭
F 2 groups of 3 equal ▭
G Seven minus three equals ▭
H 2 plus 4 equals ▭
I 3 groups of 2 equal ▭
J Six minus two equals ▭
K 5 plus 2 equals ▭
L 4 plus 3 equals ▭
M Six equals ▭ groups of three.
N One plus five equals ▭
O Six minus five equals ▭
P 5 plus 1 equals ▭
Q 1 plus 4 equals ▭
R Six equals ▭ groups of two.
S Four plus three equals ▭
T Six minus one equals ▭
U Seven minus five equals ▭
V 3 plus 4 equals ▭

A 7−3=▭
B 5−3=▭
C 1+4=▭
D 1+6=▭
E 7−5=▭
F 4+2=▭
G 5+1=▭
H 6−2=▭
I 2+3=▭
J 5−1=▭
K 3+3=▭
L 6−5=▭
M 4+3=▭
N 5+2=▭
O 6−4=▭
P 7−4=▭
Q 1+5=▭
R 2+4=▭
S 6−1=▭
T 5−2=▭
U 6−3=▭
V 2+5=▭



A The toy umbrella is ▭ inches long.

B Which toy is longer than the umbrella?

C Which toys are longer than the toy boat?

D Which toys are just as long as the toy umbrella?

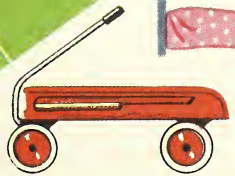
E Which toys are just 1 inch long?

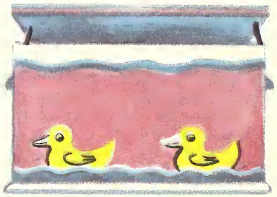
F Which toy is longer than 2 inches?

G Is there a toy more than 3 inches long?

H Is there a toy less than 1 inch long?

I Which toys are less than 2 inches long?





A Is the picture longer than the wagon?

B Is the wagon longer than the box?

C Which toys are just as long as the boat?

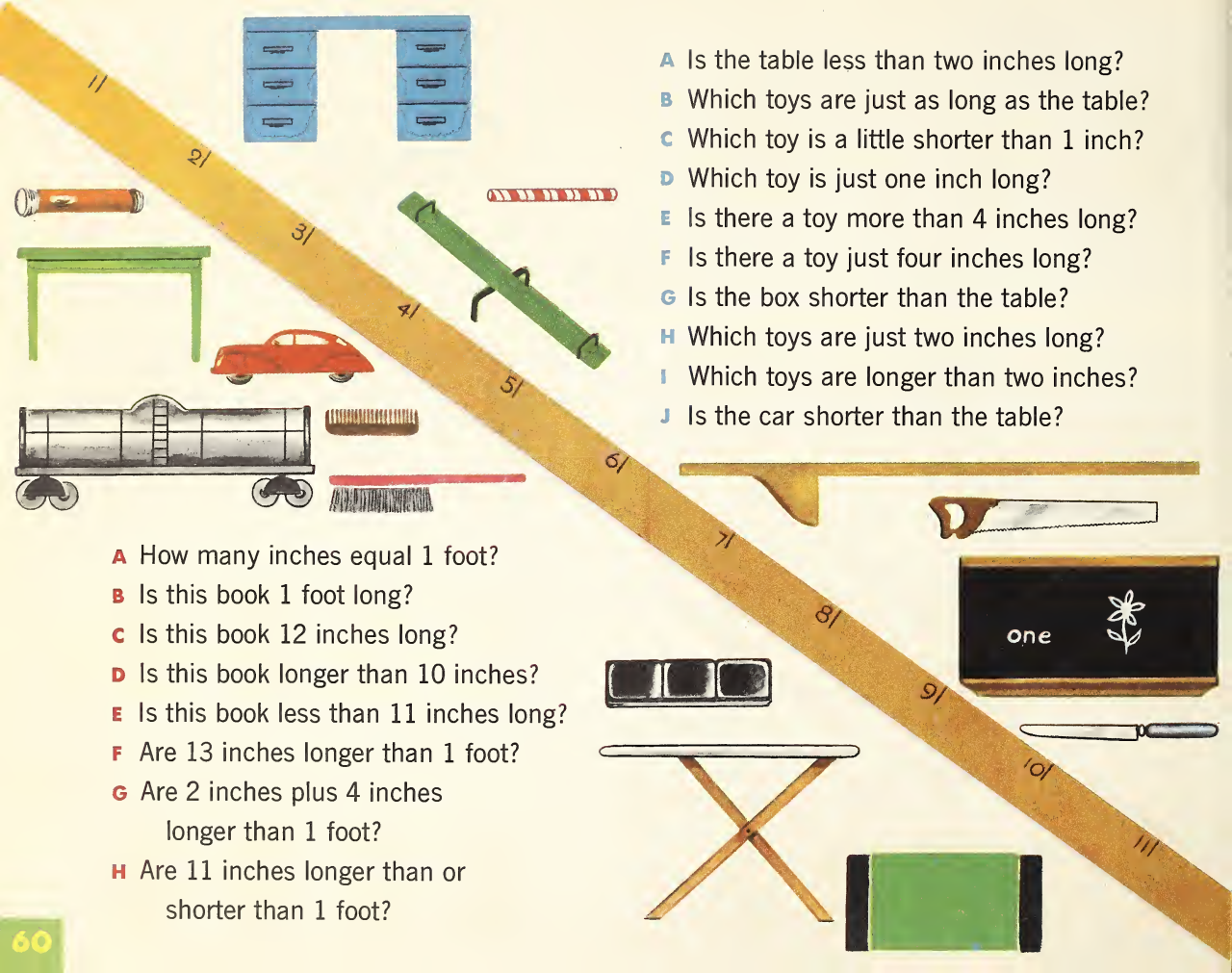
D Which toy is just as long as the car?

E Is the boat more than 1 inch long?

F Is the boat less than 2 inches long?

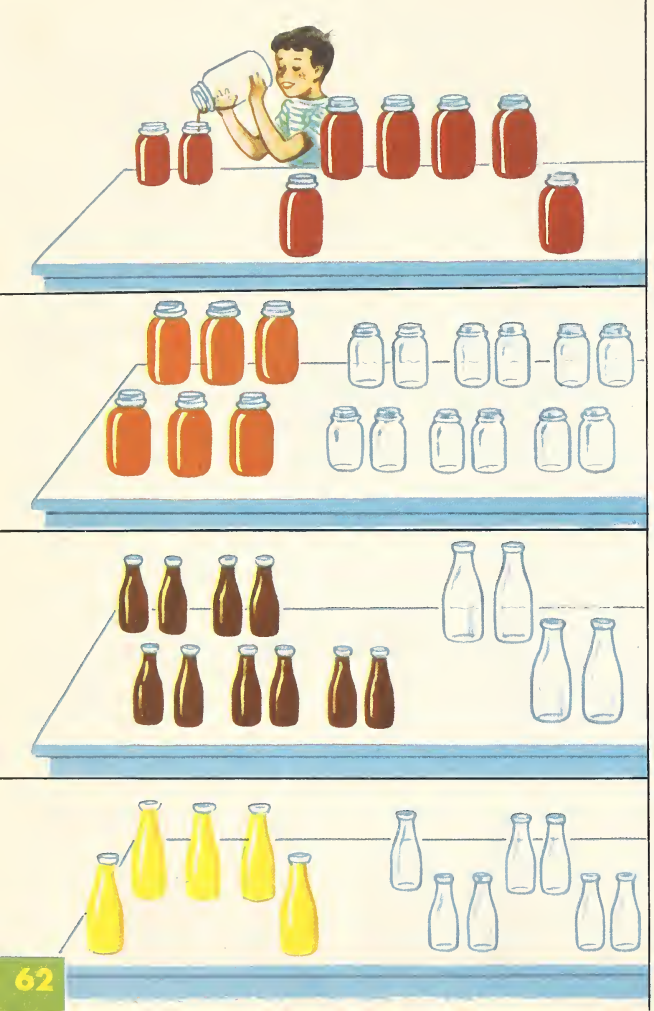
G Which toys are more than 1 inch long and less than 2 inches long?

H Which toy is more than 2 inches long and less than 3 inches long?



A Is the table less than two inches long?
B Which toys are just as long as the table?
C Which toy is a little shorter than 1 inch?
D Which toy is just one inch long?
E Is there a toy more than 4 inches long?
F Is there a toy just four inches long?
G Is the box shorter than the table?
H Which toys are just two inches long?
I Which toys are longer than two inches?
J Is the car shorter than the table?

A How many inches equal 1 foot?
B Is this book 1 foot long?
C Is this book 12 inches long?
D Is this book longer than 10 inches?
E Is this book less than 11 inches long?
F Are 13 inches longer than 1 foot?
G Are 2 inches plus 4 inches longer than 1 foot?
H Are 11 inches longer than or shorter than 1 foot?



A 3 twos = ▭

1 quart = 2 pints

3 quarts = ▭ pints

B 6 = ▭ twos

2 pints = 1 quart

6 pints = ▭ quarts

C 1 pint plus 1 pint equals ~~~~

D 2 pints plus 2 pints equal ▭ pints.

E 2 pints plus 2 pints equal ▭ quarts.

F Are 3 pints more than 1 quart?

G Are 3 pints less than 1 quart?

H 1 quart plus 1 quart equals ▭ pints.

I Are 2 quarts more than 3 pints?

J Are 2 quarts less than 3 pints?

K 1 quart plus 1 pint equals ▭ pints.

L 1 quart plus 2 pints equals ▭ quarts.

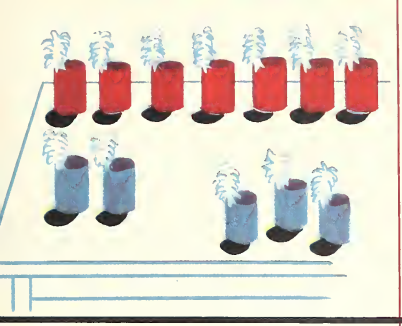
M 2 pints plus 1 quart equal ▭ pints.

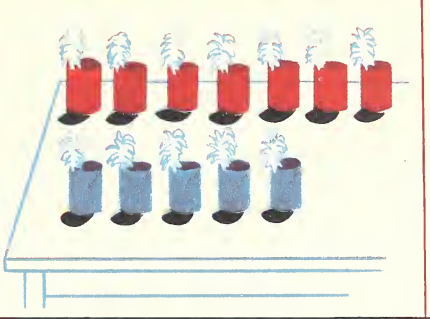
N 3 bottles of 2 pints each equal ▭ pints.

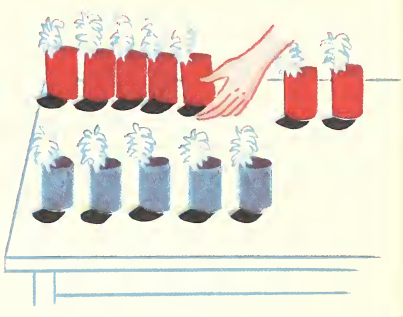
O 3 groups of 2 pints each equal ▭ pints.

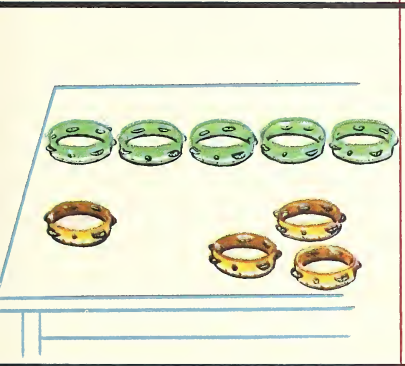
P 6 pints = ▭ bottles of 2 pints each

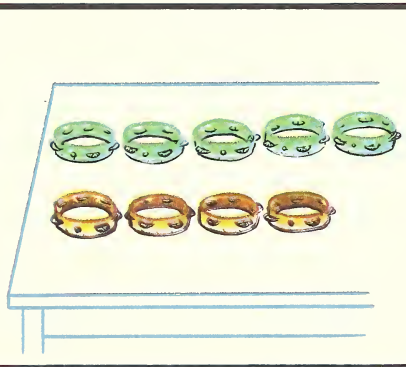
Q 6 pints = ▭ groups of 2 pints each

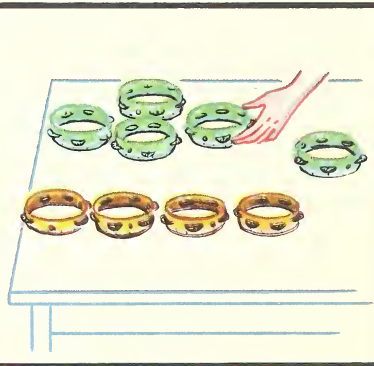


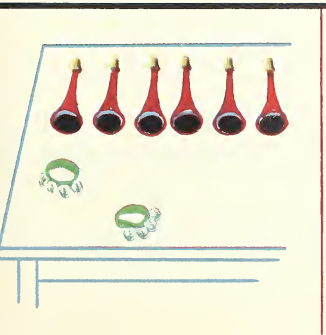


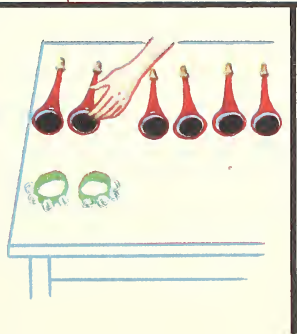


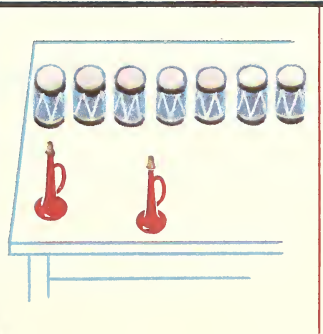


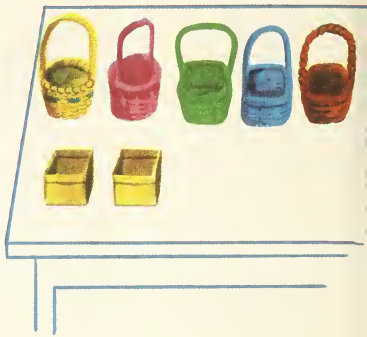


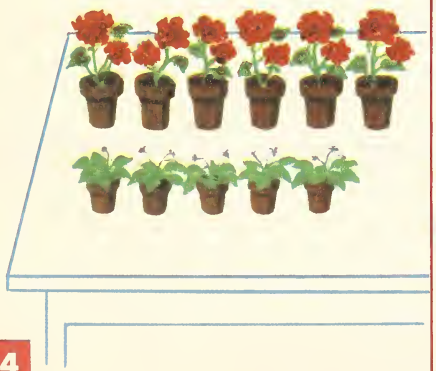












Some girls are playing they are rabbits.
How many more white rabbits are there than brown rabbits?
Subtract as many white rabbits as there are brown rabbits.
3 white rabbits − 2 white rabbits = ~~~~
There is ▭ more white rabbit.

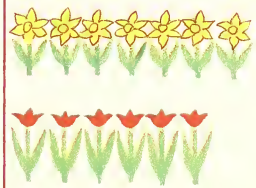
How many more bears are there than rabbits?
Subtract as many bears as there are rabbits.
6 bears − 1 bear = ~~~~

How many more wagons are there than cars?
How many wagons do you subtract?
6 wagons − 3 wagons = ~~~~

How many more little plants are there than big plants?
How many little plants do you subtract?
7 little plants − 4 little plants = ~~~~

7 yellow flowers − 6 yellow flowers = ~~~~

5 big baskets − 3 big baskets = ~~~~



How many more brown baskets are there than yellow baskets?

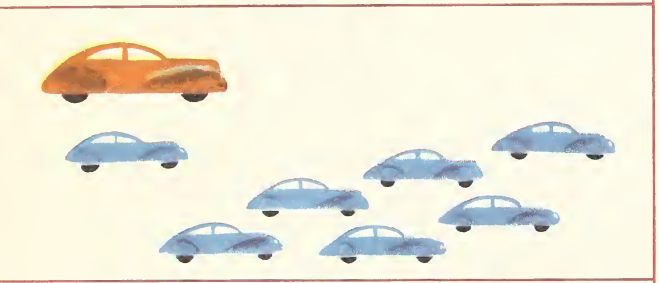
How many brown baskets do you subtract?

5 brown baskets − 1 brown basket = ~~~~

How many more kittens are there than dogs?

How many kittens do you subtract?

6 kittens − 4 kittens = ~~~~ 6 − 4 = ▒

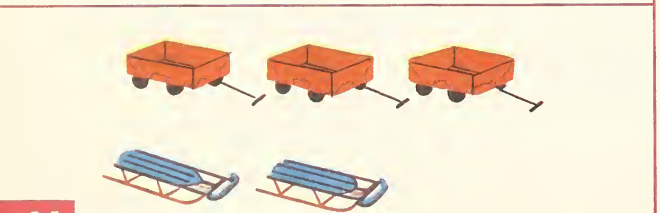


Are there more little cars than big cars?

How many more little cars are there?

How many little cars do you subtract?

7 little cars − 1 little car = ~~~~



There are how many more wagons than sleds?

How many wagons do you subtract?

3 wagons − 2 wagons = ~~~~ 3 − 2 = ▒

A 7 − 1 = ▒

B 3 − 2 = ▒

C 5 − 1 = ▒

D 6 − 4 = ▒

E 5 − 3 = ▒

F 7 − 5 = ▒

G 6 − 2 = ▒

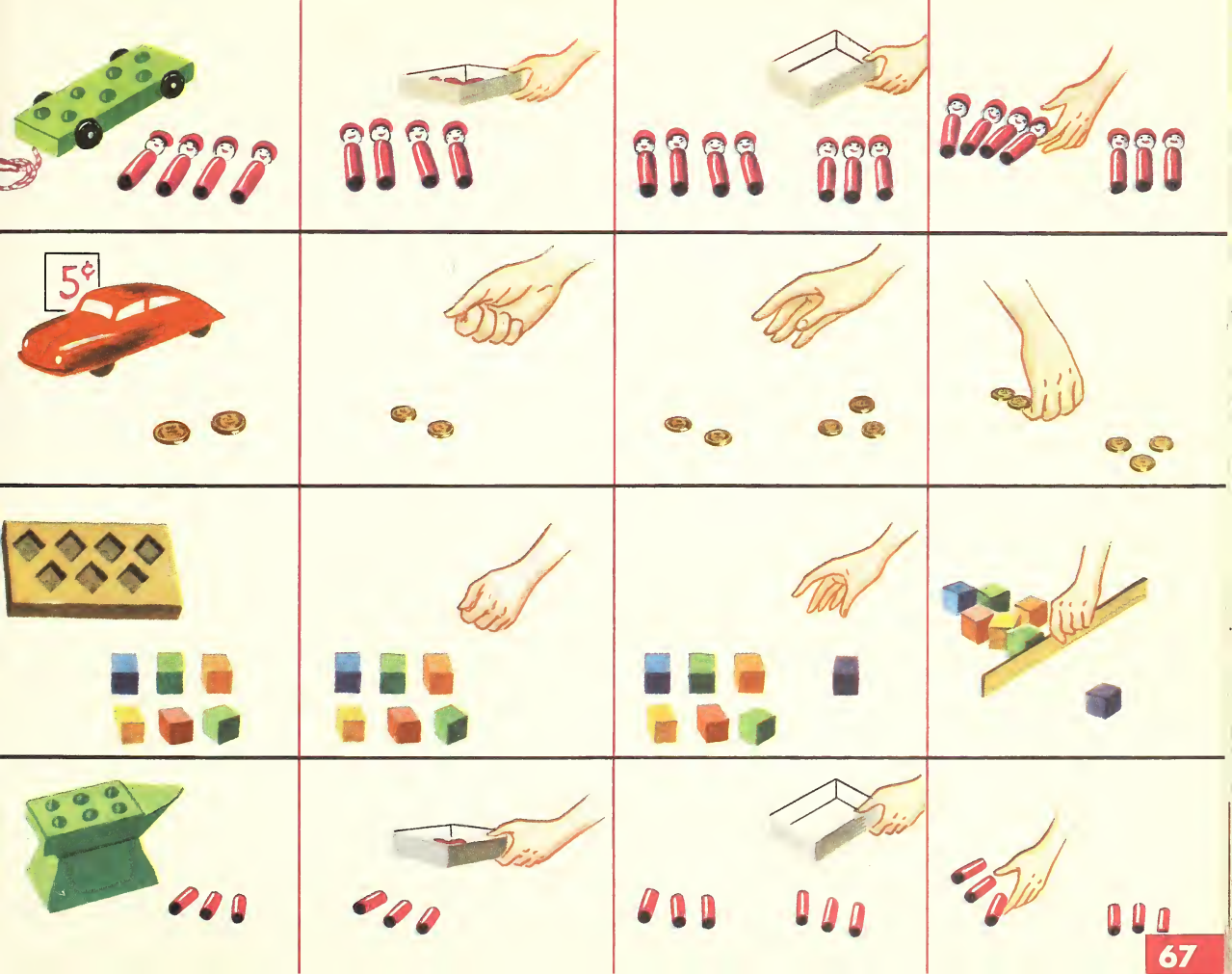
H 3 − 1 = ▒

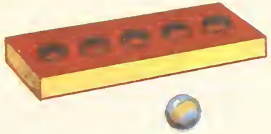
I 7 − 3 = ▒

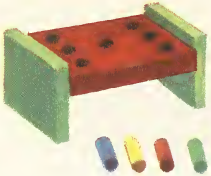
J 6 − 5 = ▒

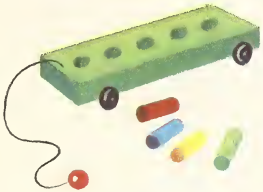
K 5 − 2 = ▒

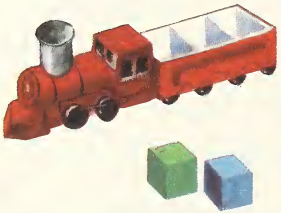
L 7 − 6 = ▒


5¢





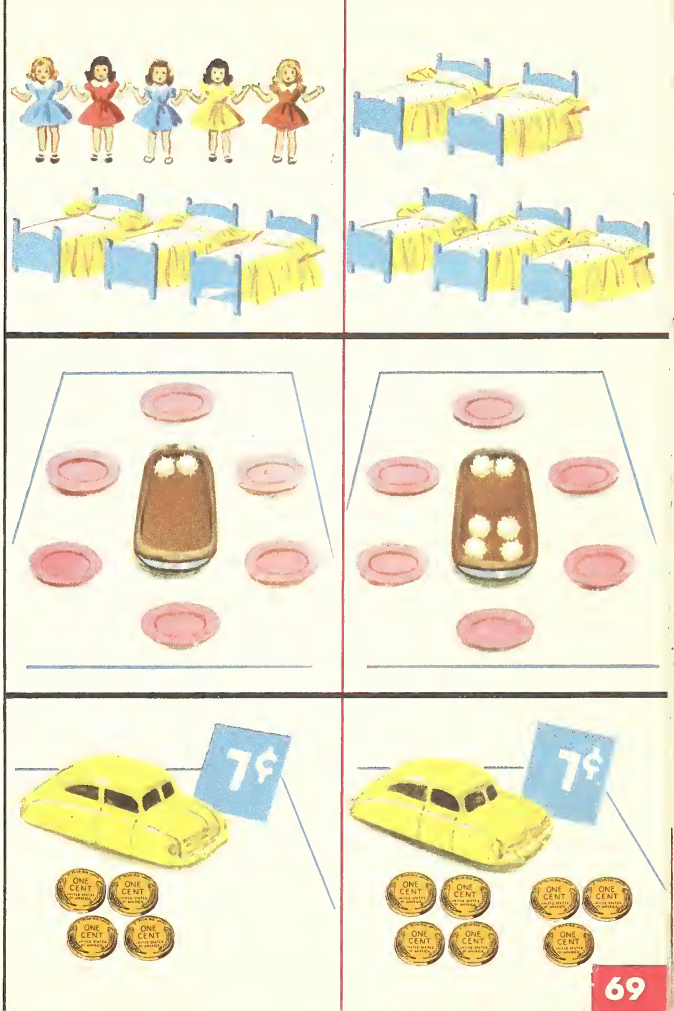


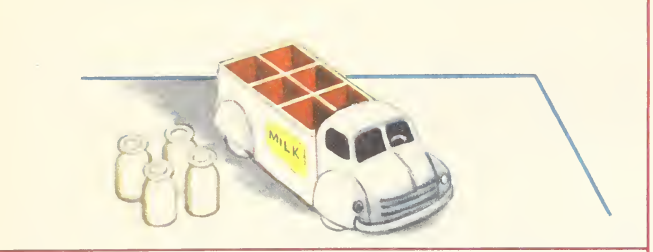


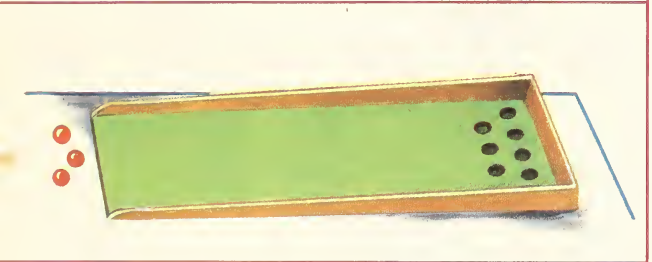
Nancy needs as many beds as she has dolls.
Nancy needs how many more beds?
Nancy will have 3 beds plus ▒ more beds.
You can subtract the 3 beds she has from 5 beds.
5 beds − 3 beds = ▒ beds
5 = 3 + ▒ 5 − 3 = ▒

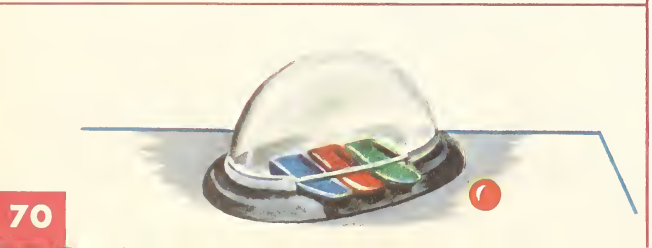
Ellen needs a cookie for each girl.
She needs how many more cookies?
Ellen will have 2 cookies plus ▒ cookies.
You can subtract the 2 cookies she has from 6 cookies.
6 cookies − 2 cookies = ▒ cookies
6 = 2 + ▒ 6 − 2 = ▒

Don can buy the car with ▒ pennies.
He needs how many more pennies?
Don will have 4 pennies plus ▒ pennies.
You can subtract the 4 pennies he has from 7 pennies.
7 pennies − 4 pennies = ▒ pennies
7 = 4 + ▒ 7 − 4 = ▒









Don needs how many more bottles?
Don will have 4 bottles plus ▭ bottles.
You can subtract the 4 bottles he has from 6 bottles.
6 bottles − 4 bottles = ▭
6 = 4 + ▭ 6 − 4 = ▭

Don needs how many more pennies?
He needs 2 pennies plus ▭ pennies.
5 pennies − 2 pennies = ▭
5 = 2 + ▭ 5 − 2 = ▭

Billy needs 3 balls plus ▭ more balls.
7 balls − 3 balls = ▭
7 = 3 + ▭ 7 − 3 = ▭

Carol needs 1 ball plus ▭ more balls.
3 = 1 + ▭ 3 − 1 = ▭

A 6 = 1 + ▭ 6 − 1 = ▭
B 5 = 4 + ▭ 5 − 4 = ▭
C 7 = 6 + ▭ 7 − 6 = ▭
D 6 = 3 + ▭ 6 − 3 = ▭
E 7 = 1 + ▭ 7 − 1 = ▭

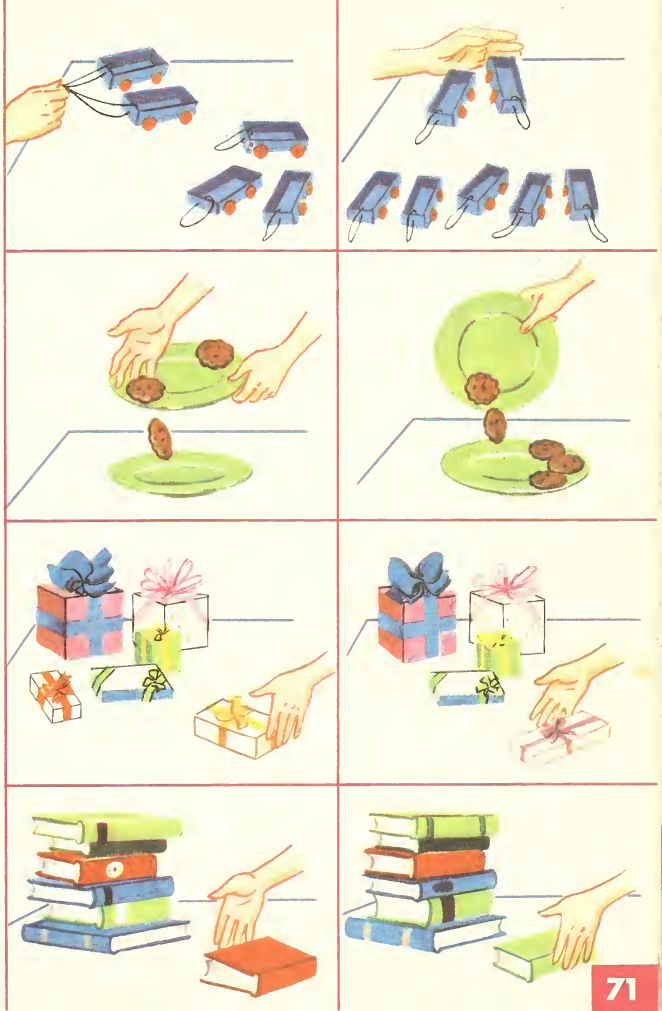
Tom had 5 little toy wagons.
He took 2 little toy wagons away.
How many little toy wagons were left?

Carol had 3 cookies.
She made 2 more cookies.
Then Carol had how many cookies?

5 boxes were on the table.
Ellen took 1 box away.
Then ▒ boxes were on the table.

Don had 6 books on the table.
He put 1 more book on the table.
Then he had ▒ books on the table.

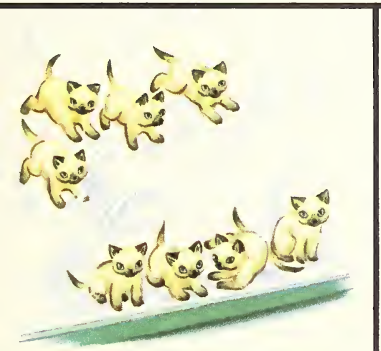
A 2+4=▒	A 2−1=▒	A 7=3+▒
B 6+1=▒	B 7−3=▒	B 5=2+▒
C 3+3=▒	C 6−1=▒	C 7=5+▒
D 5+1=▒	D 5−2=▒	D 2=1+▒
E 4+3=▒	E 7−6=▒	E 6=4+▒
F 1+6=▒	F 3−2=▒	F 6=3+▒
G 2+5=▒	G 6−4=▒	G 5=1+▒
H 2+1=▒	H 5−4=▒	H 7=2+▒

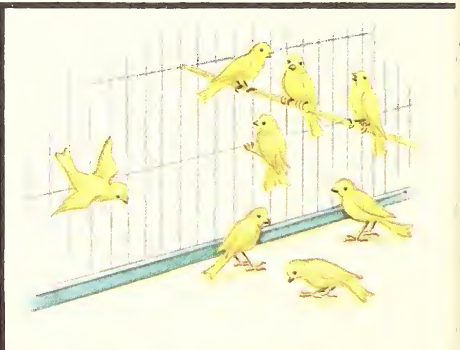


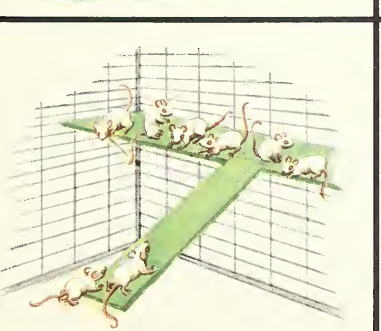
A 6=3+▭
B 7=1+▭
C 5−4=▭
D 2 threes=▭
E 7−2=▭
F 5=1+▭
G 6=4+▭
H 6+1=▭
I 5+2=▭
J 2+1=▭
K 6=▭ twos
L 3−1=▭
M 6=5+▭
N 7=3+▭
O 5−1=▭
P 5=3+▭
Q 7−3=▭
R 7=4+▭
S 5=4+▭
T 6−3=▭
U 1+1=▭
V 3 twos=▭

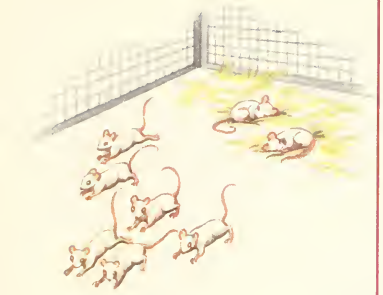
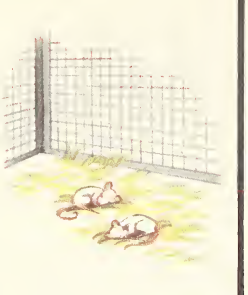
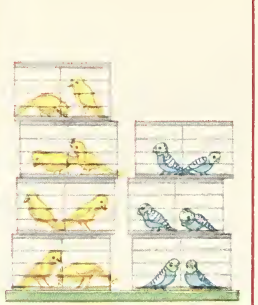
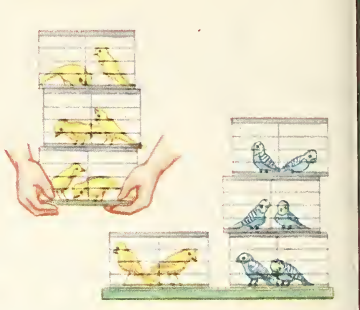
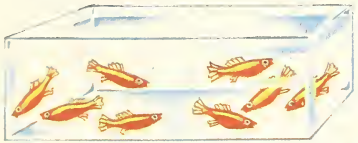
A 7=5+▭
B 5=2+▭
C 4+3=▭
D 7−1=▭
E 2−1=▭
F 3+4=▭
G 7=6+▭
H 4+2=▭
I 6=2+▭
J 7−4=▭
K 3=2+▭
L 6−5=▭
M 7=2+▭
N 6=▭ threes
O 6=1+▭
P 6−4=▭
Q 6−2=▭
R 5−3=▭
S 2+3=▭
T 3=1+▭
U 5−4=▭
V 2+5=▭

A One quart=▭ pints
B Are 14 inches shorter than 1 foot?
C Three quarts=▭ pints
D Two nickels=▭ cents
E Ten pennies=one ~~~~
F One nickel=▭ cents
G One dime=▭ nickels
H Six pints=▭ quarts
I Add three inches and four inches.
J Subtract 4 oranges from 6 oranges.
K Add two books and three books.
L Add one foot and five feet.
M Subtract five cents from six cents.
N 3 dimes plus 3 dimes equal ▭ dimes.
O 6 nickels minus 1 nickel equal ~~~~
P 1 inch plus 1 inch equals ▭ inches.
Q 2 pints minus 1 pint equal ~~~~
R 2 quarts plus 1 quart equal ▭ quarts.
S Add five bears and two bears.
T Subtract four bags from five bags.
U Add one child and one child.
V Subtract 2 squirrels from 6 squirrels.

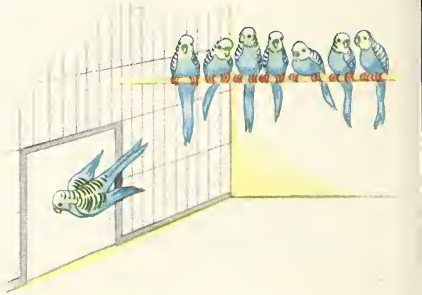
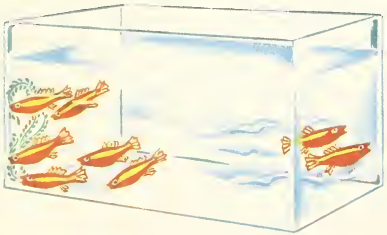
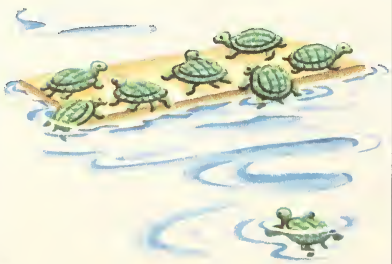
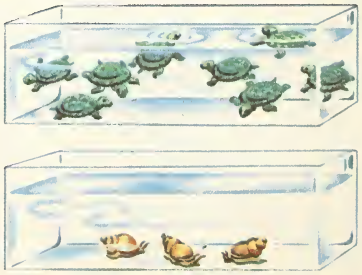








How many rabbits are eating?
How many rabbits are running to eat?
Then how many rabbits will be eating?

7 rabbits + 1 rabbit = ~~~~ 7 + 1 = ▒

3 dogs + 5 dogs = ~~~~ 3 + 5 = ▒

Some turtles were in a pond.
How many turtles were in the pond?
How many turtles are going away from the pond?
Then how many turtles will be in the pond?

8 turtles − 6 turtles = ~~~~ 8 − 6 = ▒

8 birds − 2 birds = ~~~~ 8 − 2 = ▒

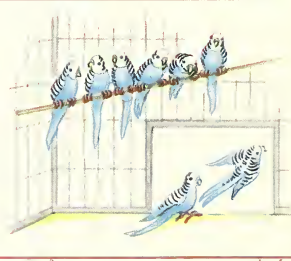
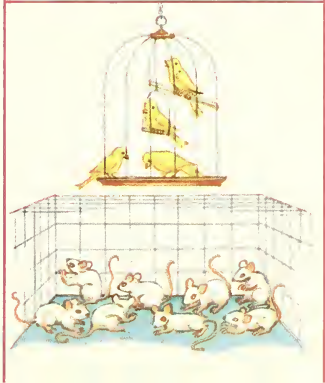
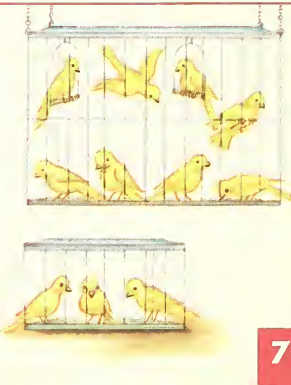
How many more mice are there than birds?
Subtract as many mice as there are birds.

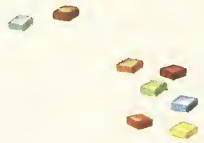
8 mice − 4 mice = ~~~~ 8 − 4 = ▒

8 birds − 3 birds = ~~~~ 8 − 3 = ▒

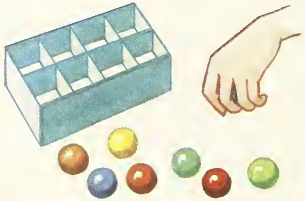
A 5 + 3 = ▒
B 4 + 4 = ▒
C 2 + 6 = ▒
D 6 + 2 = ▒
E 1 + 7 = ▒
F 8 − 5 = ▒
G 8 − 1 = ▒
H 8 − 7 = ▒
I 8 − 3 = ▒
J 8 − 6 = ▒
K 8 − 4 = ▒
L 8 − 2 = ▒

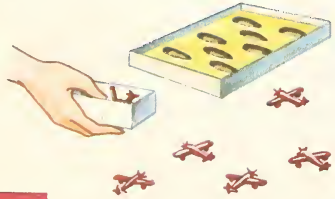


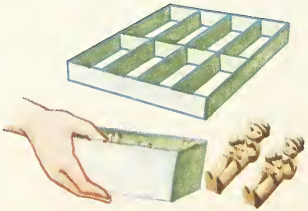








8¢



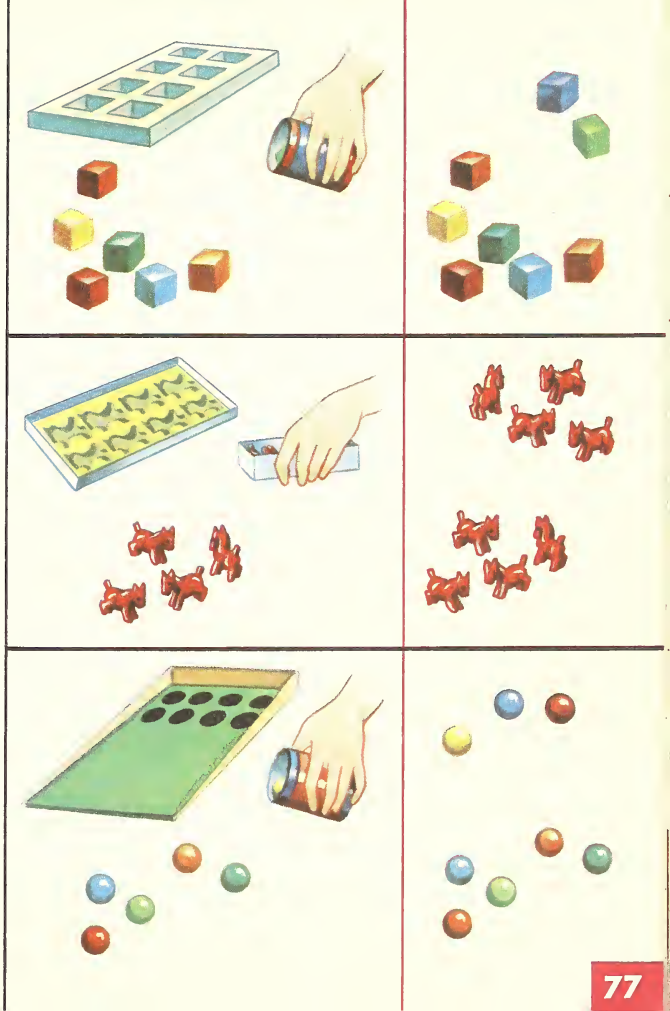


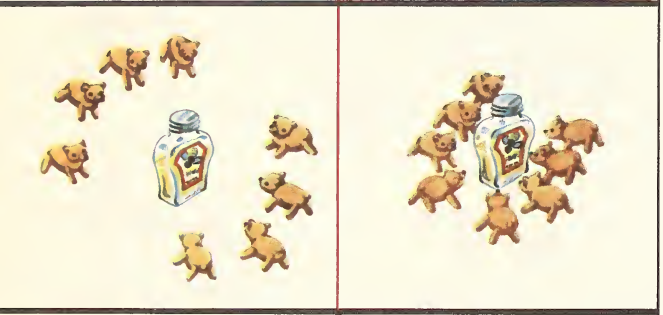


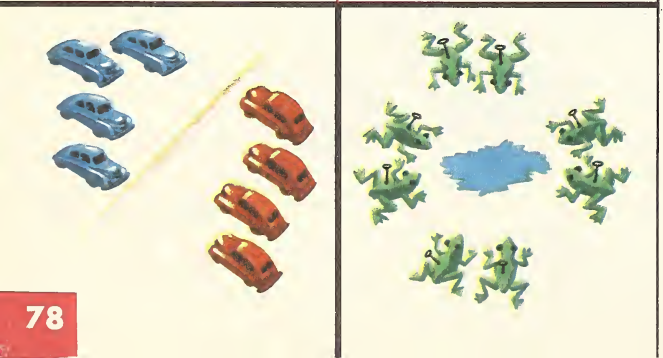
Don needs how many blocks for the box?
He needs how many more blocks?
Don will have 6 blocks plus
▒ more blocks.
You can subtract the 6 blocks he has
from 8 blocks.
8 blocks − 6 blocks = ▒ blocks
8 = 6 + ▒ 8 − 6 = ▒

Tom needs how many horses for the box?
He needs how many more horses?
Tom will have 4 horses plus ▒ more horses.
You can subtract the 4 horses he has
from 8 horses.
8 horses − 4 horses = ▒ horses
8 = 4 + ▒ 8 − 4 = ▒

Billy needs how many balls in all?
He needs how many more balls?
He will have 5 balls plus ▒ more balls.
Subtract the 5 balls he has from 8 balls.
8 balls − 5 balls = ▒ balls
8 = 5 + ▒ 8 − 5 = ▒







The toy dogs are going in groups to eat.
How many groups of toy dogs are there?
How many dogs are in each group?
How many dogs will be eating?
4 groups of 2 dogs each equal ▬ dogs.
4 twos=▬

The toy bears are going in groups to eat.
How many groups of bears are there?
How many bears are in each group?
How many bears will be eating?
2 groups of 4 bears each equal ▬ bears.
2 fours=▬

How many groups of toy cars are there?
How many cars are in each group?
2 groups of 4 cars each equal ▬ cars.
2 fours=▬

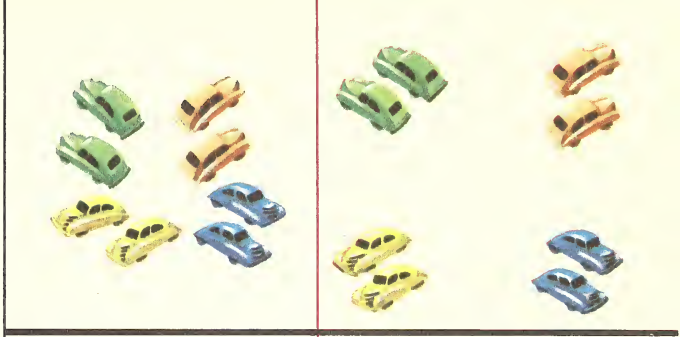
How many groups of frogs are at the pond?
How many frogs are in each group?
4 groups of 2 frogs each equal ▬ frogs.
4 twos=▬

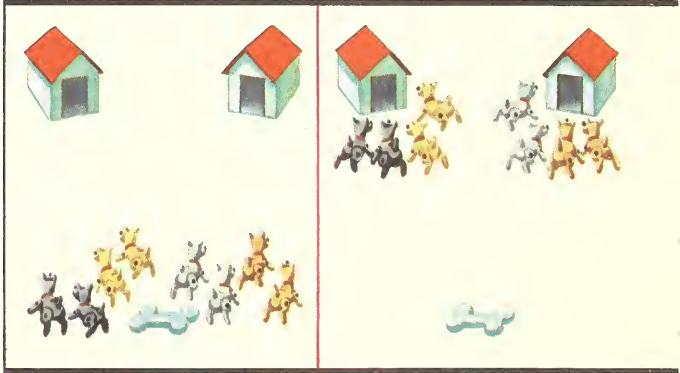
How many toy cars are going away?
The cars are going away in groups.
How many cars are in each group?
How many groups of cars are there?
8 cars equal ▭ groups of 2 cars each.
8=▭ twos

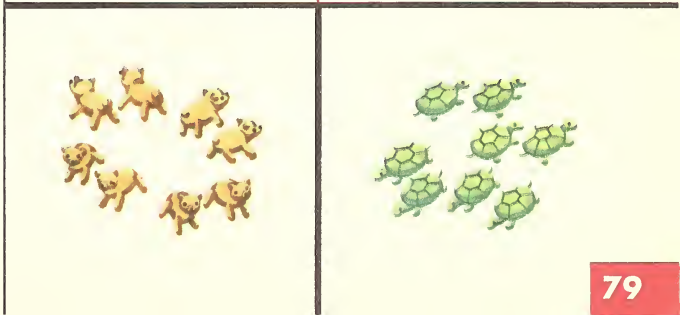
How many toy dogs are going to the houses?
The dogs are going in groups.
How many dogs are in each group?
How many groups of dogs are there?
8 dogs equal ▭ groups of 4 dogs each.
8=▭ fours

How many bears are going away?
They are going away in groups of ▭ each.
8 bears equal ▭ groups of 2 bears each.
8=▭ twos

How many turtles are going away?
They are going away in groups of ▭ each.
8 turtles equal ▭ groups of 4 turtles each.
8=▭ fours







Each boy is buying the same number of toy cars at the store.

How many boys are at the store?

How many groups of cars will there be?

How many cars are there for each boy?

How many cars will there be in each group?

8 cars equal 4 groups of ▬ cars each.

8=4 groups of ▬ each 8=4 ~~~~

The same number of dolls is to be put in each wagon.

How many wagons are there?

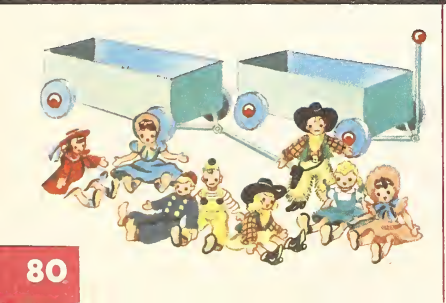
How many groups of dolls will there be?

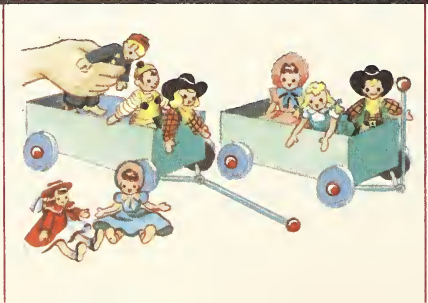
How many dolls are there for each wagon?

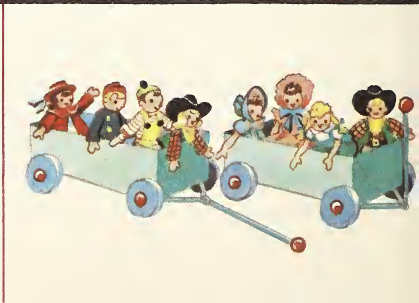
How many dolls will there be in each group?

8 dolls equal 2 groups of ▬ dolls each.

8=2 groups of ▬ each 8=2 ~~~~





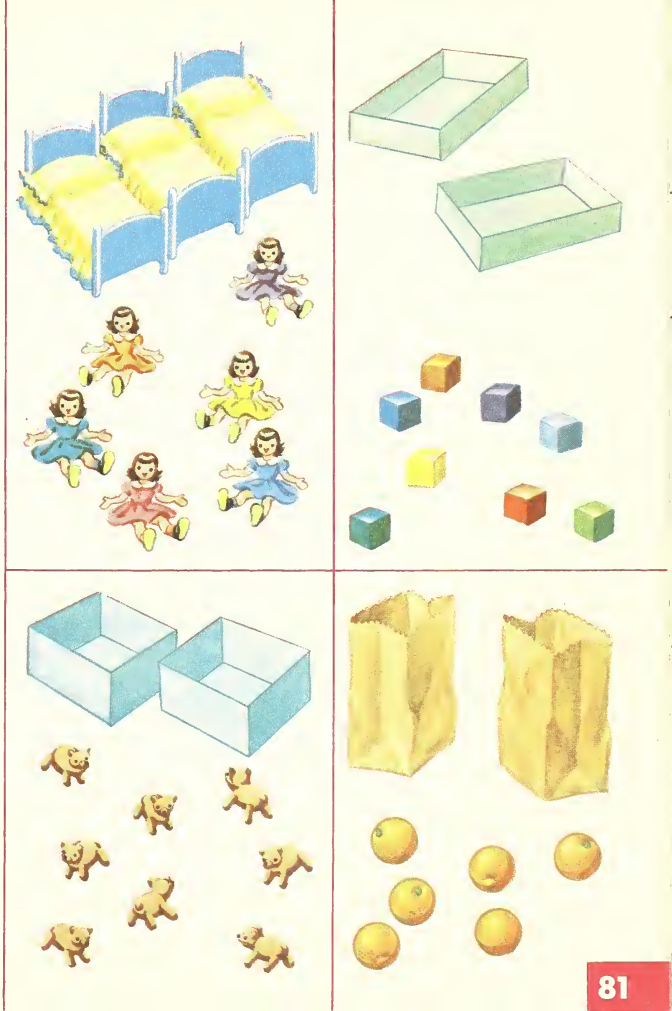


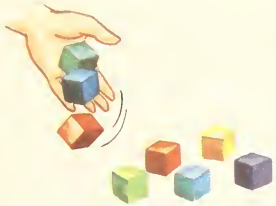
Carol will put the same number of dolls in each bed.
How many groups of dolls will there be?
How many dolls will be in each group?
6 dolls equal 3 groups of ▭ dolls each.

Billy will put the same number of blocks in each box.
How many groups of blocks will there be?
How many blocks will be in each group?
8 blocks equal 2 groups of ▭ blocks each.

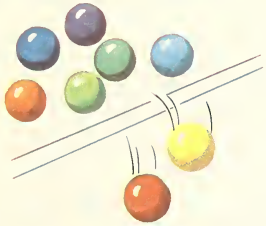
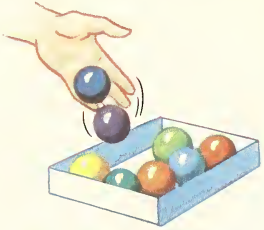
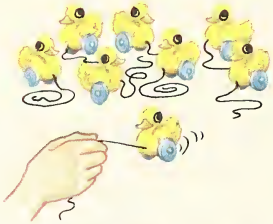
Nancy will put the same number of toy bears in each box.
How many groups of bears will there be?
How many bears will be in each group?
8 bears equal 2 groups of ▭ bears each.

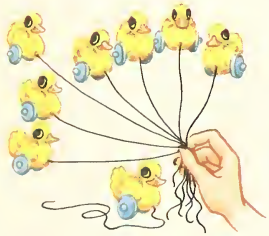
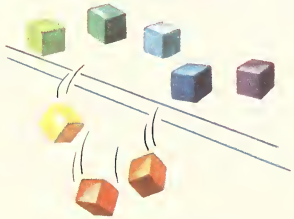
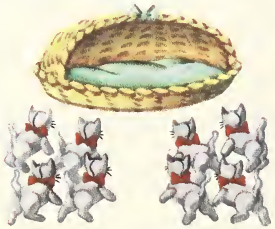
Don will put the same number of oranges in each bag.
How many groups of oranges will there be?
How many oranges will be in each group?
6 oranges equal 2 groups of ▭ oranges.










A 1+7=8
B 7+1=8
C 2+6=8
D 6+2=8
E 3+5=8
F 5+3=8
G 4+4=8

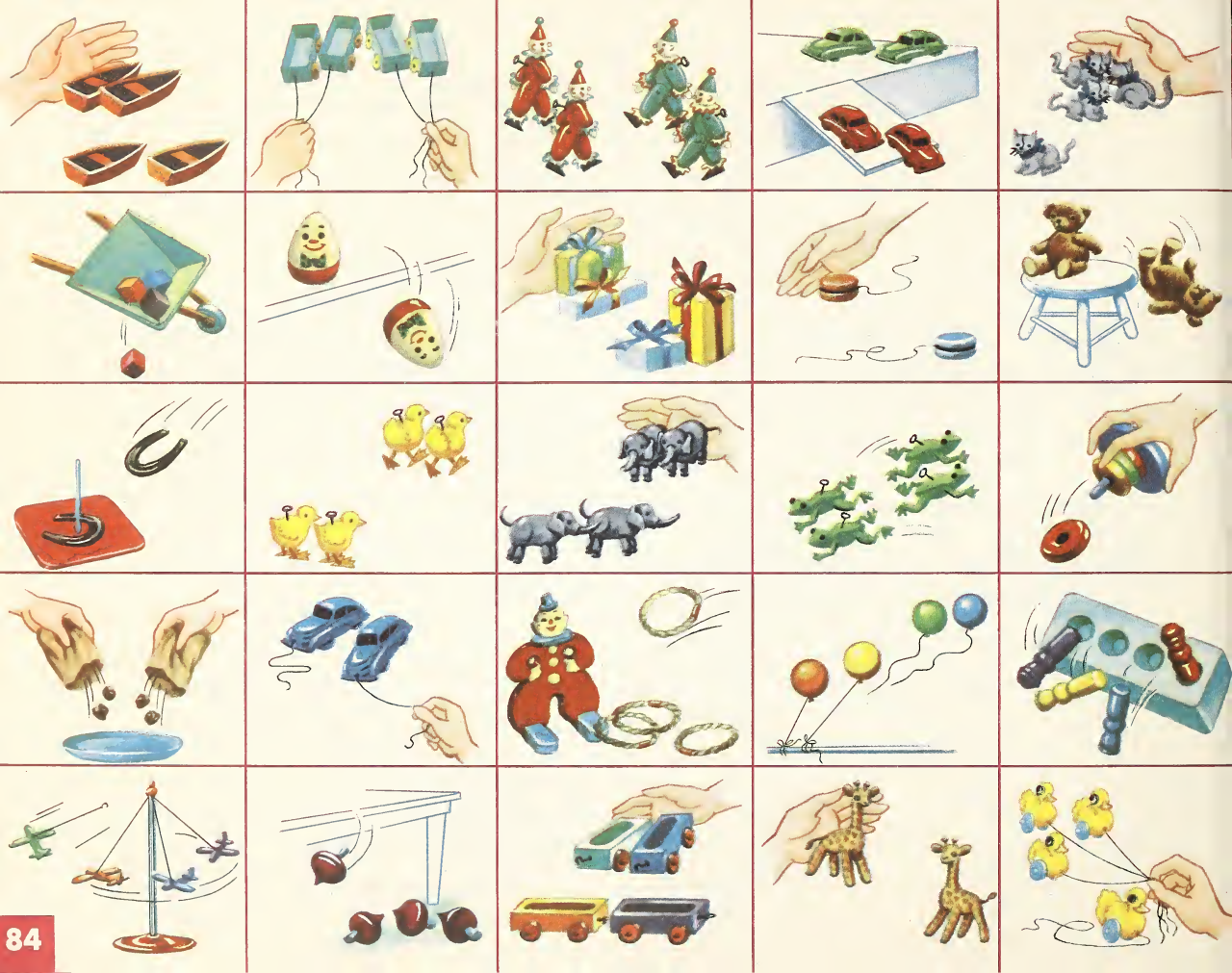
H 8−7=1
I 8−6=2
J 8−5=3
K 8−4=4
L 8−3=5
M 8−2=6
N 8−1=7

O 4 twos=8
P 2 fours=8
Q 8=4 twos
R 8=2 fours

A 3+4=▭
B 8−6=▭
C 6+2=▭
D 7−4=▭
E 4+1=▭
F 8−2=▭
G 7−1=▭
H 3+5=▭
I 1+5=▭

J 1+7=▭
K 2−1=▭
L 6−3=▭
M 3+2=▭
N 8−3=▭
O 8−7=▭
P 5−4=▭
Q 1+2=▭
R 4+4=▭

A Are 10 inches shorter than 1 foot?
B Are 8 pints equal to 4 quarts?
C Three quarts equal ▭ pints.
D 1 dime=▭ nickels
E 1 dime=▭ cents
F 1 nickel=▭ cents
G Add 5 cents and 3 cents.
H 4 mice plus 4 mice equal ▭ mice.
I 3 dimes plus 5 dimes equal ▭ dimes.
J 8 nickels minus 4 nickels equal ~~~~~
K Subtract seven frogs from eight frogs.
L 2 horses plus 6 horses equal ▭ horses.
M Eight blocks minus two blocks equal ~~~~~
N 1 child plus 2 children equals ~~~~~
O 5 beds plus 3 beds equal ▭ beds.
P Eight bags minus five bags equal ~~~~~
Q Add 2 snowmen and 6 snowmen.
R Subtract one boat from eight boats.
S Subtract 3 ducks from 8 ducks.
T 7 pigs minus 1 pig equal ▭ pigs.
U Add 1 kitten and 7 kittens.
V 3 pictures plus 5 pictures equal ~~~~~



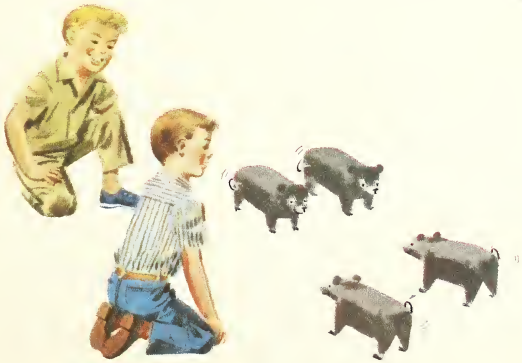
The toy bears are going to play.
How many groups of bears are there?
How many bears are in each group?
How many bears will be playing?
2 groups of 2 bears each equal ▒ bears.
2 twos=▒

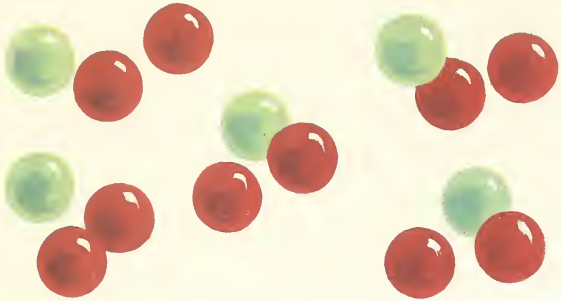
How many toy cows are there?
The toy cows are going away in groups.
How many cows are in each group?
How many groups of cows are there?
4 cows equal ▒ groups of 2 cows each.
4=▒ twos

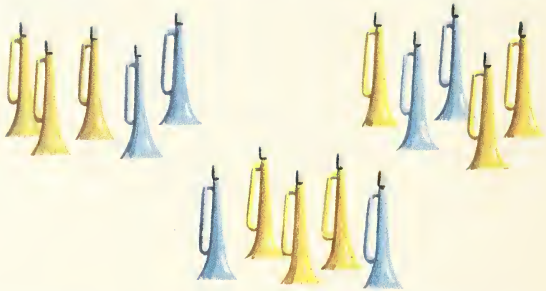
Each boy is to have the same number of toy cows.
How many toy cows are there?
How many groups of cows will there be?
How many cows will there be in each group?
4 cows equal 2 groups of ▒ cows each.
4=2 groups of ▒ each 4=2 ~~~~~

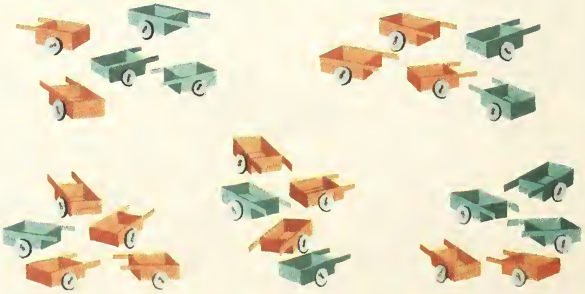
2 toy cows+2 toy cows=▒ toy cows
2+2=▒

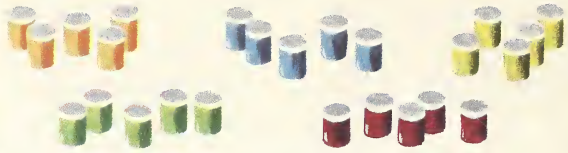
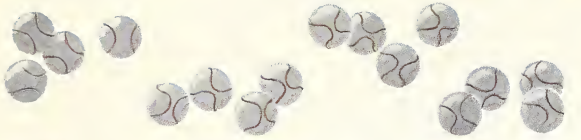
4 toy cows−2 toy cows=▒ toy cows
4−2=▒





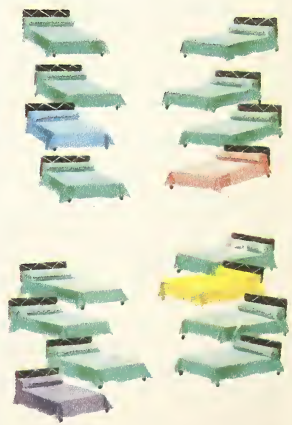








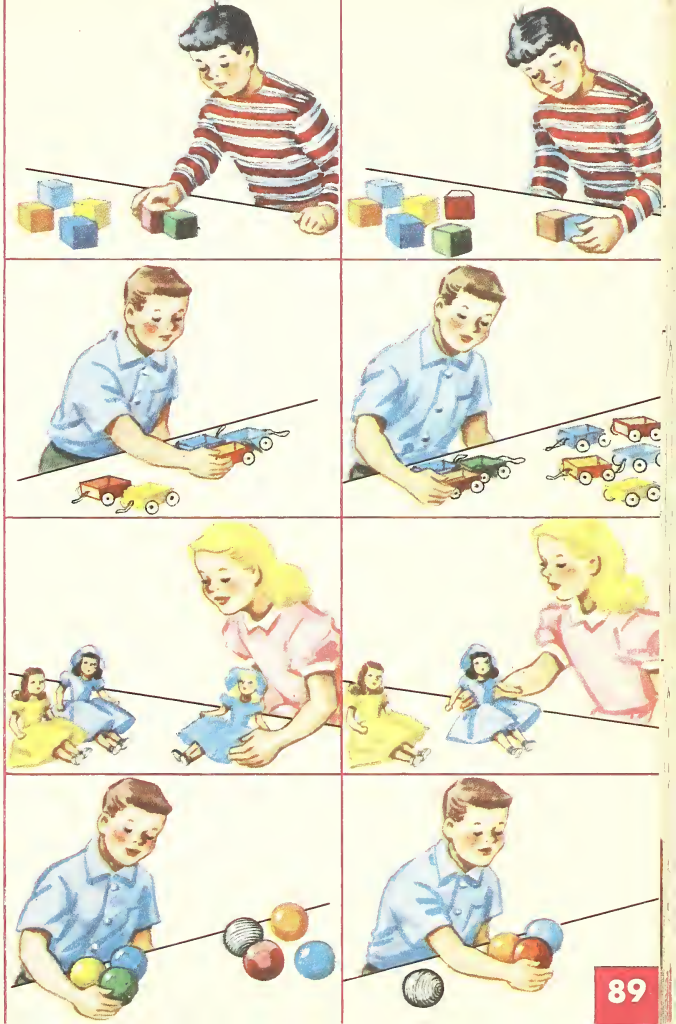
Don had 6 blocks on the table.
He put 2 more blocks on the table.
Then he had ▒ blocks on the table.

Billy had 5 little toy wagons.
He took 3 of the wagons away.
Then he had ▒ little toy wagons left.

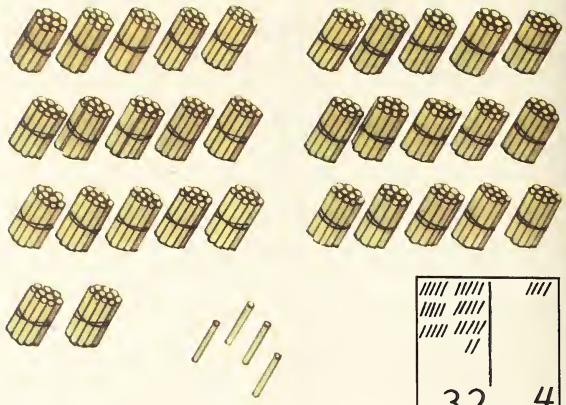
Carol had 2 dolls on the table.
She put 1 more doll on the table.
Then Carol had ▒ dolls on the table.

There were 4 balls on the table.
Billy took 3 of the balls away.
How many balls were left on the table?

A 5+3=▒	A 4−1=▒	A 2 twos=▒
B 2+2=▒	B 8−5=▒	B 2 fours=▒
C 1+7=▒	C 4=3+▒	C 6=2 ~~~~
D 4+4=▒	D 8=2+▒	D 4=▒ twos
E 6+2=▒	E 6=4+▒	E 8=▒ fours
F 1+3=▒	F 8−7=▒	F 4 twos=▒
G 3+5=▒	G 4=1+▒	G 6=3 ~~~~
H 2+6=▒	H 8−3=▒	H 2 threes=▒




21 6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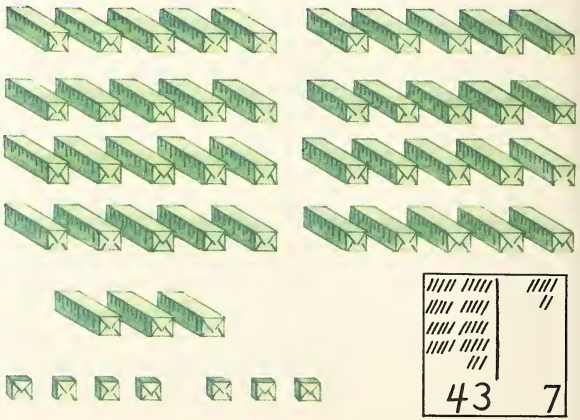
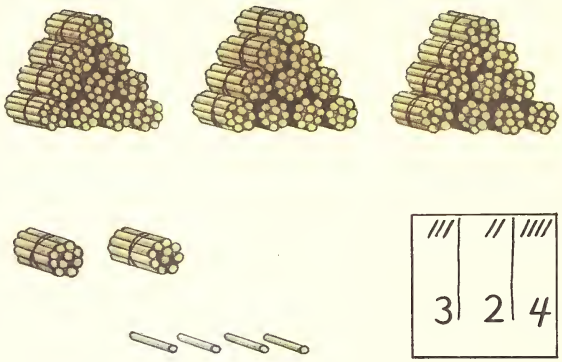
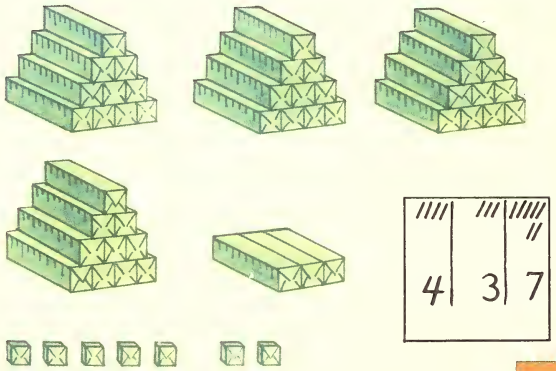

43 7

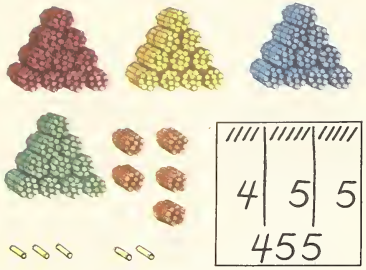
2	1	6

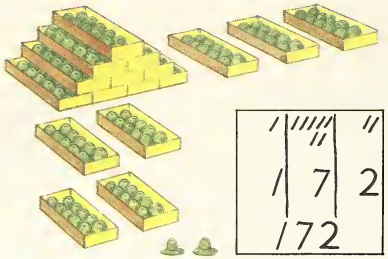


3	2	4



4	3	7


4 5 5
455


1 7 2
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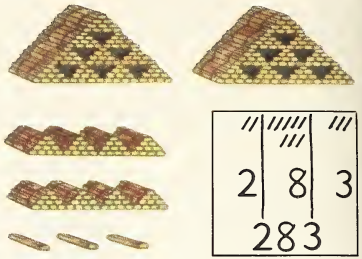
2 8 3
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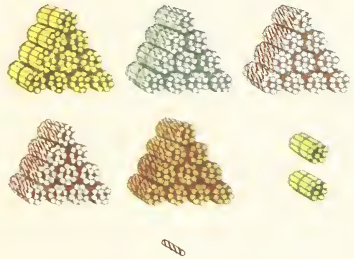

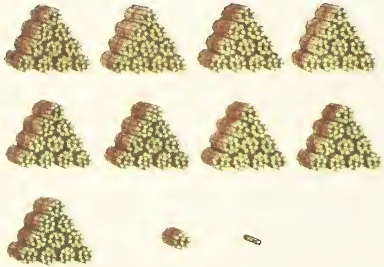

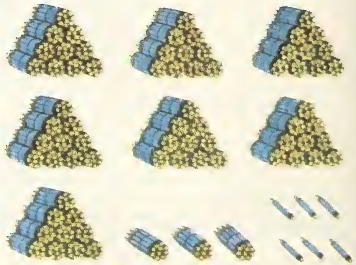

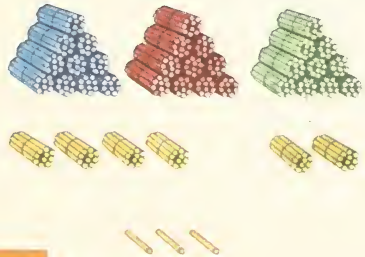

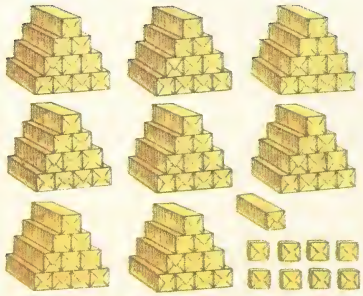

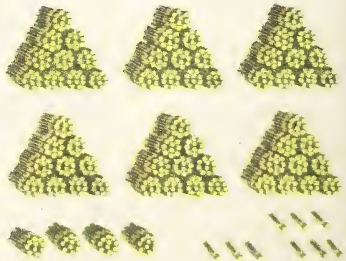

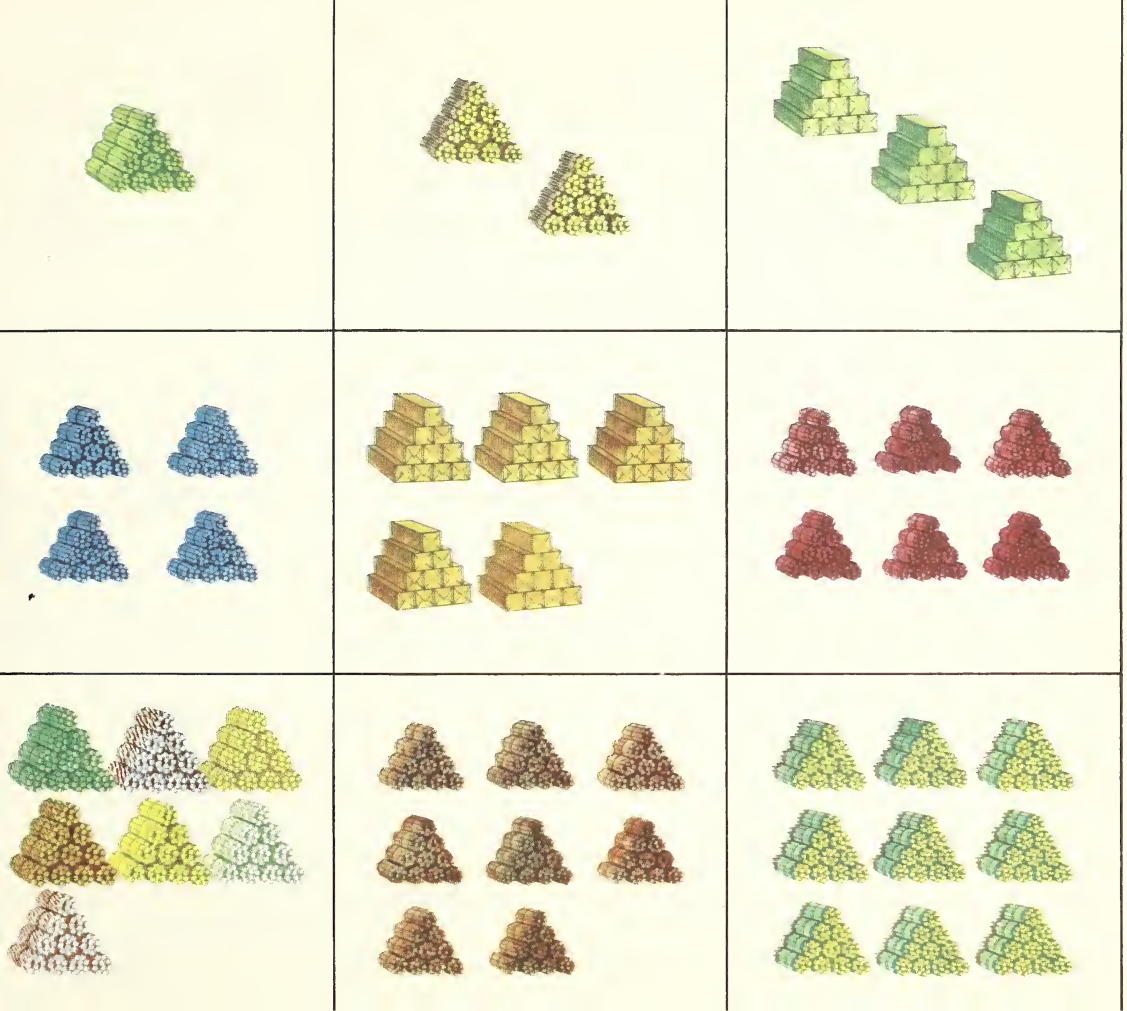
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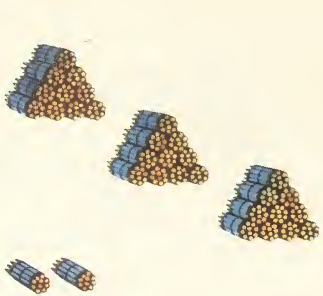

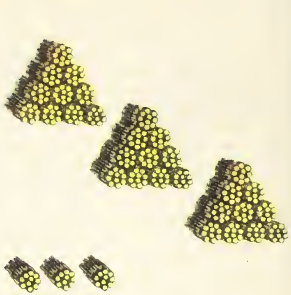

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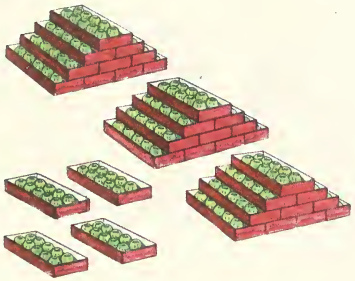

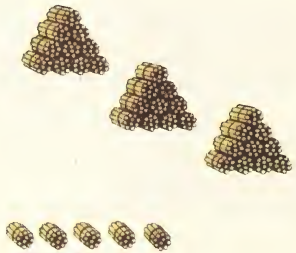

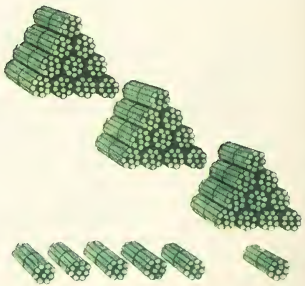

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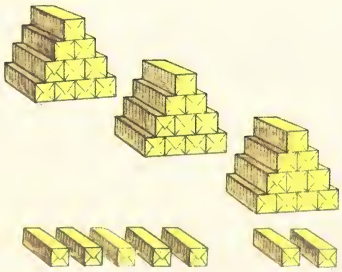
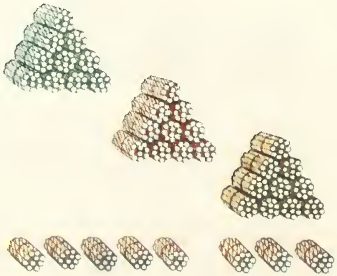
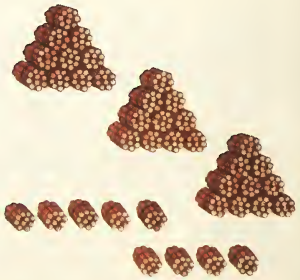
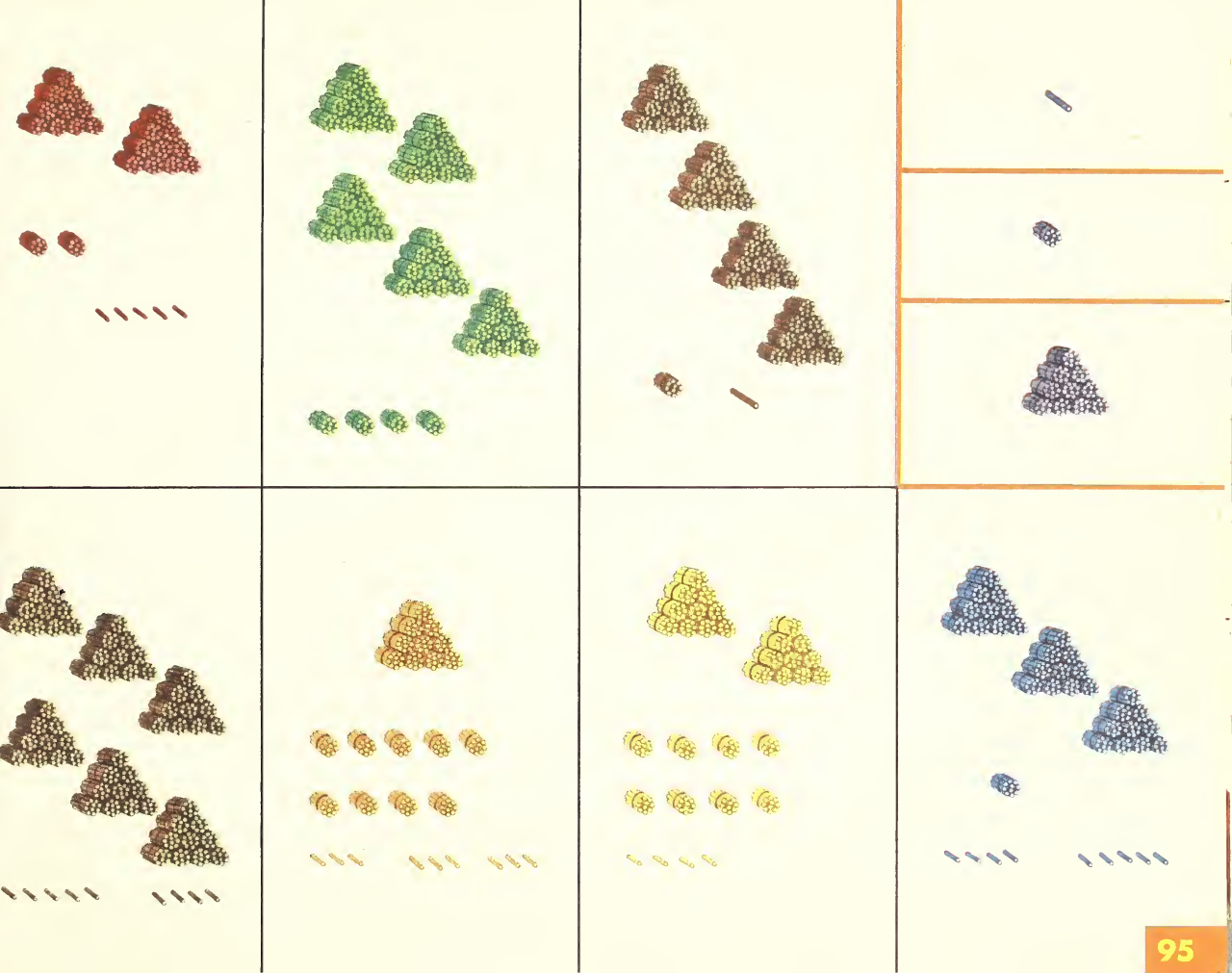
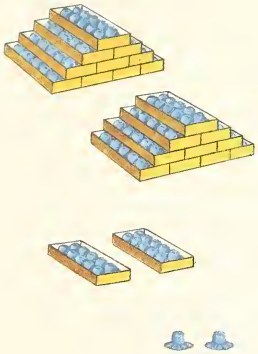
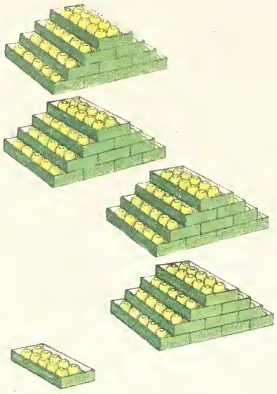


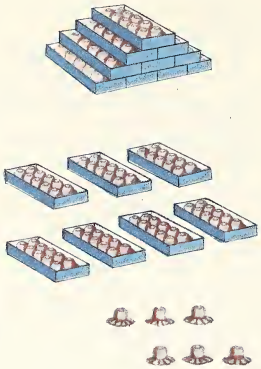


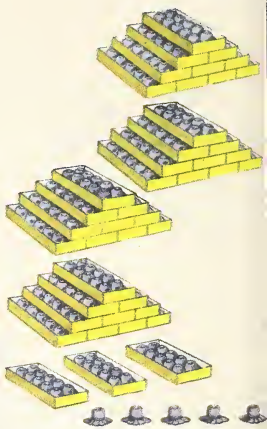


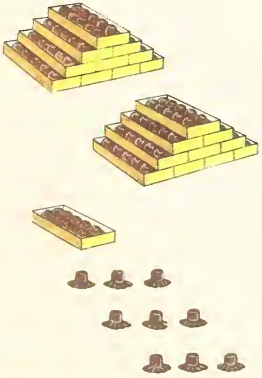


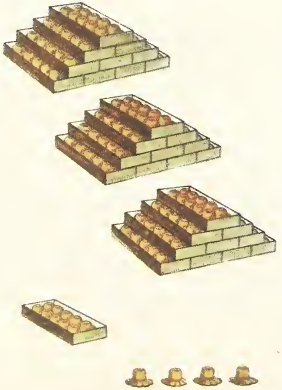


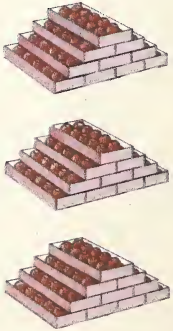












How much will the car cost?
Don has ▭ pennies on the table.
Don needs how many more pennies?

Carol has some pennies in groups.
She has ▭ pennies in each group.
How many groups of pennies has she?
How many pennies has she in all?

Each cookie will cost 2 cents.
Billy will put the money into groups
of 2 cents each.
How many groups of money will he have?

Tom has some dimes and pennies.
He has ▭ more pennies than dimes.
Do you subtract 3 pennies from 8 pennies?

The man has ▭ cents in all.
He is taking ▭ cents away.
How many cents will be left?

Don had 3 cents on the table.
He put 2 more cents on the table.
Then he had ▭ cents on the table.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

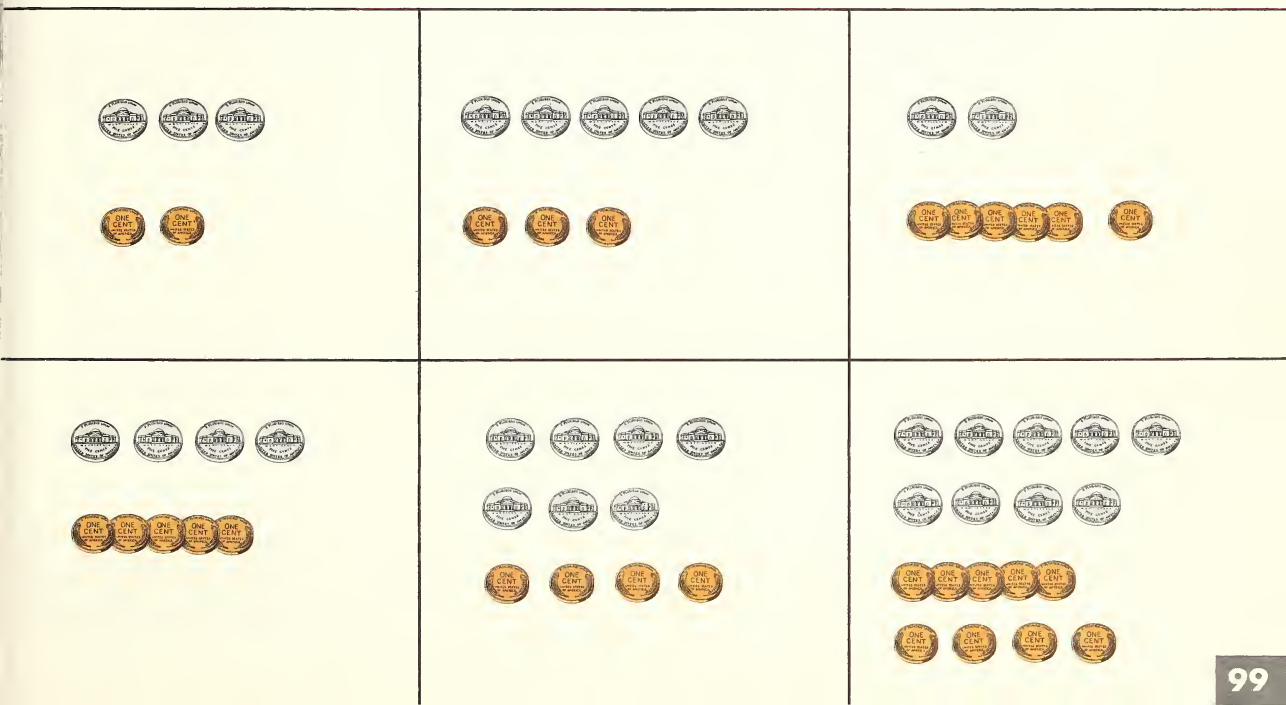
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

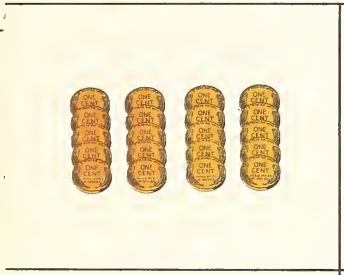
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

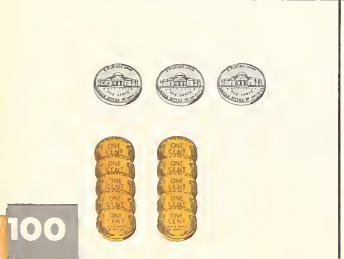
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50




25¢

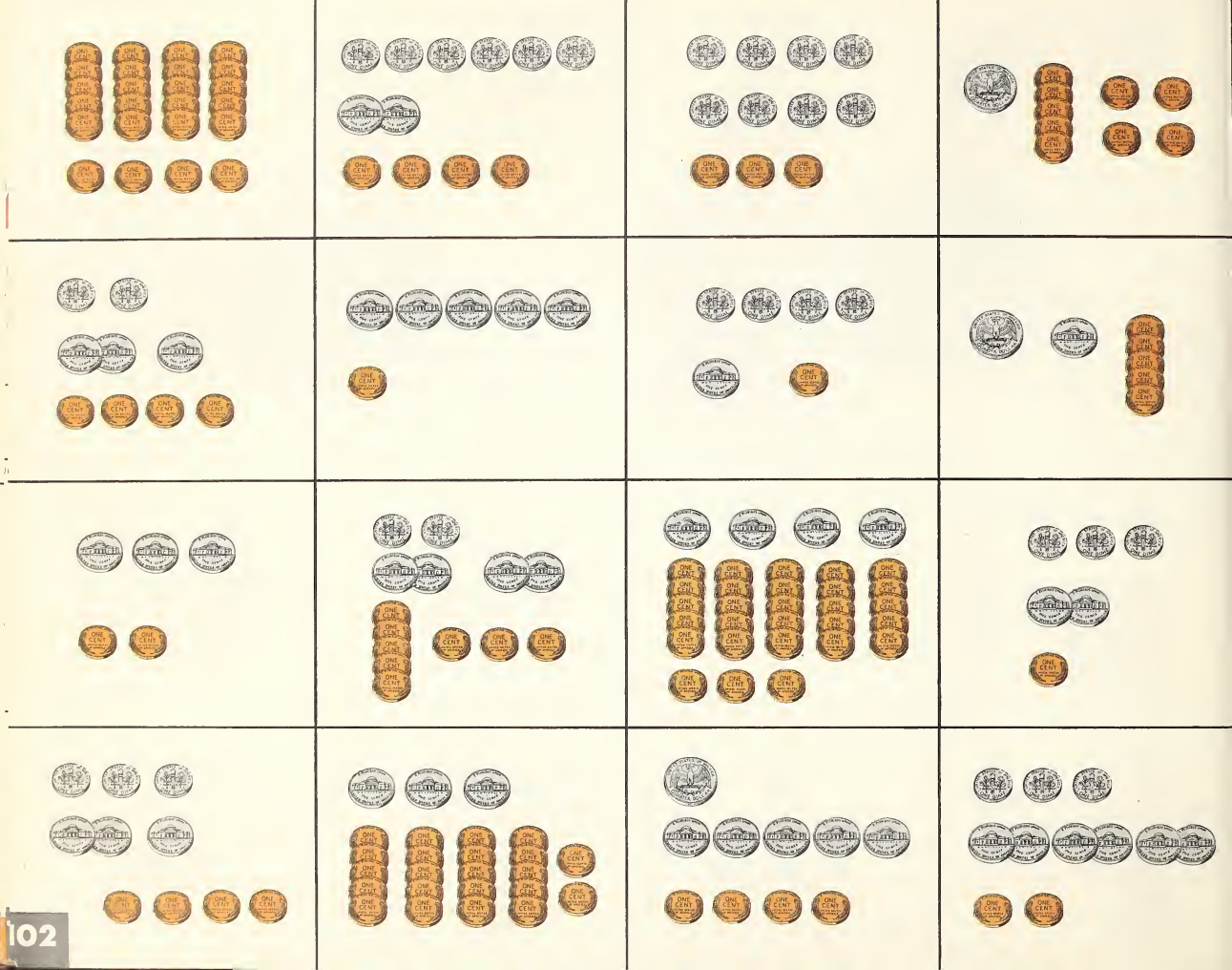

25¢






BOOKS
25¢


BOOKS
25¢



A How much more money is needed to buy the cookies?

B Is there enough money to buy the ball?

C Will the dime and 2 nickels be enough to buy the ball?

D Will the 3 nickels and 5 pennies be enough to buy the ball?

E Is there enough money to buy the wagon?

F Don has how much more money than the toy car costs?

G Will Carol need the 2 nickels to buy the doll?

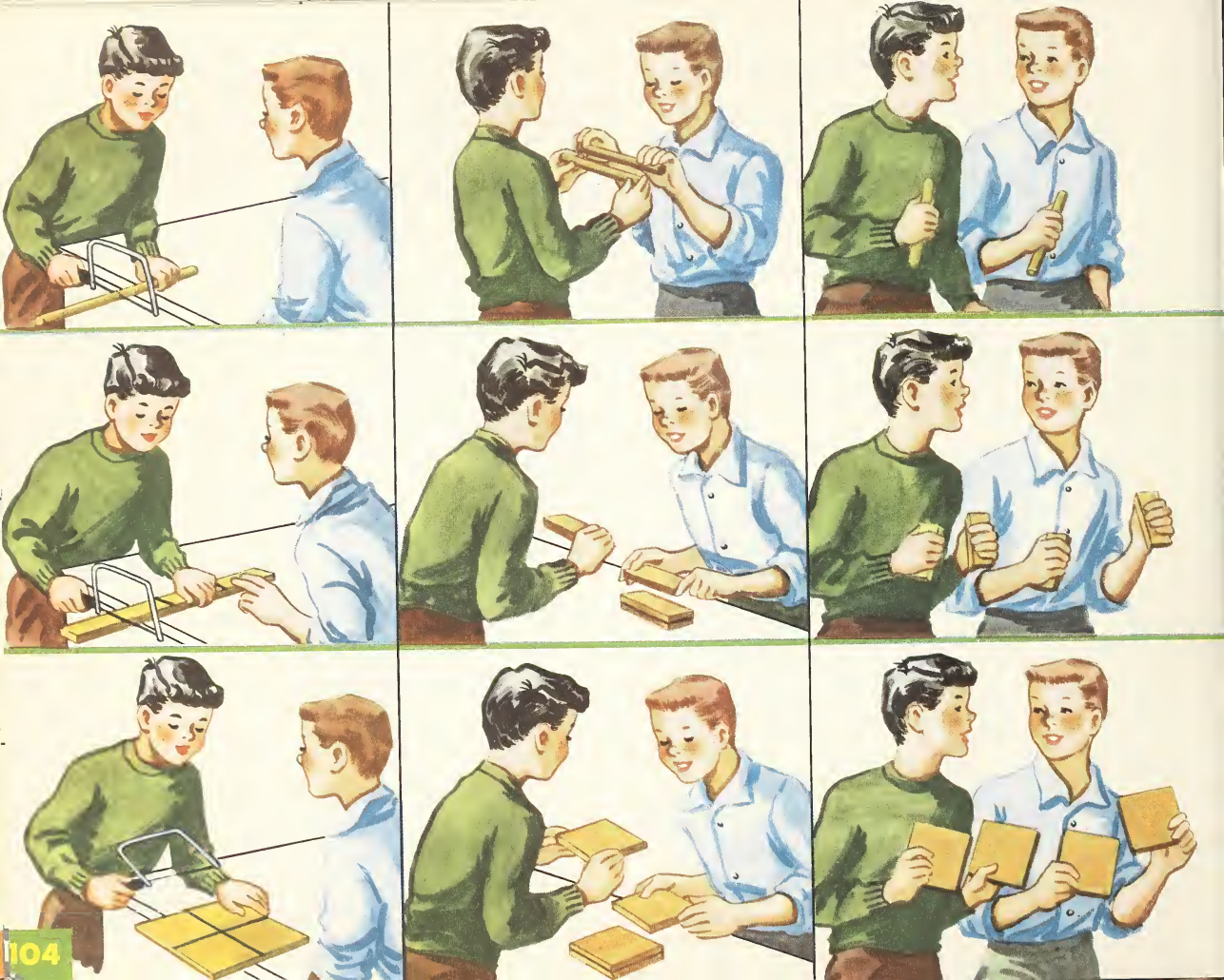
H How much more money will Billy need to buy the boat?

I How much money is on the table with the ball?

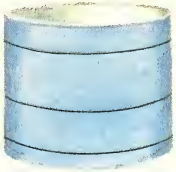
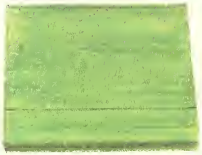
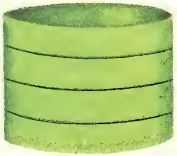
J How much money is on the table with the wagon?

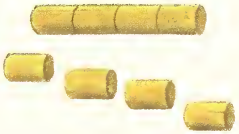
K Which table has more money, the one with the ball or the one with the wagon?

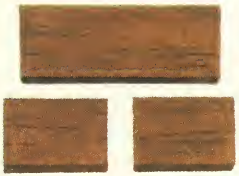
L Do Don and Billy have the same number of pennies?

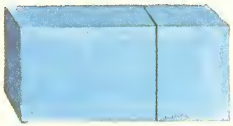
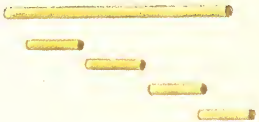
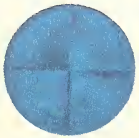


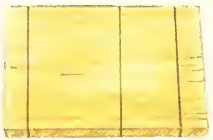


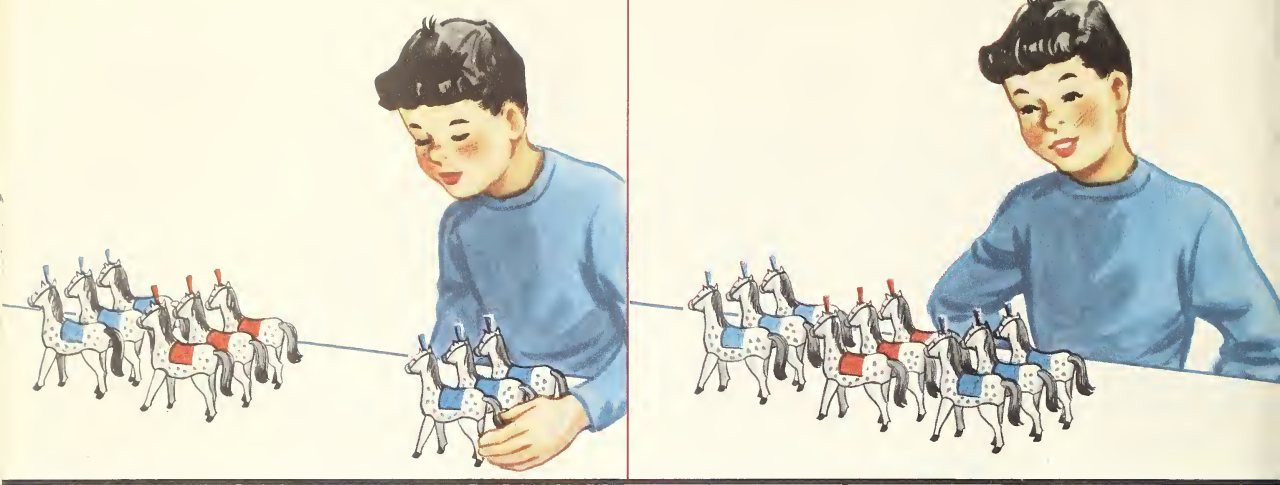




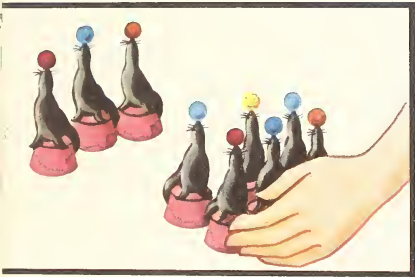


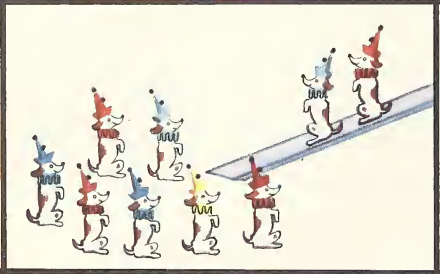


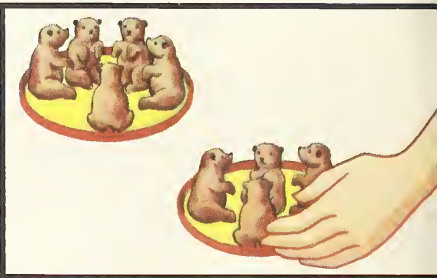




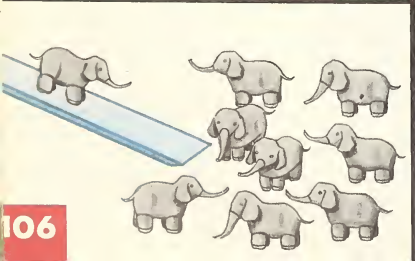



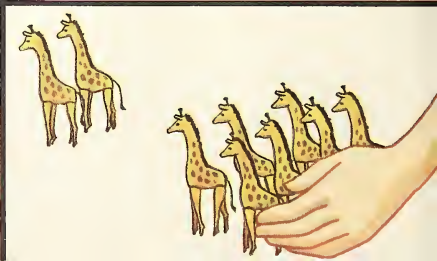


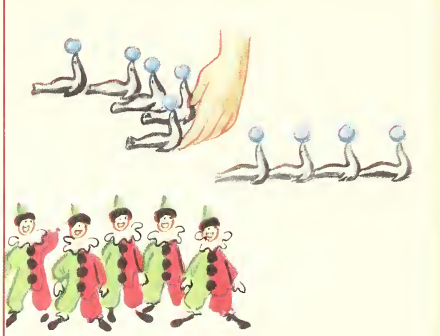


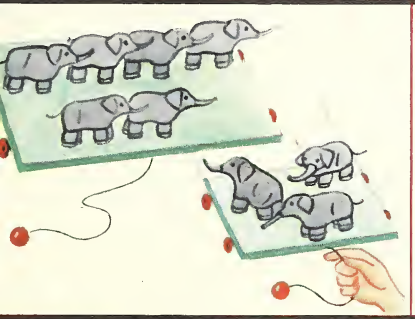


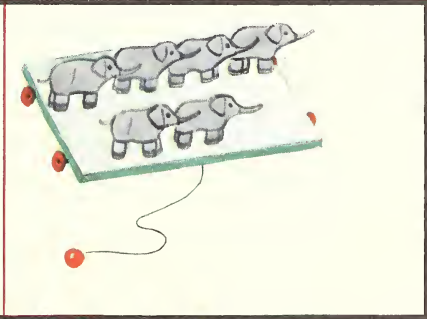


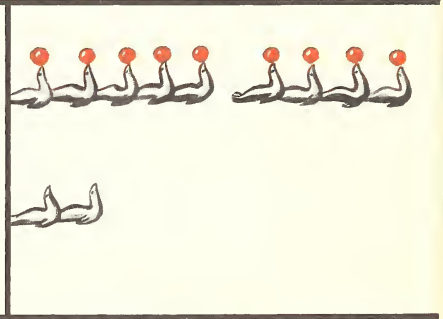


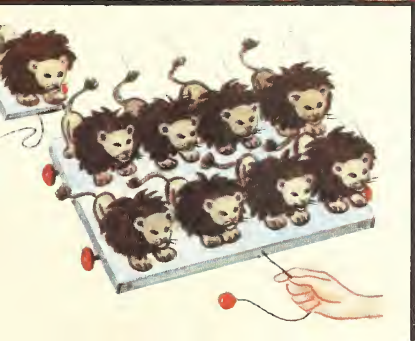


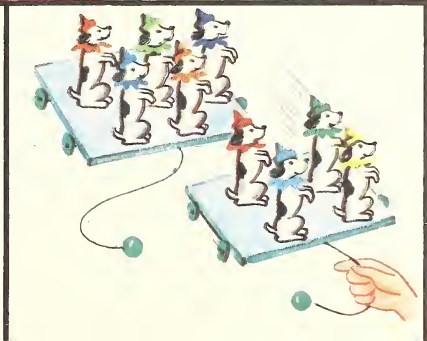


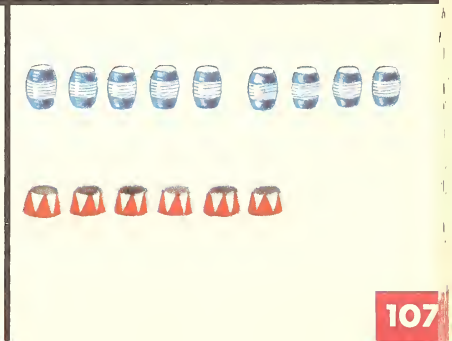


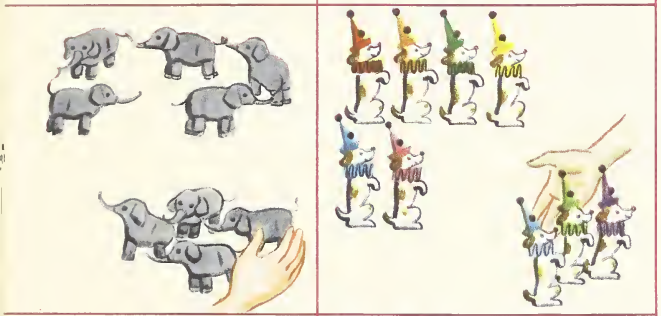


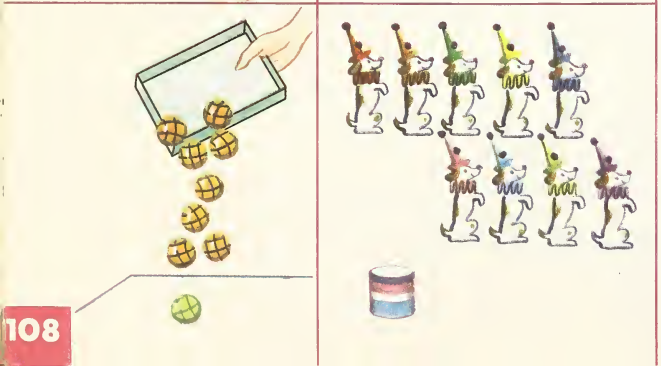












Nancy had 6 toy bears on the table.
She put 3 more toy bears on the table.
Then there were ▒ toy bears on the table.
6 bears + 3 bears = ~~~~ 6 + 3 = ▒

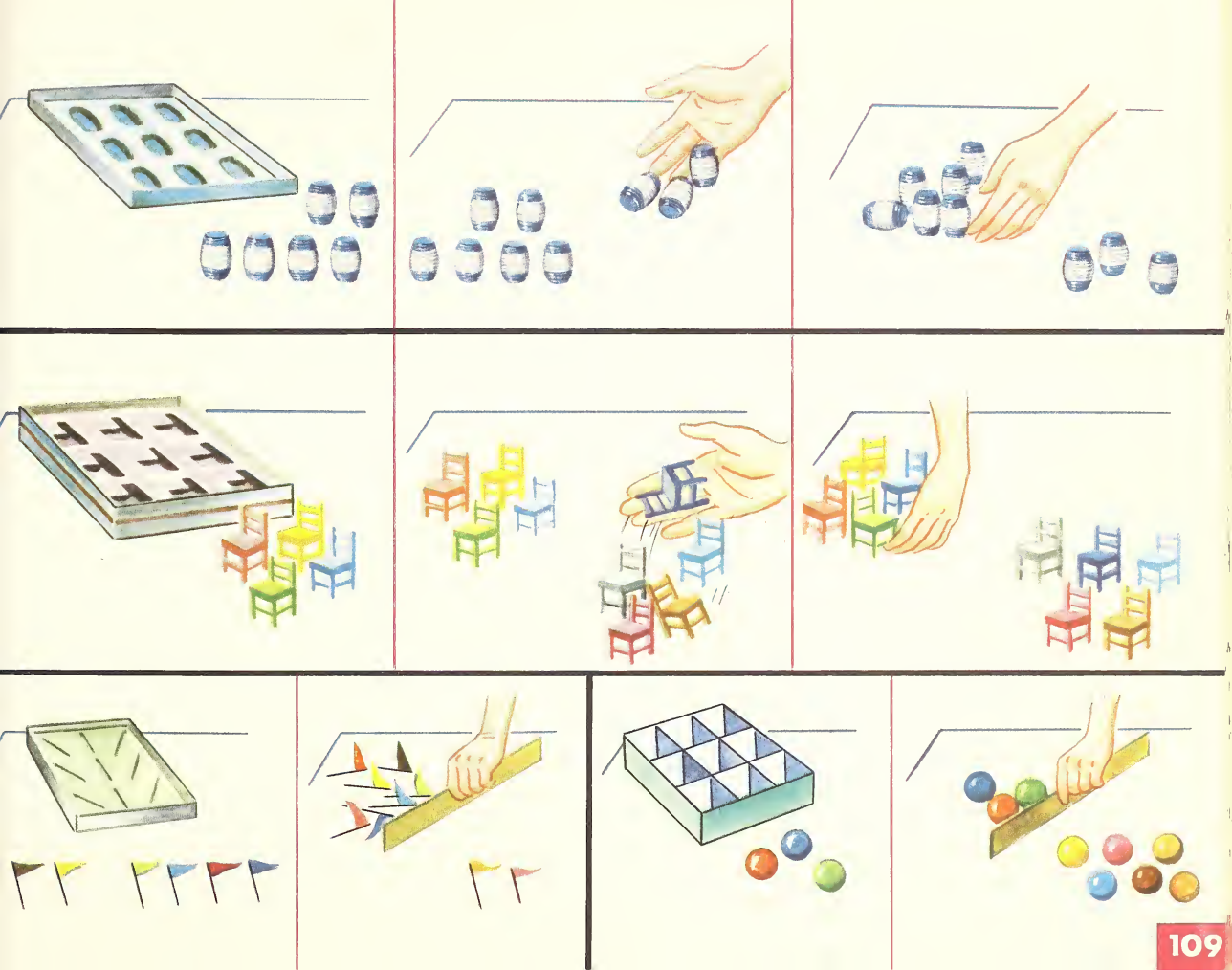
There are ▒ more blue balls than red balls.
9 blue balls − 7 blue balls = ~~~~ 9 − 7 = ▒

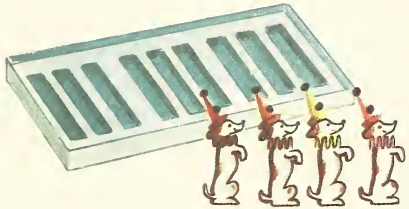
Ellen put 5 toy elephants on the table.
Nancy put 4 toy elephants on the table.
How many toy elephants are on the table?
5 elephants + 4 elephants = ~~~~ 5 + 4 = ▒

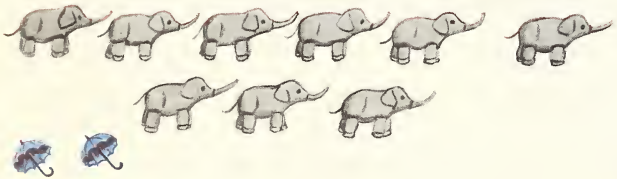
Don had 9 toy dogs.
He took 3 of the toy dogs away.
How many toy dogs were left?
9 dogs − 3 dogs = ~~~~ 9 − 3 = ▒

1 ball + 8 balls = ~~~~ 1 + 8 = ▒

How many more toy dogs are there than toy stands?
Subtract as many dogs as there are stands.
9 dogs − 1 dog = ~~~~ 9 − 1 = ▒







Don needs ▭ more dogs for the box.

9 dogs = 6 dogs + ▭ dogs 9 = 6 + ▭

9 dogs − 6 dogs = ~~~~ 9 − 6 = ▭

Billy needs how many more toy elephants to have enough for the toy stands?

9 elephants = 5 elephants + ▭ elephants

9 elephants − 5 elephants = ~~~~

Billy needs how many more toy umbrellas to have enough for the toy elephants?

9 umbrellas = 2 umbrellas + ▭ umbrellas

9 umbrellas − 2 umbrellas = ~~~~

Tom needs ▭ more ball for the clowns.

9 balls = 8 balls + ▭ ball 9 = 8 + ▭

9 balls − 8 balls = ~~~~ 9 − 8 = ▭

A 7 + 2 = ▭

B 6 + 3 = ▭

C 9 = 4 + ▭

D 9 − 8 = ▭

E 9 − 7 = ▭

F 5 + 4 = ▭

G 1 + 8 = ▭

H 9 − 2 = ▭

I 9 = 5 + ▭

J 9 − 1 = ▭

K 9 = 2 + ▭

L 8 + 1 = ▭

M 9 − 5 = ▭

N 3 + 6 = ▭

O 2 + 7 = ▭

P 9 = 6 + ▭

Q 9 = 3 + ▭

R 4 + 5 = ▭

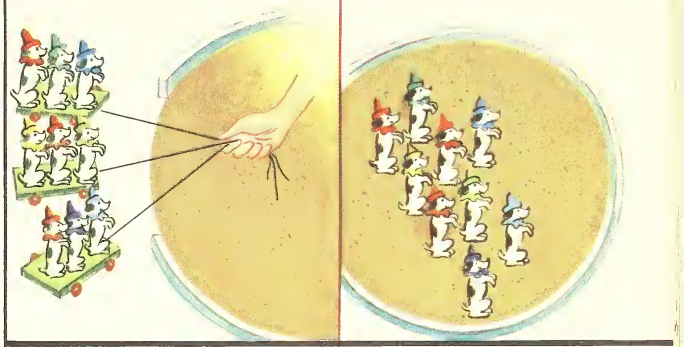
How many groups of toy dogs are there?
How many toy dogs are in each group?
How many toy dogs are there in all?
3 groups of 3 dogs each = ▭ dogs

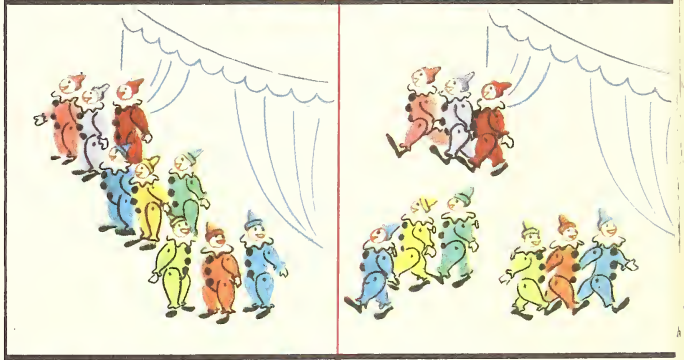
How many clowns are standing?
Now they are going away in groups of ▭
How many groups are there?
9 clowns = ▭ groups of 3 clowns each

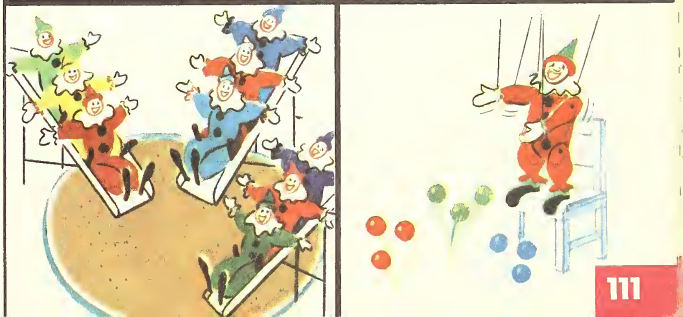
How many groups of clowns are playing?
How many clowns are in each group?
How many clowns are playing?
3 groups of 3 clowns each = ~~~~

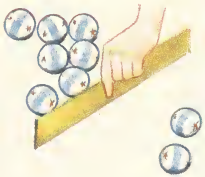
How many balls are there in all?
They are in groups of ▭ balls each.
How many groups of balls are there?
9 balls = ▭ groups of 3 balls each

A 3 threes = ▭
B 9 = ▭ threes
C 9 = 3 ~~~~
D 4 twos = ▭
E 6 = ▭ twos
F 6 = 2 ~~~~
G 2 twos = ▭
H 8 = ▭ fours







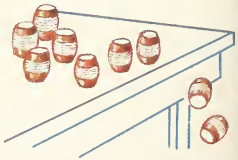



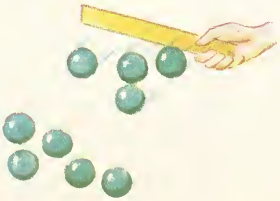


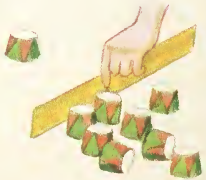








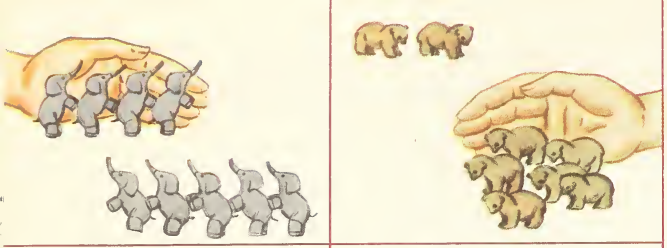


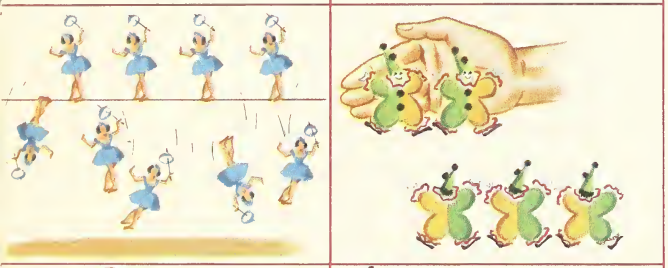


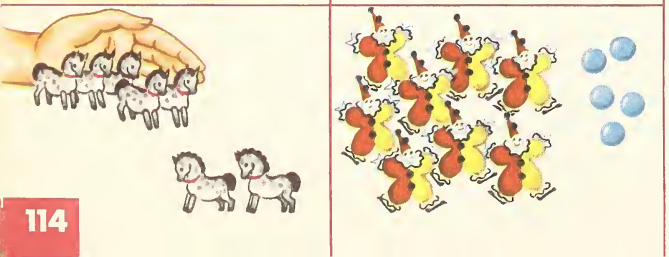
A 1+8=9
B 8+1=9
C 2+7=9
D 7+2=9
E 3+6=9
F 6+3=9
G 4+5=9
H 5+4=9
I 9−8=1
J 9−7=2
K 9−6=3
L 9−5=4
M 9−4=5
N 9−3=6
O 9−2=7
P 9−1=8
Q 3 threes=9
R 9=3 threes

A 4 twos=▭
B 6=▭ threes
C 9=3 ~~~~
D 8=▭ fours
E 6=2 ~~~~
F 8=4 ~~~~
G 3 threes=▭
H 2 fours=▭
I 2 threes=▭
J 9=▭ threes
K 7+2=▭
L 1+3=▭
M 9−4=▭
N 7−2=▭
O 9=6+▭
P 4+5=▭
Q 9−2=▭
R 4=2+▭
S 9=1+▭
T 9−5=▭

A Add six cents and three cents.
B Subtract 7 quarts from 9 quarts.
C 1 quarter=▭ nickels
D 2 nickels=1 ~~~~
E 1 dime=▭ cents
F 1 quarter=▭ cents
G 1 quarter=2 dimes and ~~~~
H 4 pints=▭ quarts
I 1 foot is shorter than ▭ inches.
J Nine toy houses−two toy houses=~~~~
K 3 frogs plus 6 frogs=▭ frogs
L One child+eight children=~~~~
M Add two horses and six horses.
N Subtract four mice from eight mice.
O 4 quarters−1 quarter=~~~~
P Seven men plus two men=▭ men
Q Add 5 toy stands and 4 toy stands.
R Nine sleds minus three sleds=~~~~
S Eight clowns−two clowns=▭ clowns
T Six squirrels+two squirrels=~~~~
U Nine turtles−one turtle=~~~~
V 2 umbrellas+2 umbrellas=~~~~







A How many elephants are there in all?
5 elephants + 4 elephants = ~~~~

B How many bears will be left?
8 bears − 6 bears = ▒ bears

C How many more dogs are there than elephants?
7 dogs − 2 dogs = ▒ dogs

D How many more dogs are needed for the stands?
9 dogs − 3 dogs = ~~~~

E How many dolls are left standing?
9 dolls − 5 dolls = ▒ dolls

F How many clowns are there in all?
3 clowns + 2 clowns = ▒ clowns

G How many horses are there in all?
2 horses + 5 horses = ▒ horses

H How many more clowns are there than blue balls?
8 clowns − 5 clowns = ▒ clowns

A The apple costs how much more than the orange?

B Nancy has how much more money than she needs to buy the apple?

C Nancy has how much more money than she needs to buy the orange?

D How much money in all do the apple and the orange cost?

E How many pints of milk can Carol put into the 3 quart bottles?

F How many quarts of milk can Carol put into the 4 pint bottles?

G How many quarts of milk can Don put into the 8 pint bottles?

H How many pints of milk can Don put into the 4 quart bottles?

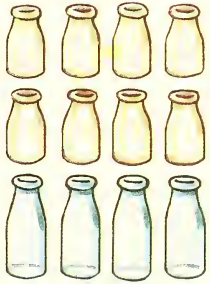
I The chicken and the duck cost ▭¢ in all.

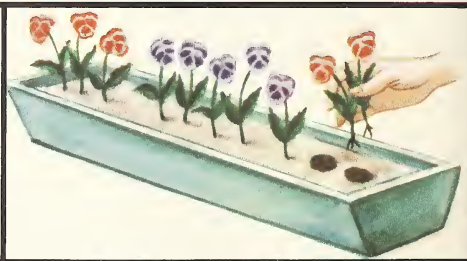
J Has Nancy enough money to buy the duck?

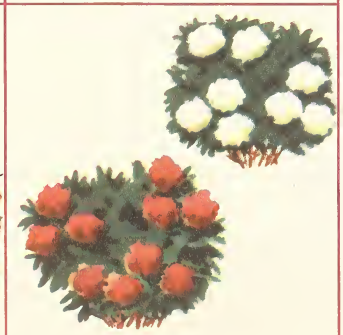
K She needs ▭¢ more to buy the duck.

L 2 feet+3 feet=▭ feet

M Can Don put 3 red boxes as long as this one into the blue box?







The man has 9 plants in the garden.
He has 1 more plant for the garden.
Then he will have ▒ plants in the garden.
9 plants+1 plant=▒ plants 9+1=▒

How many more white flowers are there than blue flowers?
10 white flowers−9 white flowers=~~~

There were 2 plants on the table.
8 more plants are being put on the table.
Then there will be ▒ plants on the table.
2 plants+8 plants=~~~ 2+8=▒

There were 10 yellow flowers in the garden.
Carol is taking away ▒ yellow flowers.
Then ▒ yellow flowers will be left.
10 flowers−4 flowers=~~~ 10−4=▒

Ellen has 5 plants, and Carol has 5 plants.
How many plants do the girls have in all?
5 plants+5 plants=~~~ 5+5=▒

How many more red flowers are there than white flowers?

Don needs ▭ more plants for the garden.

10 plants = 2 plants + ▭ plants 10 = 2 + ▭

10 plants − 2 plants = ▭ plants 10 − 2 = ▭

Carol needs ▭ more plants for the garden.

10 plants = 7 plants + ▭ plants 10 = 7 + ▭

10 plants − 7 plants = ▭ plants 10 − 7 = ▭

Nancy needs ▭ more flowers to plant.

10 flowers = 3 flowers + ▭ flowers 10 = 3 + ▭

10 flowers − 3 flowers = ▭ flowers 10 − 3 = ▭

Tom needs ▭ more plants for the garden.

10 plants = 6 plants + ▭ plants 10 = 6 + ▭

10 plants − 6 plants = ▭ plants 10 − 6 = ▭

A 6 + 4 = ▭

B 2 + 8 = ▭

C 5 + 5 = ▭

D 9 + 1 = ▭

E 3 + 7 = ▭

F 8 + 2 = ▭

G 4 + 6 = ▭

H 7 + 3 = ▭

I 10 − 5 = ▭

J 10 = 9 + ▭

K 10 = 7 + ▭

L 10 − 6 = ▭

M 10 − 2 = ▭

N 10 = 5 + ▭

O 10 = 1 + ▭

P 10 − 7 = ▭

Q 10 = 3 + ▭

R 10 − 8 = ▭

S 10 = 6 + ▭

T 10 − 3 = ▭

U 10 − 9 = ▭

V 10 = 8 + ▭

W 10 − 4 = ▭

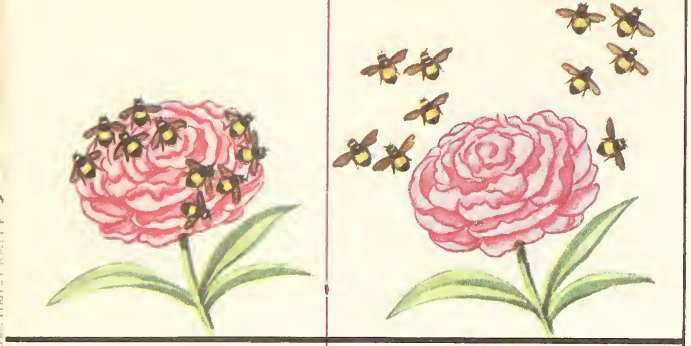
X 10 − 1 = ▭

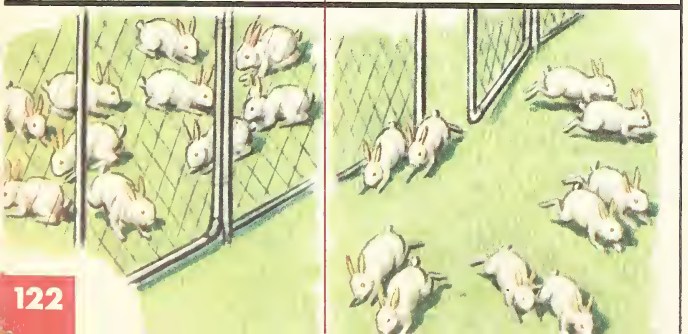
How many groups of bees are flying
to the flower?
How many bees are in each group?
Now how many bees are on the flower?
5 groups of 2 bees=~~~~~ 5 twos=▒

How many groups of birds are flying
to the garden?
How many birds are in each group?
Now how many birds are in the garden?
2 groups of 5 birds=~~~~~ 2 fives=▒

How many groups of bees are flying
to the flower?
How many bees are in each group?
How many bees will be on the flower?
2 groups of 5 bees=~~~~~ 2 fives=▒

How many groups of birds are flying
to the garden?
How many birds are in each group?
How many birds will be in the garden?
5 groups of 2 birds=~~~~~ 5 twos=▒





_____ bees are on the red flower.
Now they are flying away in groups of _____.
How many groups of bees are flying away?
10 bees=_____ groups of 5 bees
10=_____ fives

_____ bees are on the blue flower.
Now they are flying away in groups of _____.
How many groups of bees are flying away?
10 bees=_____ groups of 2 bees
10=_____ twos

How many rabbits are in the yard?
Now they are running away in groups of _____.
How many groups are running away?
10 rabbits=_____ groups of 2 rabbits
10=_____ twos

A 6=_____ twos
B 4=_____ twos
C 10=_____ fives
D 9=_____ threes
E 8=_____ twos
F 10=_____ twos
G 4= 2 _____
H 6=_____ threes
I 8=4 _____
J 8=_____ fours

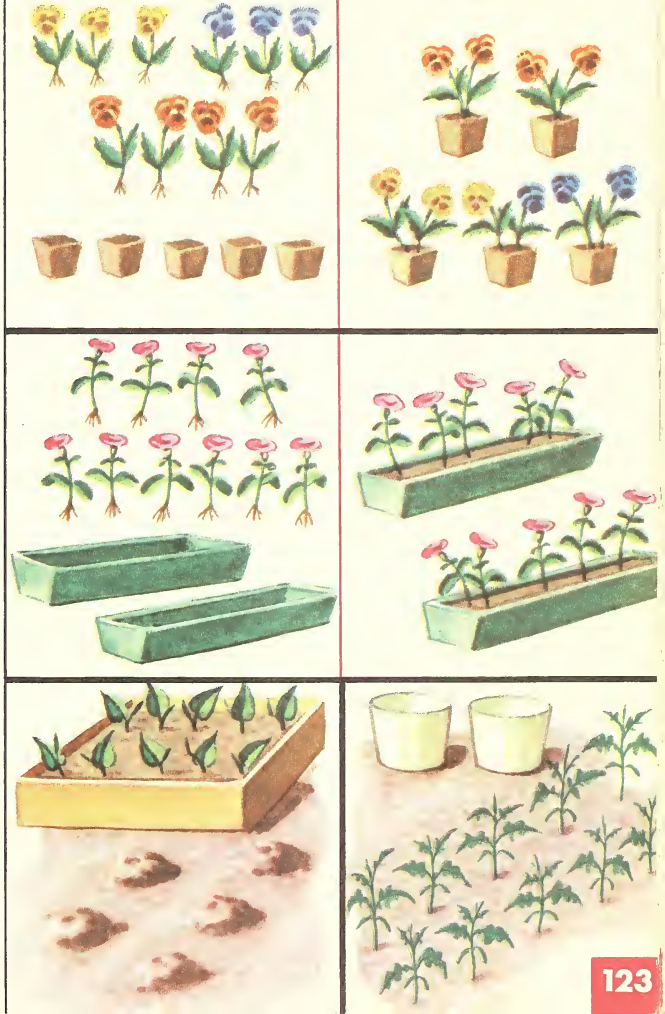
Don is going to put the same number of flowers in each of 5 little boxes.
How many flowers will be in each box?
10 flowers = 5 groups of ▭ flowers
10 = 5 groups of ▭ 10 = 5 ⁓⁓

Carol is going to put the same number of flowers in each of 2 long boxes.
How many flowers will be in each box?
10 flowers = 2 groups of ▭ flowers
10 = 2 groups of ▭ 10 = 2 ⁓⁓

10 plants = 5 groups of ▭ plants
10 = 5 groups of ▭ 10 = 5 ⁓⁓

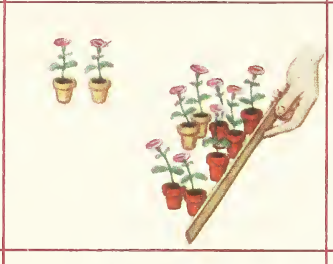
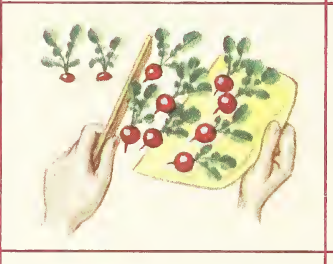
10 plants = 2 groups of ▭ plants
10 = 2 groups of ▭ 10 = 2 ⁓⁓

A 10 = 5 ⁓⁓
B 6 = 2 ⁓⁓
C 4 = 2 ⁓⁓
D 10 = 2 ⁓⁓
E 8 = 4 ⁓⁓
F 6 = 3 ⁓⁓
G 9 = 3 ⁓⁓
H 8 = 2 ⁓⁓
I 5 twos = ▭
J 3 threes = ▭
K 2 fours = ▭
L 2 fives = ▭

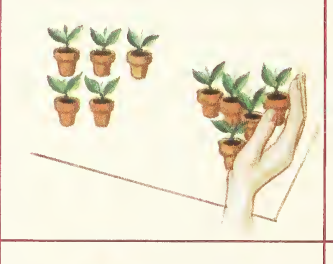








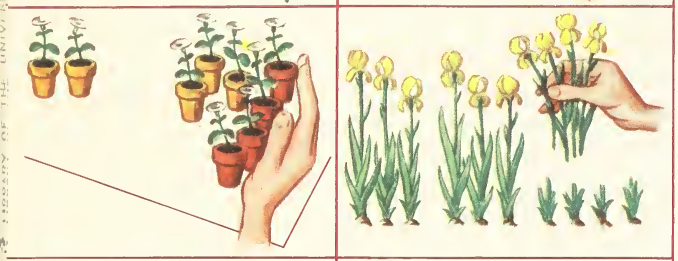





A 1+9=10
B 9+1=10
C 2+8=10
D 8+2=10
E 3+7=10
F 7+3=10
G 4+6=10
H 6+4=10
I 5+5=10
J 10−1=9
K 10−2=8
L 10−3=7
M 10−4=6
N 10−5=5
O 10−6=4
P 10−7=3
Q 10−8=2
R 10−9=1
S 5 twos=10
T 2 fives=10
U 10=5 twos
V 10=2 fives

A 10=4+▭
B 1+9=▭
C 4−2=▭
D 9−6=▭
E 8=1+▭
F 6+4=▭
G 7+3=▭
H 8=3+▭
I 4+6=▭
J 3+7=▭
K 10−5=▭
L 10−3=▭
M 3+6=▭
N 7+1=▭

A Ten pints=▭ quarts
B 4 quarts=▭ pints
C 1 foot=▭ inches
D 1 quarter=▭ nickels
E 1 dime=▭¢
F 1 quarter=▭ cents
G 1 dime=▭ nickels
H 1 quarter=1 dime and 3 ~~~~
I Add eight feet and two feet.
J Subtract seven mice from ten mice.
K Nine stands−four stands=▭ stands
L Ten clowns−nine clowns=~~~~
M One inch+nine inches=~~~~
N Nine quarters minus three quarters=~~~~
O Two pigs plus seven pigs=▭ pigs
P Eight cows plus one cow=▭ cows
Q Ten beds minus nine beds=~~~~
R Add eight frogs and two frogs.
S Subtract six sticks from nine sticks.
T Two turtles+eight turtles=~~~~
U Ten bees minus six bees=▭ bees
V Three sticks+seven sticks=~~~~



A Carol has ▒ more plants than flowers.
10 plants − 1 plant = ▒ plants

B 3 plants are being put with ▒ plants.
How many plants will there be in all?
7 plants + 3 plants = ▒ plants

C How many white flowers are there in all?
2 white flowers + 7 white flowers = ~~~~

D How many yellow flowers will be left?
10 yellow flowers − 4 yellow flowers = ~~~~

E Don needs ▒ more plant for the 4 boxes.
4 plants = 3 plants + ▒ plant 4 = 3 + ▒
4 plants − 3 plants = ~~~~ 4 − 3 = ▒

F 9 plants are being put with ~~~~
How many plants will there be in all?
1 plant + 9 plants = ~~~~ 1 + 9 = ▒

G 8 red flowers + 2 red flowers = ~~~~

H How many more red flowers are there than white flowers?
9 red flowers − 2 red flowers = ~~~~

A Tom will have ▭ flowers in the box.
7 flowers + 2 flowers = ~~~~

B Billy needs ▭ more blue flowers.
10 flowers = 8 flowers + ▭ flowers
10 flowers − 8 flowers = ~~~~

C Don is planting 1 more plant.
He will have ▭ plants in the garden.
8 plants + 1 plant = ▭ plants

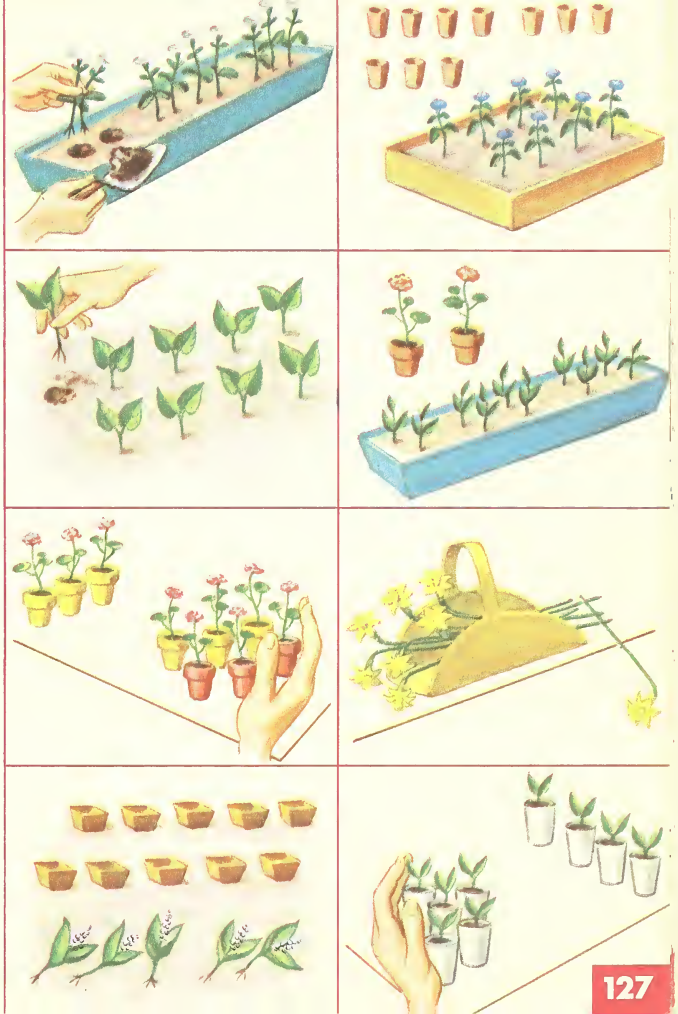
D There are how many more plants in the box than red flowers?
10 plants − 2 plants = ▭ plants

E Carol will have ▭ red flowers in all.
3 red flowers + 6 red flowers = ~~~~

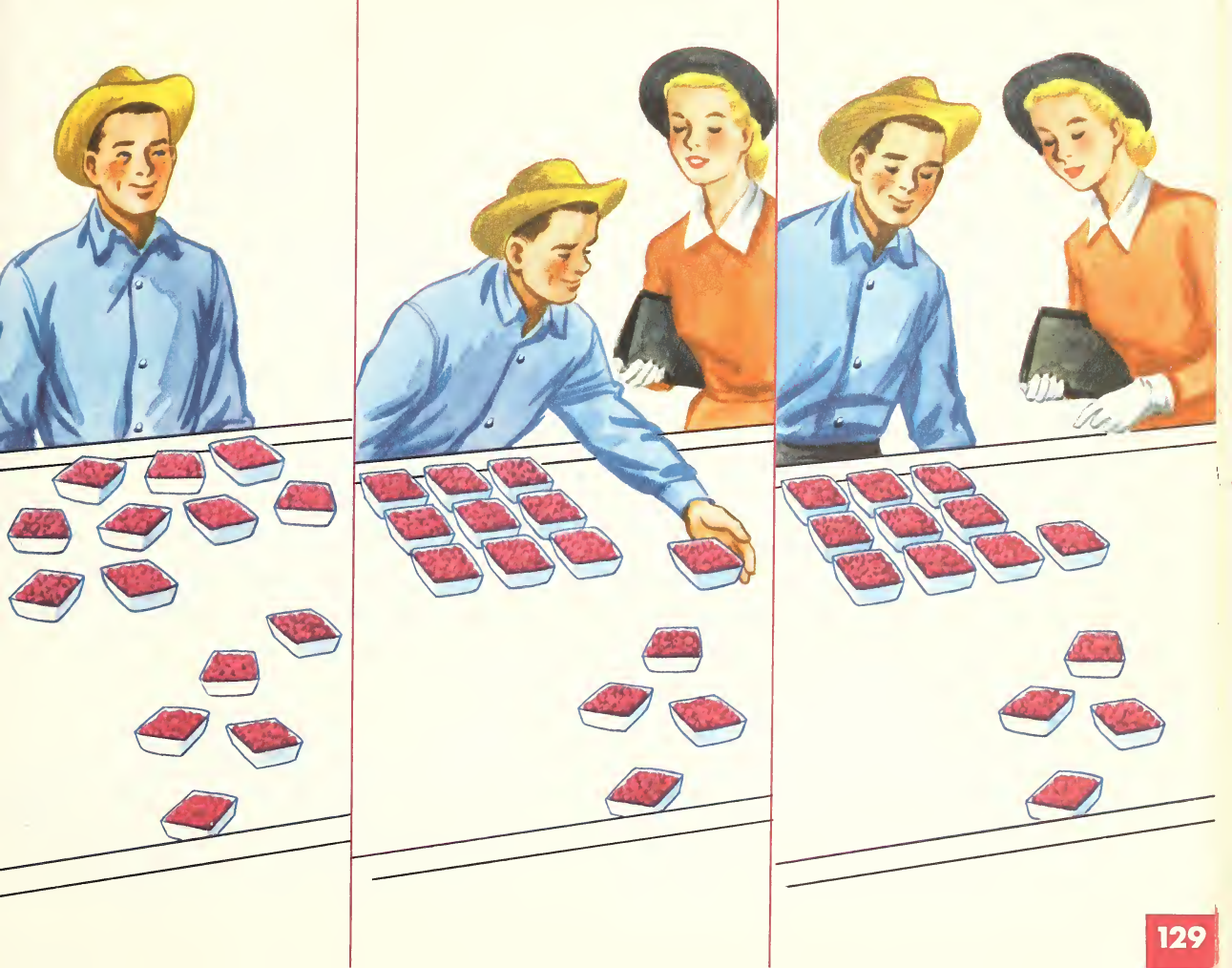
F How many yellow flowers will be left?

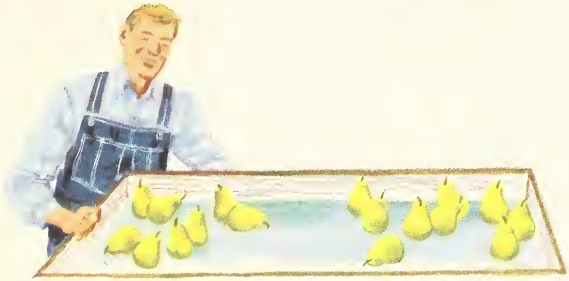
G How many more white flowers are needed for the boxes?
10 flowers = 5 flowers + ▭ flowers
10 flowers − 5 flowers = ▭ flowers

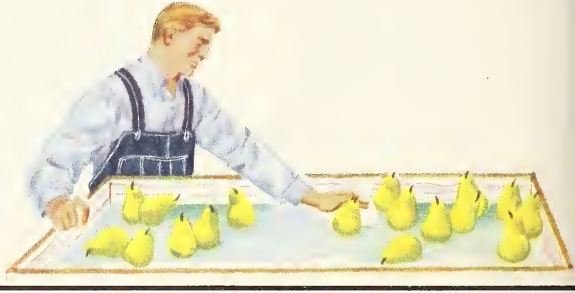
H Don will have ▭ plants on the table.

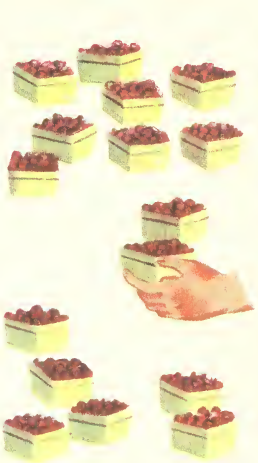


A $7+3=10$ $7+3=10$	B $2+6=$ $2+6=$	C $3+4=$ $3+4=$	D $1+2=$ $1+2=$	E $4+4=$ $4+4=$	F $2+4=$ $2+4=$	G $8+2=$ $8+2=$
H $5+3=$ $5+3=$	I $3+2=$ $3+2=$	J $6+1=$ $6+1=$	K $5+5=$ $5+5=$	L $4+6=$ $4+6=$	M $2+1=$ $2+1=$	N $3+3=$ $3+3=$
O $4+1=$ $4+1=$	P $5+2=$ $5+2=$	Q $3+7=$ $3+7=$	R $4+5=$ $4+5=$	S $4+2=$ $4+2=$	T $6+3=$ $6+3=$	U $1+1=$ $1+1=$
A $7-3=4$ $7-3=$	B $10-4=$ $10-4=$	C $3-2=$ $3-2=$	D $5-3=$ $5-3=$	E $9-1=$ $9-1=$	F $6-4=$ $6-4=$	G $5-1=$ $5-1=$
H $5-2=$ $5-2=$	I $8-7=$ $8-7=$	J $4-2=$ $4-2=$	K $9-6=$ $9-6=$	L $2-1=$ $2-1=$	M $6-3=$ $6-3=$	N $10-5=$ $10-5=$
O $7-5=$ $7-5=$	P $10-7=$ $10-7=$	Q $8-5=$ $8-5=$	R $4-3=$ $4-3=$	S $7-2=$ $7-2=$	T $8-4=$ $8-4=$	U $9-5=$ $9-5=$



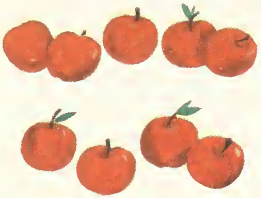


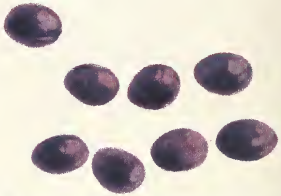
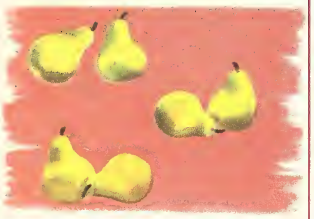


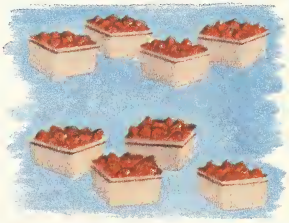




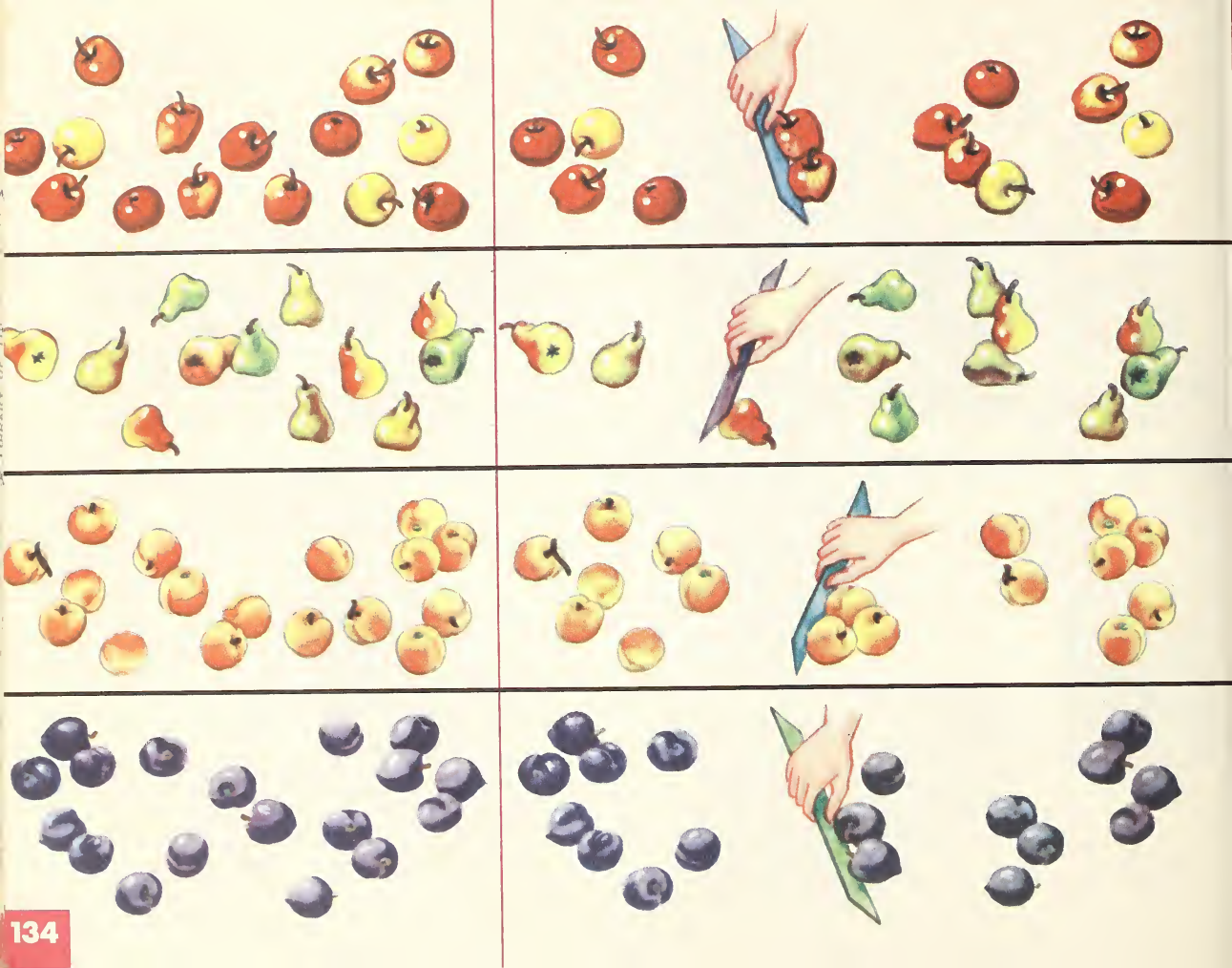


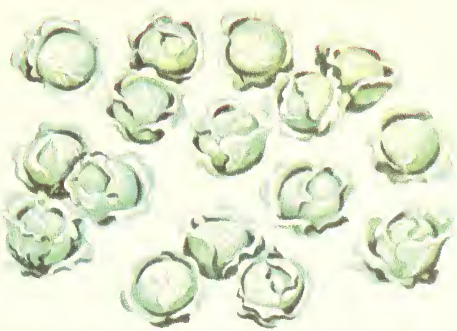



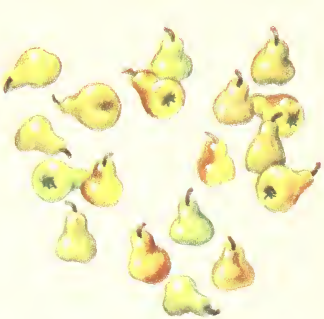



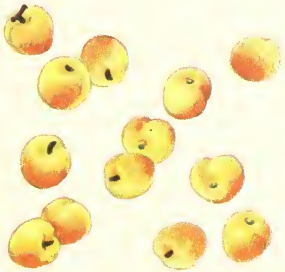


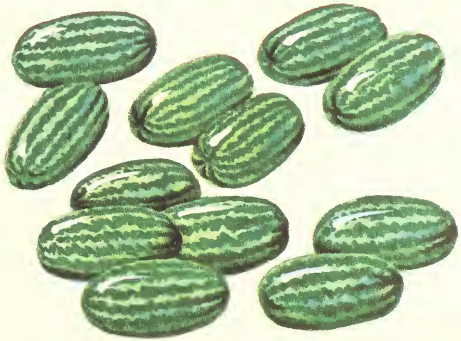


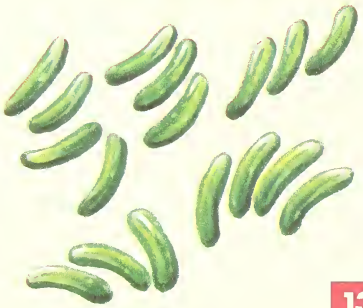



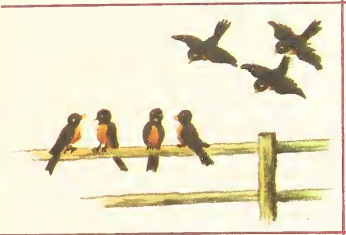


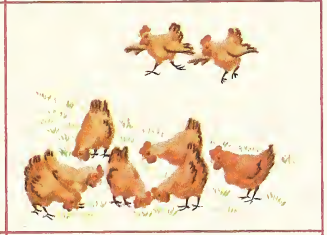


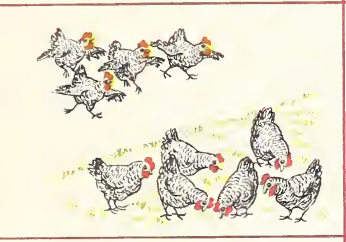


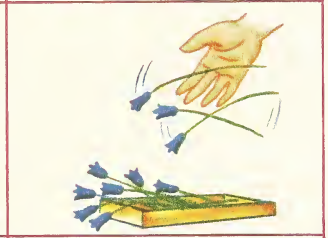


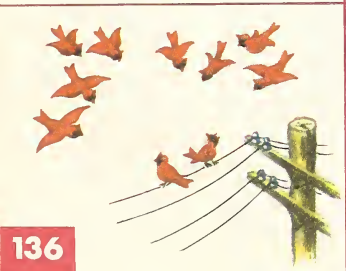












A ▭ boxes + ▭ boxes = ▭ boxes

B ▭ girls + ▭ girl = ▭ girls

C ▭ birds + ▭ birds = ▭ birds

D ▭ red chickens + ▭ red chickens = ~~~~

E ▭ chickens + ▭ chickens = ~~~~

F ▭ blue flowers + ▭ blue flowers = ~~~~

G ▭ red birds + ▭ red birds = ~~~~

H ▭ cars + ▭ cars = ▭ cars

A 1+3=▭

B 2+7=▭

C 5+4=▭

D 6+3=▭

E 1+9=▭

F 2+2=▭

G 3+6=▭

H 7+3=▭

I 7+1=▭

J 3+3=▭

K 6+4=▭

L 4+5=▭

M 1+8=▭

N 5+5=▭

O 9+1=▭

P 2+7=▭

Add

A	B	C	D	E	F
4 6 ▭	1 3 ▭	5 5 ▭	2 8 ▭	5 4 ▭	8 1 ▭

A How many more cookies are needed?

B How many more bottles of milk are needed?

C How many cookies will be left?

D How many orange cars will be left?

E How many more dolls are needed?

F How many blue cars will be left?

G Tom needs ▭¢ more to buy the boat.

H Ellen needs ▭¢ more to buy the bed.

I The bed will cost ▭¢ more than the boat.

A $9-2=\square$

B $10=4+\square$

C $10-1=\square$

D $4-3=\square$

E $9=7+\square$

F $8=7+\square$

G $9-8=\square$

H $8-3=\square$

I $4-2=\square$

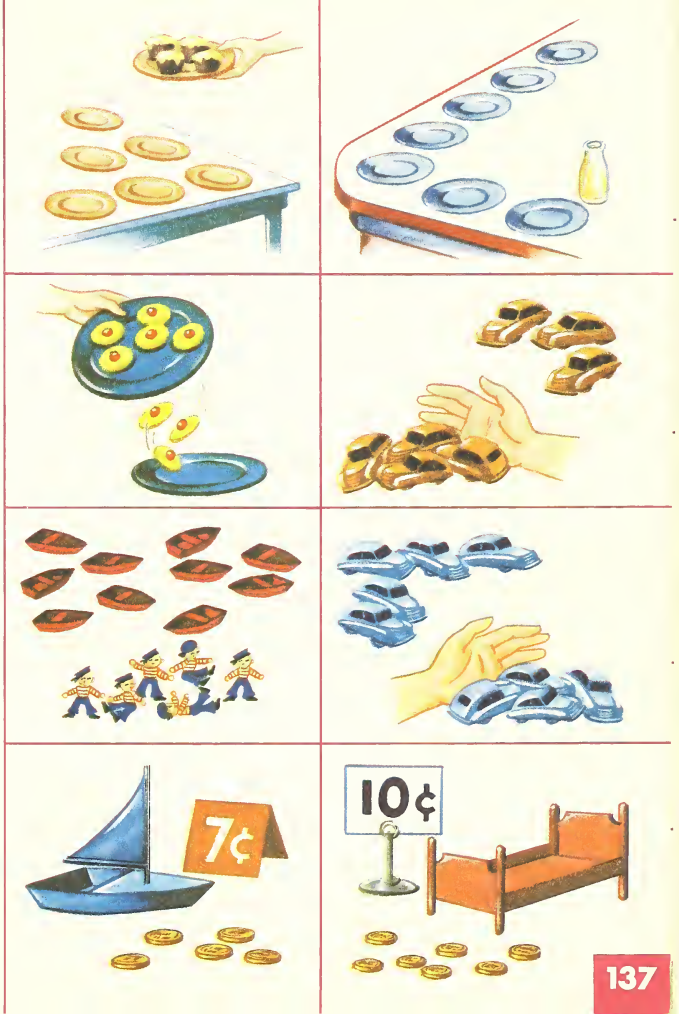
J $9=8+\square$

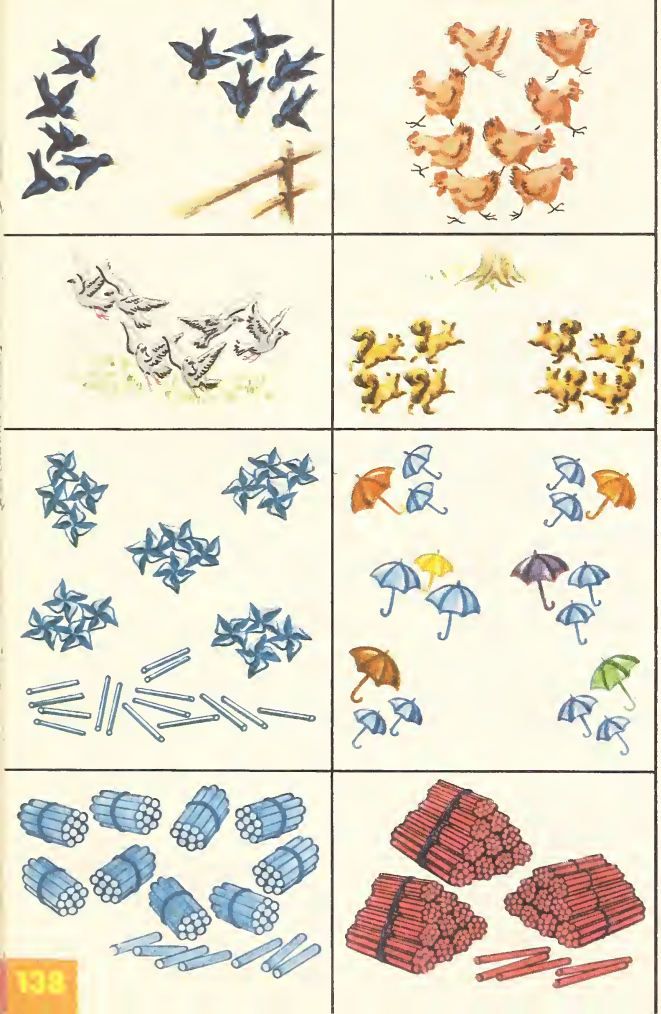
K $10-7=\square$

L $9-3=\square$

Subtract

A	B	C	D	E	F
5	10	4	9	10	10
2	2	3	4	1	3
▭	▭	▭	▭	▭	▭





A ▭ groups of ▭ birds = ten birds

B 8 chickens = ▭ groups of ▭ chickens

C 6 birds = ▭ groups of ▭ birds

D ▭ groups of ▭ squirrels = 8 squirrels

E Can you put 3 sticks with each group of 4 toys?
Are there enough sticks?

F Are there 2 blue umbrellas in each group of 3 umbrellas?

G Are there 2 little umbrellas in each group of 3 umbrellas?

H How many blue sticks are there?

I How many red sticks are there?

A 3 threes = ▭

B 2 twos = ▭

C 2 fives = ▭

D 5 twos = ▭

E 4 twos = ▭

F 2 threes = ▭

G 3 twos = ▭

H 2 fours = ▭

I 8 = ▭ fours

J 6 = 3 ~~~~

K 10 = 5 ~~~~

L 4 = ▭ twos

M 9 = ▭ threes

N 8 = 4 ~~~~

O 10 = ▭ fives

P 10 = 2 ~~~~

A Which red stick is just 1 inch long?

B Which blue stick is just 1 inch long?

C Are there enough quarts for the 5 pints?

D Are there enough pints for the 4 quarts?

E Which umbrella is just 4 inches long?

F Is the red umbrella shorter than or longer than 3 inches?

G Is the blue umbrella longer than or shorter than 2 inches?

H Is the brown umbrella longer than or shorter than 3 inches?

I Can Nancy buy a doll which costs 50¢?

J Can Carol buy a toy which costs 75¢?

K Can Billy buy a ball which costs 55¢?

L Don has ▒¢. Carol has ▒¢.

A 1 foot=▒ inches

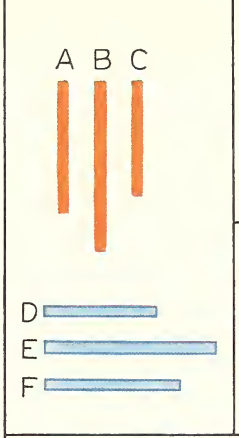
B 4 quarts=▒ pints

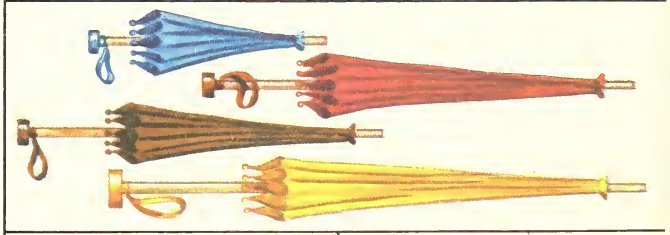
C Ten pints=▒ quarts

D 1 quarter=3 nickels and ~~~~

E Ten cents=one nickel and ~~~~

F 2 nickels=▒ cents





Add

A	B	C	D	E
7 2	6 4	2 8	3 1	9 1
F	**G**	**H**	**I**	**J**
7 3	2 6	3 7	6 2	3 1
K	**L**	**M**	**N**	**O**
2 7	4 6	3 5	8 1	7 2
P	**Q**	**R**	**S**	**T**
4 5	8 1	6 3	8 2	5 3
U	**V**	**W**	**X**	**Y**
1 9	3 6	7 1	5 4	4 4

Subtract

A	B	C	D	E
8 3	10 1	9 8	8 2	10 6
F	**G**	**H**	**I**	**J**
9 5	10 8	4 3	9 1	8 7
K	**L**	**M**	**N**	**O**
10 2	9 6	9 2	10 4	8 1
P	**Q**	**R**	**S**	**T**
10 7	9 4	4 2	10 3	10 5
U	**V**	**W**	**X**	**Y**
9 7	9 3	4 1	10 9	8 5

Purpose and Scope of This Book

Numbers in Action is designed to help teachers develop a rich and interesting number program in Grade 2. Used throughout the year either with the *Arithmetic Readiness Cards*[1] and *Our Number Workshop* 2[2], or independently, it leads the way to a systematic development of number concepts by non-formal, concrete methods. A carefully planned sequence of pictures is used (1) to introduce each new concept in a natural setting at the child's level of interest and understanding, (2) to provide a psychologically sound procedure for bridging the gap between the use of concrete objects and abstract symbolism. A number program based on these principles was developed for Grade 1 in *Numbers We See*.[3] This program enabled the child to acquire the meaning attached to the spoken number word before he was required to recognize the written symbol. *Numbers in Action* continues this program and introduces those actions which give meaning to symbols such as "+" and "—". The child's natural way of thinking about number in social situations is facilitated when his thinking is based on these actions.

Problem solving is considered to be the primary objective of a modern arithmetic program. For this reason *Numbers in Action* introduces the following three phases of problem solving:

1. *Recognizing the action:* learning that some situations use a combining action and others a separating action, thereby leading to generalized concepts of addition, subtraction, multiplication, and division.

2. *Using symbols to express the situation:* learning to represent addition and subtraction situations by using number symbols (4, 5, 6, 7, etc.) and action symbols (+, —).

3. *Processing number symbols:* using regrouping procedures and developing reasonable facility of response when using number symbols.

To insure that the child will achieve maximum success in problem solving, *Numbers in Action* develops five fundamental number ideas.

1 *Correspondence:* relating one object to one object, one-to-ten, one-to-twelve, two-to-three, and others. (Pages devoted to this phase are indicated by blue blocks in the book.)

2 *Number relationships:* developing the basic facts relating to those groups (of 10 or fewer) taught in *Numbers We See;* preparing for basic facts involving groups up to eighteen by regrouping by tens and ones. (Indicated by red.)

3 *Number system:* grouping objects by tens and hundreds to represent numbers to 999 leading to an understanding of the written notation of our number system. (Indicated by orange.)

4 *Measurement:* developing the concept of a standard unit; introducing the standard units *inch, foot, quart,* and *pint.* (Indicated by green.)

5 *Money:* recognizing coins (cent, nickel, dime, quarter); counting money by tens, fives, and ones to fifty-four cents, and by tens and ones to ninety-nine cents; establishing the relationships among coins. (Indicated by gray.)

The basic number ideas are introduced by means of a sequence of pictures. These ideas can be made clear through group discussions and by a variety of manipulative activities based on the pictures. The picture sequences show all the actions which take place in the number situations generally introduced in Grade 2. Short picture sequences, and single pictures, have been woven into the program in order to develop the ability to imagine actions—actions which eventually are represented by symbols on the printed page. A complete discussion of the points made here, as well as many interesting ways to use this book, will be found in the Teacher's Notes beginning on page 145 of the Teacher's Edition.

1 *Arithmetic Readiness Cards Set 1: Grouping; Set 2: Number System,* by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company.

2 *Our Number Workshop 2,* by Maurice L. Hartung, Henry Van Engen, and Catharine Mahaney. Scott, Foresman and Company.

3 *Numbers We See,* by Anita Riess, Maurice L. Hartung, and Catharine Mahaney. Scott, Foresman and Company.

Concept Chart

The following chart gives in brief form for each page the skills and concepts that are developed. The color band indicates for each page the area of content to which it belongs. An explanation of this color code is given on page 141. A detailed explanation of the objective for each page will be found in the directions for teaching the page. These directions begin on page 151 of the Teacher's Edition.

Page	Concepts and Skills
3	Review of one-to-one correspondence as readiness for counting
4	Review of one-to-one, one-to-two, and two-to-one correspondence
5	Review of the recognition of the groups 2, 3, and 4
6	Review of the recognition of the even number groups 6, 8, and 10
7	Review of the recognition of the odd number groups 5, 7, and 9
8	Review of positional meaning of 1 to 10; recognition of number symbols and words 1 to 10
9	Recognition of number symbols and number words 1 to 10 with emphasis on numerousness
10	Positional meaning of 1 to 10; emphasis on location by use of two directions
11	Identification of cent, nickel, and dime; counting amounts of money to total of 10 cents
12	The 5 group; completed action for the combining of two groups
13	The 5 group; imagined action for the combining of two groups
14	The 5 group; symbolism for the combining of two groups
15	The 5 group; completed action for separating into two groups; remainder idea only
16	The 5 group; imagined action for separating into two groups; remainder idea only
17	The 5 group; symbolism for separating into two groups; remainder idea only
18	The 5 group; pictorial problem situations for combining and separating actions
19	The 5 group; pictorial problem situations for combining and separating actions; symbolism
20	The 3 group; completed action for the combining of and separating into two groups
21	The 3 group; imagined action for the combining of and separating into two groups; symbolism
22	The 7 group; completed action for the combining of two groups
23	The 7 group; imagined action for the combining of two groups
24	The 7 group; symbolism for the combining of two groups
25	The 7 group; completed action for separating into two groups; remainder idea only
26	The 7 group; imagined action for separating into two groups; remainder idea only
27	The 7 group; symbolism for separating into two groups; remainder idea only
28	The 3, 5, and 7 groups; pictorial problem situations for combining and separating actions
29	The 3, 5, and 7 groups; pictorial problem situations and symbolism; combining and separating
30	Introduction of the plus sign; further symbolism for 3, 5, and 7 groups; combining action
31	Introduction of the minus sign; further symbolism for 3, 5, and 7 groups; separating action
32	The 3, 5, and 7 groups; pictorial problem situations for combining and separating actions
33	The 3, 5, and 7 groups; symbolism for and practice with combining and separating actions
34	The 3, 5, and 7 groups; pictorial problem situations; symbolism for combining and separating
35	Number system; completed action for grouping by tens and ones
36	Number system; symbolism with tallies for groups of tens and ones
37	Number system; symbolism with numbers for groups of tens and ones
38	Number system; symbolism with numbers for the decades 10 to 90
39	Number system; symbolism for the numbers within the second decade 11 to 19
40	Number system; symbolism for the numbers within the decades 20 to 99
41	Number system; changed symbolism for groups increased by one and by a group of ten
42	Number system; changed symbolism for groups decreased by one and by a group of ten
43	Money; relation of money system to number system; counting by tens and ones to 99 cents
44	Money; counting cents, nickels, dimes by tens and ones to 99 cents
45	Money; pictorial problem situations involving cents, nickels, and dimes
46	The 6 group; completed action for the combining of two groups
47	The 6 group; imagined action for the combining of two groups
48	The 6 group; symbolism for the combining of two groups
49	The 6 group; completed action for separating into two groups; remainder idea only
50	The 6 group; imagined action for separating into two groups; remainder idea only
51	The 6 group; symbolism for separating into two groups; remainder idea only
52	The 6 group; completed and imagined action for the combining of equal groups
53	The 6 group; action for separating into equal groups; finding how many groups
54	The 6 group; symbolism for combining equal groups and separating into equal groups
55	Introduction of the equals sign; further symbolism for the 5, 6, and 7 groups
56	The 3, 5, 6, and 7 groups; pictorial problem situations
57	The 3, 5, 6, and 7 groups; complete table of basic facts in abstract form; practice
58	Measurement; situations requiring a standard unit
59	Measurement; concept of the inch; use of 1-inch to 4-inch models; comparison by measurement
60	Measurement; concept of the foot; use of the foot ruler marked in inches
61	Measurement; establishing the need for standard units to measure capacity
62	Measurement; concept of quart and pint; relationship between quart and pint
63	Comparing two groups by subtraction; completed action to show why subtraction is used
64	Comparing two groups by subtraction; imagined action to show why subtraction is used
65	Comparing two groups by subtraction; symbolism; 3, 5, 6, and 7 groups
66	Comparing two groups by subtraction; pictorial problem situations; further symbolism
67	Finding how many more are needed; completed action to show why subtraction is used
68	Finding how many more are needed; imagined action to show why subtraction is used

Summary of Mathematical Content

Numbers and the number system

One-to-one correspondence
One-to-two and two-to-one correspondence
Ordinal use of numbers 1 to 10
Recognition of groups of 3, 5, 7, 9, and their common characteristics
Recognition of groups of 2, 4, 6, 8, 10, and their common characteristics
Counting by ones (from any starting point) to 999
Counting by tens (from any starting point) to 990
Counting by fives to 50
Reading and writing numbers to 999
Place value through hundreds
Readiness for concept of ratio

Addition of whole numbers

Concept of addition
Basic facts through sums of 10
Regrouping quantities of 11 to 18 as readiness for the higher decade basic facts

Subtraction of whole numbers

Concept of subtraction
Basic facts through minuends of 10
Regrouping quantities of 11 to 18 as readiness for the higher decade basic facts
Comparison of two groups by subtraction
Finding how many more are needed

Multiplication

Readiness for concept of multiplication
Basic facts through products of 10 (informal)

Division

Readiness for concept of division (situations with number of groups unknown and situations with number in each group unknown)
Basic facts through dividends of 10 (informal)

Measurement

Concept of standard unit
Inch, foot, and their relationship
Pint, quart, and their relationship

Money

Recognition of cent (penny), nickel, dime, and quarter
Value relationships among these coins
Counting money by fives and ones to 54 cents
Counting money by tens and ones to 99 cents

Fractions

Recognition of $\frac{1}{2}$ and $\frac{1}{4}$ of one thing

Vocabulary List

This list contains all 158 words included in *Numbers in Action*. For children who have completed the Basic Reading Series through Our *New Friends*, only the 63 words printed in boldface type will be new.

8 **eight**
five
four
nine
one
seven
six
ten
three
two
14 and
are
be
dogs
eating
how
in
is
many
more
pig
plus
rabbits
running
squirrels
the
then
to
will
yard
17 to
today
ball
boys
Carol
cars
dolls
girls
going
house
left
minus
of
playing
took
toy
were
19 birds
chickens
kittens
oranges
21 apples
Billy
boots
bottles
child
children
Don
for
has
have
he
put
some
with
24 big
box
can
cookies
this
27 all
boxes
from
man
taking
there
29 **bags**
plants
30 at
standing
store
31 do
33 baskets
books
cows
men
wagons
34 **add**
subtract
you
45 Ellen
less
money
Nancy
pennies
than
Tom
48 made
on
sleds
snowmen
51 **equal**
pictures
54 ducks
each
flying
groups
now
pond
they
55 ———
57 ———
59 as
inch
inches
just
long
longer
umbrella
which
60 **foot**
little
or
shorter
table
62 **pints**
quart
65 **bears**
brown
flowers
white
yellow
66 ———
69 **beds**
buy
needs
she
70 ———
71 had
72 **cents**
dime
feet
nickels
75 **mice**
turtles
77 **blocks**
horses
78 **frogs**
80 **number**
same
83 ———
85 ———
89 ———
97 **cost**
much
103 **enough**
108 blue
elephants
red
110 **clowns**
111 ———
113 **quarter**
114 ———
115 milk
118 **garden**
120 ———
121 **bees**
122 ———
123 ———
125 **sticks**
126 ———
127 ———
136 ———
137 ———
138 ———
139 ———

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 J 595857565554535251

Reading for a general overview

In general, four kinds of materials are provided in *Numbers in Action:* (1) picture sequences which help the child formulate generalized concepts of such things as addition, subtraction, measurement, and the number system; (2) single pictures which encourage the child to imagine that certain physical acts have been completed and to describe these acts by using technical words or symbols; (3) pictorial problem situations which must be analyzed and associated with the printed word; and (4) practice on number combinations and on the use of technical words. These four kinds of materials are arranged in a sequence that creates a favorable learning situation. Under such a favorable learning situation psychological blocks against learning arithmetic are less likely to occur.

The program of which this "picture number book" is a part provides a firm foundation on which to build the work with numbers in the elementary school. Instead of depending upon learning through reading or drill with abstract number symbols, the emphasis throughout is upon visual experiences which are to be supplemented by activities using actual objects.

In order to sense quickly the principal objectives of the number program presented in *Numbers in Action,* read carefully the section "Purpose and Scope of This Book," found on page 141. This section indicates, in line with modern trends, that the basic purpose of *Numbers in Action* is to teach the pupil to solve problems. In order to solve problems, the pupil must be in possession of certain key ideas which, fortunately, are few in number. These ideas are listed on page 141.

The method used throughout *Numbers in Action* is illustrated by the sequence of learning experiences presented in connection with a picture sequence (shown below) from page 15 of the book. Here the child sees that Don is driving two lambs out of the pen, and he sees the final result of this action. Gradually, the child learns to fit this situation into a general pattern: namely, 5 minus 2 is 3.

The method used to build problem-solving ability is illustrated by the material found on page 34. Here the child learns that when he attempts to solve problems he should visualize the actions described by the printed words. These actions tell him, through his generalized concepts of the fundamental processes, whether he should add or subtract.

A "Charting the Course" reading

Many teachers and supervisors will be interested in a more detailed study of the instructional program in *Numbers in Action* than has been presented in the preceding general overview. A careful reading of each "Charting the Course," found at the head of every unit of work (see the lesson notes, beginning on page 151), will supply a good insight into the number program as developed in this book. These "Charting the Course" descriptions, eighteen in all, provide an overview of the principal objectives of each unit and may be read all at one time or individually as the work with the book progresses.

The general objectives for each unit, as given in the "Charting the Course" sections, are followed by detailed lesson notes for each page. The notes list the objective of the page, give hints on vocabulary, tell what materials to prepare, explain how to use the page, and how to apply the new con-

cepts developed on the page. An examination of the headings found in the lesson notes for a typical page will show how these notes have been organized to save the teacher's time.

General directions for using the book

To avoid repetition, this discussion will be limited to general directions for planning and organizing the work.

First, the teacher should provide each child with a copy of the book so that he can individually carry on many of the activities. For example, he may be asked to place markers on an open page to show that he knows the meaning of some technical term or has mastered some general concept.

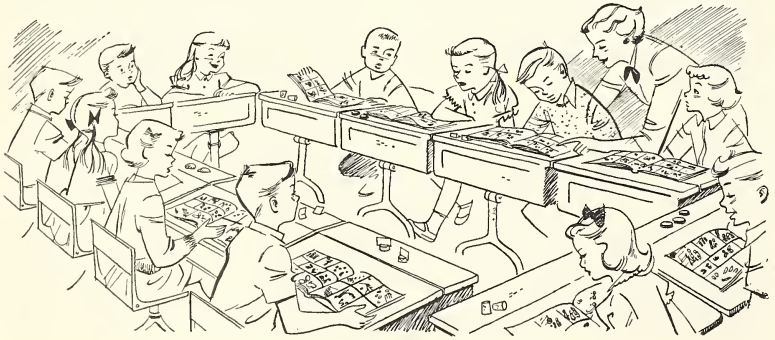
Second, in many cases the teacher will find it desirable to divide the class into two or three groups and to work with one group at a time, as is now common in teaching reading. These groups may be based on the differences in number ability and knowledge found to exist among the children. With smaller groups there is more opportunity for individual activity and participation, and the teacher can better observe the abilities of individual pupils.

Third, the teacher should know the objective that each page is designed to achieve. An explicit statement of the objective of each lesson is given under the heading "Knowing Your Objective for Page —." If necessary, the teacher should review the "Charting the Course" which states the general objective of the unit to make sure that she has in mind the unifying ideas contained in the instructional materials found in *Numbers in Action*.

Next she should read "Preparing for Page —" to find out what related materials are needed to develop the lesson. These may include stories to be read or told, markers, "frames" which cover parts of a page while exposing other parts, and other kinds of materials.

Then read the discussions found under the heading "Using Page —." The suggestions found under this heading are intended to serve only as a general guide for class activities. No attempt should be made to follow them word for word. If, however, full advantage is to be taken of the possibilities of *Numbers in Action*, plans essentially similar to those given should be followed. The pictures and the text accompanying them help to motivate the activities and to establish a natural setting for them. They represent children's doings and interests at home, at school, at the store, and in other typical places.

Finally, the pupils should be given opportunities for "Applying the New Concepts and Skills." Suggestions for such applications are outlined in sections under that heading. Many teachers have developed number activities of their own which they wish to introduce at appropriate times along with (or in place of) some of those suggested in the notes. Teachers should feel free to make use of local settings to broaden the child's experiences. Moreover, the teacher should be constantly on the alert for situations in the day's activities in which pupils use, or can be helped to use, the abilities each page is designed to develop. Number learning in arithmetic is cumulative in that later concepts and skills are built upon the foundation of earlier ones. One of the best ways of knowing that the foundation is firm is to observe the ability of pupils to apply concepts and skills in situations different from those in which they were learned.



Problem solving — the fundamental objective

The teaching of arithmetic during the first half of the twentieth century was dominated by a stimulus-response psychology which placed great emphasis on breaking down the subject of arithmetic into minute pieces. Drill procedures were the foundation of the method of instruction when the stimulus-response psychology set the stage for the learning situation. Following the drill exercises, diagnosis of pupil errors was usually confined to the mechanical aspects of the subject.

Today new principles of learning are being formulated for the guidance of teachers of arithmetic. The stimulus-response psychology, together with many of its instructional processes, is receiving relatively less emphasis. Among the new principles are three of special importance.

First, learning proceeds more efficiently when there is some insight into the total problem situation, and when the parts which make up the total situation are seen in relationship to each other and to the whole situation.

Second, learning proceeds more efficiently if the subject is organized systematically so that relationships can be recognized and later used to unify the subject.

Third, learning proceeds more efficiently if the subject is recognized by the learner as useful to him in some way.

The organization of the learning materials found in *Numbers in Action* has been guided by these fundamental principles, while at the same time retaining those principles of the older psychology which arithmetic teachers have found to be sound.[1]

Since problem solving is the "total situation" to which all quantitative experiences should contribute, the authors have given it a place of first importance. The first steps in an instructional program for problem solving are very simple, but, even so, they are essential to a meaningful and effective program. In this book a problem situation is introduced by means of a picture. Through class discussion the learner becomes aware of the problem situation and feels a need for solving it. The problem may be adequately stated by the child's saying to himself, "I wonder what's happening in this picture." He arrives at an answer by noticing the actions of the groups involved. If the actions are of a combining nature, his answer may be, "The three children are running to play with Don and Carol. That makes five children playing together." The child then indicates his awareness of the nature of the actions in the problem by placing markers on the picture and moving them so as to duplicate the actions that have been represented pictorially. As the work progresses, the child is gradually given fewer pictorial aids for arriving at a solution; that is, he is asked to imagine that certain elements of the situation have occurred. Still later he learns to substitute symbols (3, 4, etc.) for the objects and symbols (+, −) for the actions experienced in the arranging of objects, thereby arriving at problem solutions in a mature and efficient manner.

However, to solve problems it is helpful to have in mind certain general ideas about numbers and the relationships among numbers. For each grade in the elementary school these general ideas are, fortunately, few in number. *Numbers in Action* develops a systematic program of instruction based upon problem solving and at the same time initiates the development of these general ideas, namely, correspondence (counting, ratio, and comparison), number relationships, the number system, measurement, and money. These ideas give unity to arithmetic for the child. They supply principles around which he can organize the arithmetic he learns. These ideas are fundamental not only to the subject itself but, from the standpoint of the new psychology, also to the "healthful" learning of arithmetic by the child.

To make the subject significant for the child, *Numbers in Action* makes him conscious of the arithmetic in his world by means of real and vicarious experiences with toys, store situations, play activities, and school activities—all interesting to him. The child is brought closer to the arithmetic of the adult world by units of work de-

[1] Cf. T. R. McConnell, "Reconciliation of Learning Theories," *The Psychology of Learning*, Forty-first Yearbook of the National Society for the Study of Education, Part II. Public School Publishing Company, Bloomington, Illinois, 1942.

veloped around experiences which all children are likely to have had at some time. Thus, there is a unit on the grocery store, one on the garden, one on the pet store, and others which are both interesting and valuable to the children.

Learning through experience — the method

Research suggests that children think in terms of actions. They think in terms of what they have seen happen or have caused to happen to objects, such as blocks, markers, toys, animals, or people. This conforms to the well-known fact that children learn through the senses of touch, sight, hearing, and smell. *Numbers in Action* provides a wealth of experiences which direct attention to those actions which are involved in grouping and regrouping objects and which can be interpreted mathematically. In particular the child has experience with those actions which are later expressed by such words and symbols as *plus*, *minus*, "+," and "−." However, to arrive at this stage a definite sequence of learning experiences must be provided—a sequence based on sound psychological principles.

Numbers in Action develops this sequence of learning experiences in the following way. The child is first given many experiences with groups until he can recognize, almost immediately, the numerousness of a group of objects numbering 10 or fewer. He then experiences actions involved in the grouping of objects. For example, the child sees a group of 2 joining a group of 3 and recognizes the result as a group of 5 (*completed* action). Many experiences with one group joining another group lead to the generalization that such situations are similar and are called additive situations. The child learns that the action of combining, as described above, not the words that would be used to describe the action, indicates that it is an additive situation. In the same way he is led to the generalization that when one group is separated from another group (3 toys from 8 toys), the situation is a subtractive situation.

Through these direct experiences the child learns what such technical terms as *add* and *subtract* mean. They refer to generalized situations in which combining actions and separating actions like those mentioned above are used. It is at this stage of the learning process that the child learns to use the vocabulary of arithmetic orally. Note that, as yet, he has had no experience with written symbols.

The child should be encouraged to become gradually independent of the use of all concrete aids in thinking about the organizing and reorganizing of groups. *Numbers in Action* provides a program which assists the child in gradually becoming independent of all learning aids by supplying picture sequences. At the very beginning, picture sequences are supplied to set the stage for number situations and to guide the actions of the child in manipulating groups. Later, single pictures set the stage for number situations but do not complete the actions of combining or separating, the completion being left for the child. This may be called *imagined action*.

Having become adept at recognizing additive and subtractive situations represented pictorially and described verbally, the child is taught to represent these situations by using abstract symbols. *Numbers in Action* introduces symbolism gradually, as illustrated by the following.

a. 2 dogs and 3 dogs are 5 dogs. (oral)
b. 2 dogs plus 3 dogs are 5 dogs. (oral)
c. 2 dogs and 3 dogs are 5 dogs. (in text)
d. 2 dogs plus 3 dogs are 5 dogs. (in text)
e. 2 dogs + 3 dogs are 5 dogs. (in text)
f. 2 + 3 is 5. (in text)
g. 2 dogs plus 3 dogs equal 5 dogs. (oral)
h. 2 dogs plus 3 dogs equal 5 dogs. (in text)
i. 2 dogs + 3 dogs = 5 dogs. (in text)
j. 2 + 3 = 5 (in text)

Meaningful symbols — a necessity

While the answer to how children acquire meaning is complex, the essential idea can be best brought out by initially considering a non-quantitative experience. The symbol "cat" or the spoken

word "cat" will be meaningful to a child to the extent to which he has had experiences with cats. The child who has pulled a cat's tail, or who has been scratched by a cat, or who has had a cat for a pet can recall these experiences when he hears the spoken word "cat" or sees the symbol "cat." In other words, the symbol "cat" will, in the end, be associated with these experiences and have meaning for the child. He will tend to react to the symbol as he would react to a cat.

It follows that the elements of meaning are based largely upon experiences—direct contact with objects through the senses of touch, sight, hearing, and smell. Number meanings are no exception. If the child has had a variety of experiences with groups of six objects and if he associates these experiences with the symbol "6," he is reacting meaningfully to the symbol 6. These experiences should include such activities as grouping 4 objects with 2 objects to make a group of 6 objects, grouping 3 objects and 3 objects, regrouping 6 objects into a group of 2 objects and 4 objects, and all other possible groupings of 6 objects. Some of these experiences will naturally include ideas which are the foundation for the processes of addition and subtraction.

In much the same way such symbols as "+" and "−" may be made meaningful to the child. The child formulates a generalization that those actions which result in the combining of two groups, as when 4 balls are put with 2 balls, are symbolized by "+" or the word *plus*. Likewise, the child formulates a generalization that those actions which result in the separating of a group from a larger group (as when 5 apples are removed from a group of 6 apples) are symbolized by "−" or the word *minus*.

When the tendencies to react to a symbol are similar to those reactions present when the real objects or conditions are at hand, the symbol is said to have meaning for the child.

The program developed in *Numbers in Action* helps the child to sift from the heterogeneous experiences usually found at school and at home, those actions which are represented by arithmetical words, signs, and symbols. These experiences in the book are so organized that the child learns to associate a particular symbol with a particular kind of experience or set of actions. It is important to remember that the actions are represented by the symbol "−" and not by words or phrases, such as "take away," "spent," or "how many are left."

The effect of such a program of instruction on problem solving should be evident. The child decides whether to add or subtract on the basis of what the situation demands that he do with the groups involved instead of on the basis of a set of "cue" words. In this way problem-solving procedures become meaningful to the child because what he does on paper symbolizes the action implicit in the problem situation.

The actions essential to the grouping and regrouping of objects are vital elements in any meaningful arithmetic program. The grouping activities found throughout *Numbers in Action* are fundamental. Arithmetic cannot be taught meaningfully without them.

Action versus process — an important distinction

The entire program of *Numbers in Action* is designed to help children learn to think about number with a minimum of difficulty. This program has been described in considerable detail in the previous sections. There is, however, an

important distinction between action and process that teachers should keep in mind if arithmetic is to be taught so as to avoid blocking the learning progress of the child.

There are problems in arithmetic in which the child is usually taught to subtract, but which, in his natural way of thinking, are additive situations. For example, John has 6 cents, and he wants to buy a candy bar that costs 10 cents. How much more money does he need? There is evidence in the research on arithmetic that children tend to think of this as an addition problem. This tendency is not at all surprising since the words and the actions indicate that some money must be combined with the 6 cents to make 10 cents. All the child's previous experiences have taught him to think of this as an additive situation. With faulty methods of instruction, the child is told that this is a subtractive situation. Lack of understanding and confusion naturally result.

Now it happens that the child is right—psychologically right and logically right. The situation is an additive situation by every standard that can be brought to bear on it, but the answer is obtained by subtraction; that is, the numbers are processed by subtraction. In other words, the actions that would be used with the money itself to solve the problem indicate that this is an additive situation. When the child solves the problem by means of symbols, he is required to process numbers. In the problem above, the child processes the numbers by subtraction. The situation is additive; the process is subtraction. The term "additive subtraction" can be applied to problems of this kind because the thinking is additive and the processing of the numbers is done by subtraction.

As has been previously indicated, it is evident that, in the above problem, the actions are additive. If, as is usual, pencil and paper are used to get the answer, it also becomes evident that in processing the numbers the process of subtraction is needed. Hence, while the action is additive, the numbers are processed by subtraction.

Additive-subtraction problems, if not handled properly in the classroom, can develop formidable learning blocks. In fact, traditional methods have set up this learning block in many instances. Under traditional methods of instruction the difficulty resides in the fact that the child is not taught why the process of subtraction enables him to obtain the answer to a problem situation in which the actions are naturally considered additive. *Numbers in Action* avoids this block by providing experiences which indicate to the child why subtraction provides a means of getting an answer to the "how many more are needed" problem situation.

Another illustration may help clarify the action-processing distinction. Mary has 8 dolls and 5 doll hats. She wants to know how many more dolls she has than doll hats. Mary is comparing the number of dolls with the number of hats. This is a comparative situation, not a subtractive situation, even though it is processed by subtraction. The action of matching the dolls with the hats and counting the dolls not matched, indicates this fact. The work introduced with page 63 (page 227 of the lesson notes) shows why this comparative situation can be processed by subtraction.

This discussion points up the fact that there are two very important aspects to consider in teaching problem solving. (1) The child (in Grade Two) must be able to recognize whether a situation involves additive actions, subtractive actions, or comparative actions. (2) The child must be able to perform the number-processing techniques of addition and subtraction. The problem-solving objective cannot be achieved unless the teacher has both of these factors constantly in mind. Furthermore, a balanced program of arithmetic instruction cannot be provided without considering both of these factors.

In *Numbers in Action* the following action-process types are introduced along with many applications appropriate for Grade Two.[1]

a. *Additive-Addition*

Example: Mary had 4 apples and her mother gave her 2 more. How many apples did Mary have then? Here the actions are of the combining type. Hence the situation is additive. Furthermore, the numbers are processed by means of addition. This is the additive-addition type.

b. *Additive-Subtraction*

This type is illustrated and discussed above.

c. *Subtractive-Subtraction*

Example: John had 12 cents and lost 5 cents. How much money does he have left? The action is that of taking 5 cents away from 12 cents. Hence the situation is subtractive. The numbers are processed by means of subtraction.

d. *Comparative-Subtraction*

This type is illustrated and discussed above.

[1] Subtractive-addition and comparative-addition, as well as other action-process types, will be introduced in later grades.

Charting the Course — Correspondence and grouping

A few very simple ideas provide the foundation stones upon which all of arithmetic is built. These fundamental ideas include the concept of *one-to-one correspondence*, the concept of a *group* of objects and of the *number* associated with each group, and the concept of order or *position* in an arrangement of objects. These ideas are so elementary that arithmetic is used with little awareness of them by most older children and adults. Younger children, however, need planned experiences in the use of these ideas as a foundation on which to build their arithmetic knowledge.

The idea of *one-to-one correspondence* is used when the members of one set of objects can be paired or matched one by one with the members of another set. When sets or groups can be put in one-to-one correspondence, they are alike in *number*, no matter how different they may be in other respects. The same number *word* (*three*, for example) is used with all groups that can be matched or put into one-to-one correspondence with each other.

Sometimes the members of a group can be matched by twos with the individual members of another group. Then there is a two-to-one (or one-to-two) correspondence. This idea can be extended or generalized to include correspondences such as two-to-three, one-to-ten, and innumerable others. This general concept also plays a fundamental role in mathematical thinking.

Familiarity with the numbers *one* through *ten* is obviously basic to all number work. The child should learn to recognize immediately, without counting, groups of 2, 3, and 4 objects. He should also become skilled at recognizing each of the other groups from 5 through 10. He can do this by becoming familiar with the subgroups into which each group may be separated.

Numbers are used not only to tell how many objects are in a group; they are also used to indicate order or *position* in an arrangement of objects. Pupils must learn to use the number words and numerals for this purpose. They must also use numbers in connection with prices and money.

All of these ideas were introduced and developed in *Numbers We See*. Pages 3 to 11 of *Numbers in Action*, and the activities described in these lesson notes, provide a review of these fundamental ideas which are the foundation stones of arithmetic. No number larger than 10 is used on these pages.

3 Simple pairing; *as many as, not as many as, more, fewer*

KNOWING YOUR OBJECTIVE FOR PAGE 3

In the work connected with this page pupils will review one-to-one correspondence and will practice rational counting up to 10.

PREPARING FOR PAGE 3

From time to time in these lesson notes, books or individual stories from books will be suggested as suitable to arouse interest in certain social settings. While it is desirable to have these books available, it is not absolutely essential. However, if they can be obtained, the stories suggested may be read aloud or told to the children in a free period some time before the arithmetic lesson.

The Hollyberrys or *Picnic Woods* (items 14 and 26 in the bibliography[1]) should be available if you plan to use a story with page 3. The story "The Hot Day" from *The Hollyberrys* is especially appropriate for use with this page.

In all the lesson notes frequent reference will be made to markers. Some markers may be made by the teacher or, better, by the children. (Some markers that can be made will be described and illustrated later.) But, in addition to these, always have on hand a large collection of small objects to use as markers. These may be buttons, corks, small stones, shell macaroni, jacks, pieces of paper or cardboard, checkers, etc. Get as much variety

[1] A complete bibliography of all stories and books referred to in these lesson notes will be found on pages 282 and 283 of this book.

in these objects as possible so that each child in a group will have different markers and so that each child can use different ones from day to day. Some markers are illustrated immediately below.

For the work with page 3 provide enough markers so that each child in the group has 12.

Each lesson note contains a section headed "Applying the New Concepts and Skills." The applications suggested in these sections have deliberately been made as comprehensive as possible to provide a wide range of activities. However, it is unlikely that you will ever use all of them. The best plan is to give them all careful consideration and then to choose those best adapted to the abilities and needs of your group. Because some preparation is usually necessary, the materials needed in the lesson will always be mentioned in the section "Preparing for Page ——." By getting ready only a few of the materials at a time you will gradually assemble a wealth of objects, work sheets, charts, etc., that can be used many times, and in subsequent years as well, to extend and enrich the children's number experience. If you plan to use any of the activities suggested for page 3 under "Applying the New Concepts and Skills" (page 153), have the necessary materials on hand.

DEVELOPING VOCABULARY FOR PAGE 3

Throughout the work in this book the development of an arithmetic vocabulary is an important objective. The section "Developing Vocabulary for Page ——" is not included in each lesson note. It occurs only when necessary to alert you to the introduction of a new technical arithmetic word. Since such technical words as *plus*, *minus*, *add*, etc., should always be used orally before they occur in the reading matter, the lesson notes will point out the most suitable time for both the oral and the reading introduction of each technical arithmetic word. All new words should be developed and taught according to the reading procedures used in your school. See the word list on page 144.

Since page 3 is a review page, there are, of course, no new technical words. However, the page offers many opportunities to use orally the expressions "as many as," "just enough," "more than," "not enough," "too few," "fewer than," and "more than enough." The notes that follow indicate some ways in which this oral vocabulary may be used.

INTRODUCING PAGE 3

If either of the suggested stories has been used, let the children talk about it. Lead them into a discussion of various picnics they remember. Let them tell where the picnics were held, who went with them, what they did, and what they had to eat.

Throughout the work in this book it is important to remember that the children should always have ample opportunity and time to orient themselves with each picture, to familiarize themselves with the characters involved, and to discuss the general social setting (the farm, the pet store, etc.).

USING PAGE 3

Have the children open their books to page 3. This page reacquaints them with their old friends Carol (in the yellow sweater), Nancy (in pink, sitting on the lawn), and Don (in the striped shirt, leaning over beside Nancy) from *Numbers We See*.[1] Be sure that the pupils can identify these three children.

After Carol, Nancy, and Don have been identified, say that the children in the picture are preparing to go on a picnic. Discuss the picture and ask such questions as: "What are these children waiting for? Why do you think so? What are they taking with them? Have you ever taken such things with you when you went on a picnic?" If the children wish, let them tell more about picnic experiences they have had.

Then, to develop the idea of one-to-one correspondence, proceed with such instructions and questions as: "We are going to use markers to see if there are more boys than girls or if there are just as many boys as girls. Put one marker on each boy in the picture. Now move your markers from the boys to the girls. Are as many girls going to the picnic as boys?

"Now put down more markers until you have one marker on each child in the picture. Move your markers from the children to the packages of lunch. Be sure you find all the packages. Are there enough packages so that each child can have one? Are there more packages than children? Do you think that more children may be coming?"

1 *Numbers We See*, by Anita Riess, Maurice L. Hartung, and Catharine Mahaney. Scott, Foresman and Company.

(Remember always in reading these lesson notes that questions and directions, as given, are only suggestions. Use any form of language and sentence structure that conveys the idea and the meaning to the children.)

Tell the children to take their markers off the picture. Ask such questions as the following: "What toys do you think the girls will play with at the picnic? Are there enough pails for all the girls?" Help the children to discover that they can find out by putting a marker on each girl and then moving each one to a pail.

"What toys do you think the boys will play with? Use your markers to find out if there are as many bats as there are boys." Work for the responses "There are not enough bats for all the boys," "There are fewer bats than boys," etc.

Proceed in similar fashion to see if there are more or fewer rubber balls than bats, more or fewer baseballs than rubber balls, enough bicycles for all the boys, enough bicycles for all the girls, etc. Work for maximum understanding of the oral vocabulary mentioned in the section "Developing Vocabulary for Page 3."

Similar procedures may be followed next to teach the children to compare by using the number words. For example, have pupils count first the boys and then the bicycles. Since there are five boys and only four bicycles, the children may be able to use their knowledge of numbers to arrive at such judgments as: "There are more boys than bicycles," "There are not enough bicycles for all the boys," and so on. If some of the children cannot use the number words to state such judgments, revert to matching procedures until you are sure that understanding has been established.

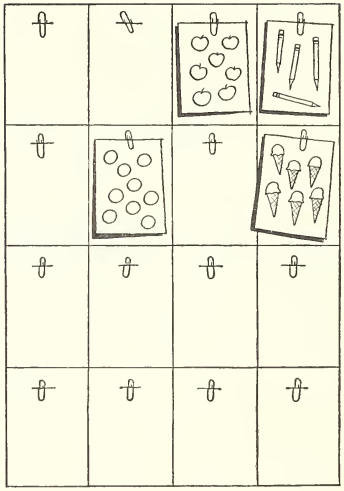
APPLYING THE NEW CONCEPTS AND SKILLS

Remember that it is not essential to use all of these activities. Use as many or as few as you think necessary to develop the essential meanings.

Let the children pretend that they are going on a picnic. If the group is small, provide articles like hats, jumping ropes, balls, etc., that they might take with them. Use matching procedures to determine if there are enough of each article, not enough, too many, just enough, more than enough, too few, fewer than, etc. If the group is large, markers (or pictures of suitable objects cut from magazines) may be used in place of the real articles. The children may pretend that the markers are toys they might take to a picnic.

For another activity rule a 24" x 36" sheet of oaktag into 6" x 9" boxes. Make a slit near the top of each box and insert a paper clip in each slit. Then on 5" x 8" pieces of oaktag draw or stencil groups of simple objects, such as apples, balls, pencils, kites, suckers, and so on. These cards may be attached to the slits in the boxes by sliding them under the paper clips. (When this chart is referred to later, it is called Card-Holder No. 1.) A sample is illustrated at the top of the next column.

Place several cards in position on the chart. Then ask the children to show with their markers the number of objects in a given group. They can then use a matching procedure with their markers to determine if there are enough apples for the



girls in their group, too many or too few kites for the boys, just enough pencils for all the children, etc.

Later on the children may be asked to form similar judgments using the number words (without markers). This may be hard for the slower children and probably should not be stressed too much at this stage.

The *Arithmetic Readiness Cards Set 1: Grouping* may be used to advantage when working with page 3.[1]

[1] *Arithmetic Readiness Cards Set 1: Grouping*, by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company.

Activities especiolly prepared for use with *Numbers in Action* ore to be found in *Our Number Workshop* 2.[1] There is o wide ronge of octivities in the workshop for oll the lessons in the text. On eoch page of the workshop ore complete directions for its use. The directions olso tell which poges of the workshop to use with eoch page of *Numbers in Action.*

4 One-to-one, two-to-one, and one-to-two correspondence

KNOWING YOUR OBJECTIVE FOR PAGE 4

In this lesson the children continue to review simple poiring, with further emphosis on the ideas of *too few, too many, more thon enough, just enough,* etc. They olso review the motching of two objects to one object (thot is, of two-to-one correspondence) ond the motching of one object to two objects (one-to-two correspondence).

PREPARING FOR PAGE 4

If the book *The Poppy Seed Cokes* (item 27 in the bibliogrophy) is avoiloble, plon to reod or tell "The Picnic Bosket" or "The Teo Porty" to the children.

Provide at leost fourteen markers for each child (see poge 151 for a list of objects thot moy be used os morkers). The morkers for poge 4 should be foirly smoll, since the child will be osked, for exomple, to put one morker on eoch spoon, ond the spoon should not be completely hidden by the morker.

1 *Our Number Workshop 2* (for *Numbers in Action*), by Mourice L. Hortung, Henry Von Engen, ond Cothorine Mohoney. Scott, Foresmon ond Company. Avoilable, spring, 1952.

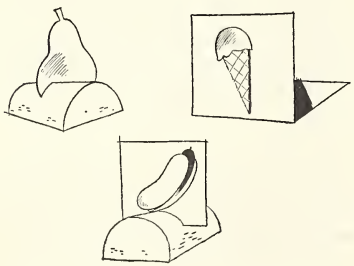
If you plon to use the octivities described under "Applying the New Concepts and Skills" (poge 155), it is odvisable ot this point to start moking some special morkers similor to those illustroted below. Pictures of various picnic foods moy be cut out ond mounted in different woys, os shown, or they may be drawn on folded pieces of heavy poper so thot they will stond up. Try to hove 10 to 16 of each ond also provide enough smoll boxes so thot eoch child in the group can have o box.

INTRODUCING PAGE 4

If you hove used a story, let the children tolk about it. Encouroge them to discuss especially the foods that they hove hod on picnics ond their favorite foods for such occosions. Try to guide the discussion so thot the children will see the necessity for trying to decide how much of eoch kind of food should be taken on o picnic and ways in which these omounts moy be determined.

USING PAGE 4

Tell the children to open their books to poge 4. Be sure they con identify Mother, Noncy, ond



Carol. Let them tolk obout the picnic toble—where it is, whether or not there might be room enough for more than the four girls ond Mother, whot food ond dishes are olreody on the table, what might be in the picnic boskets, ond so on.

Estoblish motching procedures by giving instructions similor to the following: "Put o marker on eoch person in the picture. How can you tell, without counting, if there ore enough pink plates so that each person in the picture con hove one plote?" See thot each child moves his markers to discover thot there ore more plates thon persons. Be sure that the children verbolize the ideo by using such expressions os: "There are not enough people for oll the plotes," "There ore more plotes thon people," "There is one extra plote," ond so on.

"Now toke off oll your morkers. Put o morker on each spoon. How can you find out if there ore os many spoons os plotes? Are there just as mony spoons as there ore persons in the picture, or are there more spoons thon persons?" See thot eoch child moves his markers from spoons to plotes ond from plotes to persons, since this octivity will develop the coördinotion of visuol, muscular, ond thinking responses thot is so importont in ochieving full understonding of the idea of motching.

Use similor motching procedures for other objects in the picture, such os forks, tomotoes, glosses.

During this discussion and work the children moy hove discovered thot since the toble is set for six, Don will probobly come along loter to eot with his family. The bright children moy olso decide thot, in this case, two more glosses will be

needed if all the children are to drink milk or lemonade, but ideas like this should not be stressed.

After the idea of one-to-one correspondence and its related vocabulary have been thoroughly covered, proceed with two-to-one and one-to-two correspondence somewhat as follows: "What is Carol doing? What do you think is in each of those packages? How do you know there are two sandwiches in each little pile? Let's find out if there are enough sandwiches so that each person in the picture can have two. How can you find out? Are there just enough sandwiches for Mother and the girls?

"Joan, how can you find out if each person in the picture can have two apples?" Note here that Joan may use any one of four procedures to find out: 1. She may put two markers on each person and then move them down to two apples. 2. She may put one marker on each person and move it down to cover two apples. 3. She may put one marker on each of two apples and then move them to a person. 4. She may cover two apples with one marker and then move it to a person. Any one of these procedures is acceptable as an indication of understanding. Keep these alternative procedures in mind in asking the following questions:

"Dick, how can you use your markers to see if you could put two apples on each plate? Martha, could each person in the picture have two cupcakes? Use your markers to find out. If Don comes, can he also have two cupcakes? How do you know? Are there enough bananas so that each person in the picture can have one? Are there enough so that each person can have two?"

Proceed in this way until the children clearly understand that there are more than enough plates for the persons in the picture; that there are just enough piles of sandwiches to give each person in the picture two, and so on. Keep in mind the arithmetic expressions that are being reviewed and work for these oral responses in as many situations as possible.

In working with page 4 try to avoid the use of counting words to establish two-to-one or one-to-two correspondence. For example, do not ask the children to count the apples and then count the girls and try to figure out if there are enough apples to give two to each girl. Such abstractions will be developed later. If introduced at this point, they actually interfere with the visual, oral, and manual responses that the child should develop.

APPLYING THE NEW CONCEPTS AND SKILLS

If time is available, these follow-up activities will help to establish the concept of correspondence.

If the markers referred to and described on page 154 have been made, tell each child to select some one kind of food that he particularly likes. Supply each child with a small box to serve as a picnic basket (match boxes will do). Then he is to put enough of this kind of food, by twos, into his basket to supply each child in his group. This should be done by taking two for Helen, two for David, etc., until enough have been supplied. This activity further reinforces the idea of two-to-one correspondence by means of physical action.

Small objects (erasers, jacks, stones, etc.) may be used in place of the special markers just referred to. Let the children pretend the objects are articles of food. Give each child a small box and have him put enough objects, by twos, into the box to supply each person in his group.

As another activity, put a random number of objects into a child's basket or box. He then takes out two for each child in his group and determines if he has just enough, too many, or too few.

5 Recognizing groups of 2, 3, and 4 without counting

KNOWING YOUR OBJECTIVE FOR PAGE 5

In the work with this page the children become reacquainted with the groups of 2, 3, and 4 objects. They also review the work of recognizing these groups without counting.

PREPARING FOR PAGE 5

Provide enough markers so that each child in the group can have 15 or more. The markers for each child should all be of the same kind. Also provide several collections of small objects of various sizes, shapes, and colors (sticks, stones, jacks, corks, marbles, buttons).

This is a good time to begin making sight cards for use in practicing recognition of the number of objects in both organized and unorganized groups. Draw, paste, or stamp pictures of objects on 6" x 9" cards. All objects on a card should be identical, but they should vary from card to card. Make one set for each of the numbers 2, 3, 4, 5, 6, 7, 8, 9, and 10 with the objects arranged in organized groups, as shown on pages 6 and 7 of the book. Make another set for each number

with the objects in unorganized groups. A good way to make these unorganized arrangements is to throw the desired number of jacks down on the card. Then paste, stamp, or draw pictures of little objects in the positions of the jacks. Use small pictures and keep them fairly close together. For page 5 use *only* the cards showing groups of 2, 3, and 4.

If the sheets of transparent paper or either of the work sheets described and illustrated under "Applying the New Concepts and Skills" are to be used, have the materials available.

INTRODUCING PAGE 5

Ask the children how they feel when a picnic is over and get them to tell what is the last thing they should always do before going home. Let them talk about packing up any leftover food, picking up scraps of paper, properly disposing of all waste, and gathering up all toys so they can be taken home by their owners.

USING PAGE 5

Have the children open their books to page 5. After they have looked at the picture for a few minutes, ask if they recognize any of the children. By this time pupils should have no trouble identifying Carol and Don. Ask how they can tell that the picnic is over and that the children are going home.

Proceed with questions like the following, which are designed to encourage responses using the words *two, three,* and *four.* "Look at the big picture on the left. What do you see in this picture?" Work for numerical responses, such as: "I see 4 children," "There are 2 little ducks," "I see 2 boats beside the pond," and so on. Watch individual children as they respond, since quickness of response is a good indication that the size of a group is being recognized without counting.

Work with the right-hand picture in a similar way. Ask such questions as: "How many boys are there, John? How many girls? How many toys have been placed in the station wagon? Who can find a group of 3 toys on the ground? What are these toys? Can you find another group of 3 toys?

"Let's see how many groups of 2 you can find in both pictures. Jean, tell us all the twos you see in the first picture. John, tell us all the twos you see in the next picture. Have any groups of 2 been missed, Helen?

"Find all the threes in both pictures, Dick. Find all the fours in both pictures, Betty. Now look at the little pictures at the bottom of the page. Who can find a group of 4 in one of them? What is in this group, Jim? Can anyone find another group of 4? What is in this group? How many plates are in one of the little pictures, John? Does another little picture show 2, Peter? What is in this picture? Tell us what is in one little picture that shows 3, David. Who can find another group of 3?"

As an extension of this work in recognizing the groups of 2, 3, and 4, especially with the slower children, give instructions similar to the following: "Show with markers on your desk how many little ducks are in the pond. Arrange your markers to show how many shovels are on the ground. Put as many markers on your desk as there are flowers in the little picture," etc.

Use markers also to bring out such facts as: "There are just as many boys as girls," "There are fewer plates than children," "There are more big balls than boys," etc.

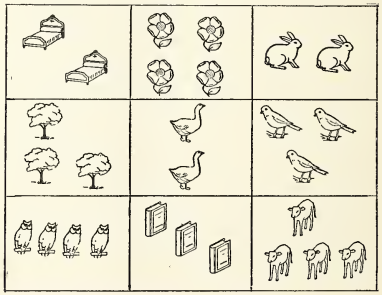
APPLYING THE NEW CONCEPTS AND SKILLS

From the collections of objects ask the children to select, for example, as many jacks (or buttons, sticks, etc.) as there are boys in the picture, as many as there are ducks in the pond, etc.

Tell the children to arrange their markers, of which they should have 15 or more, into as many groups of 2 (then 3, then 4) as they can. Get them to notice that sometimes they will be able to use up all their markers and at other times they will have markers left over.

Clip a sheet of transparent paper to page 5 in each child's book. Use large clips and fasten them at the top. Then ask the children to draw a ring around each picture that shows 2, to put a large X on each picture that shows 4, to draw a square around each picture that shows 3.

The work sheet shown below was prepared by first stamping the objects on hectograph paper on

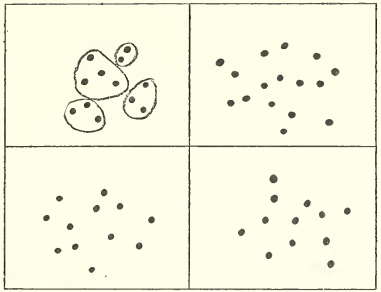


the side used for typing. Then the outlines were traced over with a sharp pencil, thereby producing the impression for the master copy on the reverse side of the sheet by means of the hectograph carbon. Many teachers will prefer to draw their own objects, and this, of course, is desirable. However, for the teacher who feels she cannot draw well enough the method just described will make the preparation of the work sheets easier. Give a work sheet to each child. Tell the children to color (or mark in some distinctive way) each group of 4, each group of 2, and each group of 3.

Another activity makes use of work sheets with pictures of marbles scattered within sections. The child is to draw a circle around each group of 2, 3, and 4 that he can find, the object being to use all the marbles in a section. Of course, such a sheet must be carefully planned so that the arrangement is not too complex for second-graders and so that the marbles can easily be seen as groups with no marbles left over. A sample arrangement, with the groups in one section circled, is shown in the next column.

Use the sight cards showing groups of 2, 3, and 4 that you prepared. Hold up a card before the children and ask for a quick response to the number of objects pictured. Here, again, a quick response is an indication of group recognition rather than of reliance upon counting. These cards may be used over and over again during the year for quick practice on the recognition of groups.

Remember that it is not necessary to undertake all of the activities suggested for any given lesson. Use only those that best fit your children's needs.



6 Recognizing groups of 6, 8, and 10

KNOWING YOUR OBJECTIVE FOR PAGE 6

In this lesson the children review the groups of 6, 8, and 10 by recognizing the subgroups that make up these groups. The recognition is to be made without counting. Attention here is centered on the even groups and their special characteristics—that each can be made up from two equal groups, each can be separated into two equal groups, and each can be separated into groups of 2 without a remainder. These characteristics should be emphasized, but the word *even* should not be applied to the groups.

PREPARING FOR PAGE 6

The work here can best be accomplished by the use of a device called a "frame." Teachers who have used *Numbers We See* will be familiar with the frame, which is used to cover some of the pictures while exposing others. The frames may be purchased[1] or made from oaktag. The picture on page 159 shows the exact size of the frame and how it should look. Use a tracing of the picture if it is necessary to make frames for the children. Be sure to put a circle at the top of one side and a star at the top of the other side in the positions indicated on the picture. Provide enough frames so that each child in a group will have one. Use of the frame will add to the teaching and learning value of page 6 and also to that of pages 7, 11, 18, 28, 44, 82, 102, 105, 112, and 124.

It is possible to do the work on page 6 without the full-page frames. An alternative is to provide a single-view frame for each child in a group. To make this frame, cut a rectangular opening $2\frac{1}{4}$" x $1\frac{3}{4}$" in the center of a 6" x $4\frac{1}{2}$" piece of oaktag or paper. This frame is used to show one picture at a time. It also may be used in work with later pages.

Still another way to direct attention to certain pictures is to use markers. This use of markers is explained on page 158 under "Using Page 6."

Have on hand a quantity of small objects that the children may use as markers. Each child in the group will need at least 10.

If the activity involving transparent paper (see pages 158 and 160, "Applying the New Concepts and Skills") is to be used, provide enough of this paper so that each child may have a sheet.

INTRODUCING PAGE 6

Ask the children if they remember what Nancy, Carol, Don, and their friends were doing the last

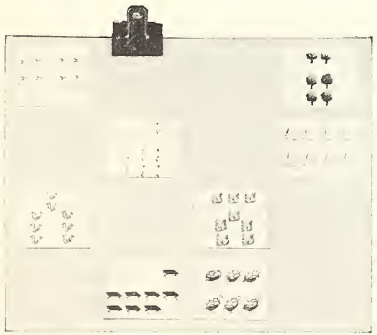
[1] These frames may be purchased from Scott, Foresman and Company in unbroken packages containing 25 frames and 25 windows (see pages 191 and 193).

time the book was used. Let the children talk about some things that Nancy, Carol, and Don may have seen while they were at the picnic. Different children will probably want to tell about things they have seen while on picnics.

USING PAGE 6

Direct the children to open their books to page 6. To encourage general discussion of the pictures, ask such questions as: "Do all these pictures show things that might be seen at a picnic? Are there any that we forgot when we were talking about the things Nancy, Carol, and Don might have seen?"

If the children have not used frames before, show them one. Tell them: "I am going to give each of you a frame. Find the circle on your frame. Now put the frame over the page so that the circle is at the top." Show the children how to do this, and make sure that each child has his frame in the correct position. If necessary, fasten the frame at the top of the page with a paper clip or a clamp. The illustration below at the left shows a frame in this position (with the circle at the top) over page 6. Note that in this position only groups of 6 and 8 are visible.



When each frame is in its proper position, ask such questions as: "What do you see in the first picture? How many ducks are there? What is in the next picture?" As you direct the children's attention to each of the pictures, vary the questions as much as possible, always encouraging numerical responses.

Now have the children turn their frames so that the star is at the top. In this position a group of 10 shows in each opening. See that the frames are firmly in position. Ask: "What is in the first picture? Are there many airplanes or only a few airplanes? How many are there?" When you have finished all the pictures (with the star still at the top), the children should be able to recognize that each picture shows 10 objects.

Two other positions of the frame may be used: with the star at the bottom and with the circle at the bottom. In each of these positions groups of 6, 8, and 10 are visible, making greater variety possible. Some typical directions and questions are: "Find the squirrels. How many are there? Find the rabbits. How many are there? Are there as many rabbits as squirrels? Find a picture that shows 6. Find a picture that shows 10. Find all the pictures that show 8," and so on. It may be desirable, especially with the slower children, to use markers on the objects to determine the comparative sizes of groups.

If you are using single-view frames, direct the children to isolate one picture at a time. Take the groups in order first (6, 8, and 10) and then mix them up. The procedures outlined for the full-page frame should be adapted as seems necessary.

Markers may also be used (without the frame) along somewhat the following lines: "Put markers on the trees. Now find the squirrels and move your markers from the trees to the squirrels. Could each squirrel live in a different tree? Take up your markers.

"Now put markers on the balls. Move your markers to see if there are as many mitts as there are balls. Take up the markers. Now see, by using markers again, if you could put a watering can on each table."

There is still another way to use markers on page 6. Direct the children: "Put a marker on each picture that shows a group of 6. What pictures do you have markers on, Ann? Put a marker on each picture that shows a group of 10. What is in the pictures you found, Roy? Put a marker on each picture that shows a group of 8. Peter, what is in the pictures you marked?"

APPLYING THE NEW CONCEPTS AND SKILLS

Have the children use their markers to make the groups pictured on page 6. The approach might be like this: "Find the sand pails. Put markers on your desk to show the same groups that are in the picture of the sand pails. Find another picture that shows 10 and fix your markers so that they show the same groups that are in the picture."

Several different children may make arrangements of markers on their desks that conform with

Remove each of these rectangles by cutting on the black lines.

Draw a small black circle in this position on reverse side

groups shown in different pictures on page 6. Then other children should identify the arrangement with the correct picture, in some such way as: "Dick's markers mean the picture of the turtles because he has 2 groups of 3."

Ask various children to arrange groups of 6, 8, and 10 markers on their desks *without counting*. These same children, or others, may then look at page 6 to see if their arrangement of subgroups is the same as that shown in any of the pictures on the page.

Children may make up riddles about things in the pictures. For example: "I see some things that grow very tall. Birds live in them. What do I see? How many are in the picture?" The child who guesses correctly might arrange markers on his desk to conform with the groups in the picture.

Clip a sheet of transparent paper over page 6. Have the children mark with a circle all the pictures that show 6, with a square all those that show 8, and with an X all those that show 10.

7 Recognizing groups of 5, 7, and 9

KNOWING YOUR OBJECTIVE FOR PAGE 7

The child now reviews groups of uneven numbers of objects (5, 7, and 9), by recognition of their subgroups. This is to be done without counting. In working with this page keep in mind that these uneven groups cannot be separated into two equal groups, and they cannot be made up by combining two equal groups. Also, of course, they can neither be split up by pairs nor be made up by combining pairs of objects. However, do not use the term *odd* when discussing the groups of 5, 7, and 9 with the children.

PREPARING FOR PAGE 7

If possible have on hand one frame for each child in the group. The discussion of the full-page and single-view frames on pages 157 and 158 applies equally well to the work with page 7.

The markers and transparent paper discussed on pages 158 and 160 may be used in connection with this page in much the same way as described in the lesson notes for page 6.

INTRODUCING PAGE 7

This is the final page of the picnic setting. Ask the children to tell one thing that everyone does at a picnic and emphasize the fact that everyone eats. Let the group talk about their favorite picnic foods and tell if they are prepared before the picnic or cooked after the party has arrived at the picnic site.

USING PAGE 7

Tell the children to open their books to page 7, and let them discuss the various kinds of food and picnic equipment pictured there. Direct the children to fasten their frames on the page so that the circle is at the top. With the frame in this position only articles of food in groups of 5 and 7 are visible. Direct attention to the various pictures, using questions similar to those used for page 6 but varying them to fit the new picture content.

For the next position of the frame (with the star at the top) note that only picnic equipment is visible, in groups of 9.

The other two positions of the frame (with the circle at the bottom and the star at the bottom) show groups of 5, 7, and 9 in random order. Questions similar to those suggested for page 6 should be asked here also.

Finally the children may be told to remove the frames. They may then be asked in turn to tell what is in each box, beginning with the first box in the first row. In each case a numerical response should be required, such as: "I see 5 apples."

If the full-page frame is not used, develop the lesson by means of the single-view frame or markers. Use procedures similar to those suggested in the lesson notes for page 6.

APPLYING THE NEW CONCEPTS AND SKILLS

Use here activities of the same type that were suggested for use with page 6, with one exception: Emphasis should be placed on the fact that groups of 5, 7, and 9 objects cannot be separated into, or made up by combining, two equal groups.

Note again that it is neither necessary nor desirable to use all the activities suggested for any given lesson. Use only those necessary for complete understanding and use these only as long as real interest can be maintained.

8 Positional meaning of 1 to 10

KNOWING YOUR OBJECTIVE FOR PAGE 8

The child here learns to identify the positions indicated by the numbers 1 through 10. He also reviews the number symbols 1 to 10 and learns to recognize the number words one through *ten*.

PREPARING FOR PAGE 8

Prepare two sets of markers, 10 markers to a set, for each child in the group. Label each marker in one set with one of the number symbols 1 to 10. Label each marker in the other set with one of the number words *one* to *ten*. Markers that are easy to make and use are illustrated below. Make all the markers in a given set alike in color, shape, etc., so that you can be sure the children are identifying the number symbols and words and are not choosing markers on the basis of some special characteristics.

If the transparent paper mentioned under "Applying the New Concepts and Skills" (page 163) is to be used, provide at least one sheet for each child who is to take part in the activity.

If the number card activity (page 163) is to be used, prepare 20 cards of heavy paper or cardboard 6" x 9", 8½" x 11", or some other convenient size. On 10 of these cards, later called "number cards," write the numerals 1 through 10. On the other 10 cards write the number words *one* through *ten*. These are later called the "number word cards."

DEVELOPING VOCABULARY FOR PAGE 8

Reading matter appears on this page for the first time in the book. It is wise to check with the reading program and vocabulary lists to determine which of the number words *one* through *ten* the pupils have already encountered. The number words that the child is least familiar with are obviously those that must receive the most stress.

The vocabulary list on page 144 of this book shows that the words *six*, *seven*, *eight*, *nine*, and *ten* are considered new words. As such, they should be introduced and developed carefully according to the procedures and practices followed in the regular reading program. If any other of the ten number words are new to the class, they should also be developed carefully.

In the work with this page develop orally the ordinal words *first* through *fifth*, but do not overstress their use.

INTRODUCING PAGE 8

Ask the children how many of them have toy cars to play with and if any of these cars are racing cars. Since some of the boys probably will have toy racers, have them tell the class about races they have had with their toy cars. Let them describe how they line up the cars, how they start them off, how they determine the winners, etc.

Direct the children to open their books to page 8. Ask what they see on the page and let them guess what is being done with the toy cars. In the course of the discussion the children will probably discover for themselves that there are 10 cars, that they differ in color, and that they have been lined up in different positions for three different races.

USING PAGE 8

The cars in the picture are arranged in such a way that greater emphasis is placed on the positional numbers 6 to 10 than on the positional numbers 1 to 5. The assumption is that children who have used *Numbers We See* in Grade One will have considerable familiarity with the ordinal use of the numbers 1 to 5. Certain positions, however, are emphasized in each of the three rows. These positions are indicated by the large cars. Thus, in Row 1, the positions receiving emphasis are 6 and 10, and pupils should learn that 6 comes immediately after 5, while 10 is last in the row. In Row 2 the middle positions are emphasized: that is, 3 is between 2 and 4 in the first group of 5, while 8 is between 7 and 9 in the next group of 5. In Row 3 the emphasis is placed on 7 and 9 and their "betweenness" in relation to previously identified positions.

The directions and questions that follow will indicate how these positional concepts may be developed. It is suggested that you read through this quite complete development so that the general plan will be clear. Then make whatever adaptations seem desirable in view of the abilities and needs of the children in your group.

Direct the lesson somewhat as follows: "Look at the top, or first, row of cars. Starting at the left, which car is Car 1? Which car is Car 5? Find Car 3. What color is it? What color is Car 2? What color is Car 4? Car 3 is between what other two cars?"

Give each child in the group a set of markers labeled with the numbers 1 through 10. Give such directions as: "Put Marker 1 on Car 1. Put Marker 5 on Car 5. What is the number of the black car? Find the car that is between Car 1 and Car 3.

What marker should you put on this car? Who can tell what marker to put on the green car?" Observe that no marker is put on Car 3.

"Now who can find Car 6? What color is it? What marker should you put on this big red car? What is the color of the last car in this row? Who can tell the number of this car? Put the correct marker on the big blue car."

Direct attention to the middle, or second, row of cars. Ask such questions as: "Find the big red car in this row. It is between what other two cars? What is its number? Put the correct marker on the red car. Would the black car in Row 1 have the same number? Why? Move Marker 3 to the car that has that number in Row 1.

"Is the big blue car in the same place that it was in Row 1? Who can tell what its number is now? Put the correct marker on the big blue car. Which car in Row 1 has this same number? Move your marker up to this car."

Direct attention to the bottom, or third, row. Give such instructions as: "Is the big red car in a different place again? Who can tell what its number is now? What car in Row 1 has this number? Put the correct marker on the dark green car in Row 1. What is the number of the big blue car in the last row? What car in Row 1 has this number? Put the correct marker on the yellow car in Row 1.

"John, tell the number of the car that comes after Car 5. Helen, what is the number of the car between Car 7 and Car 9? What is the number of the car between Car 6 and Car 8? What is the number of the car between Car 8 and Car 10?"

The markers should now be in position and in sequence on Row 1. Ask the children such questions as: "What is the number of the big red car in Row 2? It is between what other two cars? What car is number 8 in Row 2? What car is number 6? What car is number 10?

"Who can tell the number of the big red car in Row 3? What car is number 9 in this row? What car is number 5? What is the color of the car that is between Car 6 and Car 8?"

Continue until the children have gained facility in naming the position of each car in each row.

Now proceed to teach recognition of the number words. Have the children put aside the markers with the number symbols and distribute the sets labeled with the number words. If the group is made up of very able children, give them all the number words, since they may be able to learn the words *six* through *ten* in one day. With slower pupils it probably would be best to do no more than review *one* through *five* and then concentrate on *six* for the first day.

Direct the attention of the group to the numbers and words at the bottom of page 8. Confine attention first to the numbers 1 through 5 and their corresponding words. Give such directions as: "Find the number 2. Put your finger on it. What is the word that is right above this number? Now find your marker with the word *two* on it and put it on the word *two* in your book. Move this marker to Car 2 in the top, or first, row. What color is this car, John? Now put your finger on the number 5 in your book. Put the marker with the word *five* on the word *five* in your book. Move this marker to Car 5 in the bottom, or third, row." Continue until all the children have had experience in selecting the number words *one* through *five* and placing them in proper position on cars in the various rows.

When the children can recognize the words *one* through *five* with ease, proceed somewhat as follows to teach the sequence *six* through *ten:* "What number is this [pointing to 6]? Find your marker with the number 6 on it. Put this marker on Car 6 in the top row. What color is this car? Who can tell what this number word is [pointing to the word *six*]? Find your marker with the word *six* on it. Put this marker on Car 6 in the first row. Now move your marker with the number 6 down to Car 6 in the third row. What marker with a number word on it should you put on the black car in the middle row? Put this marker on the black car."

Continue working with the number word *six* until the children can identify it, understand that it corresponds to the number symbol 6, and can place it on the red car in Row 1, the black car in Row 2, and the dark green car in Row 3.

The meaning of the words *seven, eight, nine,* and *ten* may be taught in much the same way.

When all the numbers and words have been carefully introduced, give the children a set of number symbol markers. Be sure they are "scrambled," that is, not in numerical order. Call out numbers in random order (say, 3, 8, 5, 6, 1, 4, 2, 7, 10, 9) and for each number have the children select the correct marker and place it in proper position on one row of cars. Later, carry out the

same activity using the markers with the number words on them.

APPLYING THE NEW CONCEPTS AND SKILLS

Stand the number cards (described on page 161) up against the blackboard. Then pile the number word cards, in random order, on a chair. Each child in the group should pick up a number word card, tell what number he has, and then take his place before the corresponding number card. Thus, Mary might say, "I have the card with the word *seven* on it," and she will then stand in front of the card with the numeral 7 on it.

Place 10 chairs in a row. Scramble the number cards and give such instructions as: "Joe, find the card marked with the number 7. Now sit in Chair 7, counting from the left. [Indicate the direction for those who do not know left.] Roberta, pick up Card 9. You sit in Chair 9." Continue until each of the 10 number cards has been picked up and the children are sitting on the chairs and holding the cards in numerical order. The same activity may be carried out using the number word cards.

Do not ask the children to respond by writing numbers except in those cases where they have considerable facility in making number symbols. Children who give evidence of tension when writing numbers should not be asked to give written responses. For those who do write numbers easily, however, the following activity may be used. Clip a sheet of transparent paper over page 8. Then ask questions and give directions along the following lines: "What is the number of the red car in Row 1? Write this number over the car on the sheet of thin paper. Find the red car in Row 2. Write its number. Now find the red car in Row 3. What is its number now? Write its number."

9 Recognizing and writing the numbers 1 to 10

KNOWING YOUR OBJECTIVE FOR PAGE 9

In this lesson the children continue to develop recognition of the number symbols 1 to 10 and to associate each symbol with a group of that many objects. Writing the numbers 1 through 10 is formally begun on page 9.

PREPARING FOR PAGE 9

The number symbol markers and number word markers made previously (see page 161) may be used again on this page. Provide a set of each kind for every child in the group.

If the folded sheets of paper, the work sheets, or Card-Holder No. 1 (see "Applying the New Concepts and Skills," page 164) are to be used, have the necessary materials available.

INTRODUCING PAGE 9

Have the children open their books to page 9. Let them talk about the pictures. Bring out the fact that the boy has just written a number on the blackboard and call attention to the numbers at the bottom of page 9.

USING PAGE 9

Distribute a set of number symbol markers to each child in the group. To develop the association of each symbol with the proper number of objects, give directions and ask questions somewhat as follows: "Where did this boy draw his picture? What did he draw? What number did he write? Why did he write that number? Find a marker with the number 5 on it and put it on the blackboard picture in your book.

"Now look at the small pictures at the side of the page. How many teddy bears are in the first picture? Look at the numbers at the bottom of the page and find the number that tells how many teddy bears there are. Now find your marker with this number on it. Put your marker on the picture of the teddy bear.

"What is in the picture next to the teddy bear? How many wagons are in this picture? Find the number at the bottom of the page that tells how many there are. Now find your marker with that number on it. Put it on the picture of the wagons."

Continue with similar questions and directions for the remaining groups (3, 4, 5, 6, 7, 8, 9, and

10 objects). This exercise or those that follow also may be carried out using the number word markers.

Additional practice in recognizing the number symbols and identifying them with groups of the correct size may be necessary. If so, the following suggestions may be helpful: "What is the first number at the bottom of the page? What picture has 7 toys in it? Find the marker that shows 7 and put it on the picture. What is the next number at the bottom of the page? What picture shows only 1 toy? Put the correct marker on this picture." Continue with similar questions and directions for all the numbers.

As a final check on the children's ability to recognize the numbers, say: "Mix up your markers and close your books. I am going to say numbers. As I say each number, find the correct marker." Say the numbers in order and have the children arrange the markers in a row on their desks.

When you are sure the children recognize the numbers 1 to 10, begin teaching them how to write the numbers. Follow whatever writing procedures are in use in your school. Allow plenty of time for the development of this skill, which is difficult for many children. If a child shows any evidence of tension when writing the numbers, he should not be required to give written responses in the lessons until he can write the numbers with ease. Allow such children to use the number symbol markers used above.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a sheet of drawing paper and a marker bearing one of the first ten number symbols or number words. Explain to the group that they are going to draw some pictures. Let each child decide what he wants to draw, but be sure he chooses a small object easily drawn. Then explain that each child's marker tells him how many objects he is to draw. Any pupil who can write the numbers may write beside his picture the number that tells how many objects he drew.

Give each child a 12" x 18" sheet of paper. Show the children how to fold these sheets so that the creases form six sections (fold the sheets in half one way and in thirds the other way). Draw a large rectangle on the board and divide it into six sections like those on the children's papers. In each section write one of the numbers 1 to 10 in random order. Tell the children that in each section on their papers they are to draw the number of objects shown by the number in the corresponding section on the blackboard. Be sure they choose very simple objects to draw. When they have completed their pictures, they may put number symbol markers or number word markers on each picture to show the number of objects in that picture. The children who write numbers with ease may write the correct number in each section.

Then have the children turn their papers and use the sections on the back for the same kind of activity outlined above. Change the numbers on the blackboard, being sure to include the four that were omitted the first time.

Card-Holder No. 1 (see page 153) may be used here also with the sight cards described on pages 155 and 156. Use cards showing both organized and unorganized groups. Insert cards on the chart. Then have the children place both number symbol markers and number word markers on their desks to show the number of objects in each picture on the chart.

The *Arithmetic Readiness Cards Set 1: Grouping* may be used to advantage with page 9. The number cutouts that accompany these cards will serve very well as markers.

10 Practice on the positional meaning of 1 to 10

KNOWING YOUR OBJECTIVE FOR PAGE 10

The child reviews the positional meaning of the numbers 1 to 10 with special emphasis on locating a position by the use of numbers in two directions. He also participates further in recognizing and writing the numbers 1 to 10.

PREPARING FOR PAGE 10

Have available for each child one special marker. This may be a checker, a piece of brightly colored cardboard, or almost any object that is distinctive in shape or color and not too large.

Use again the set of number symbol markers described on page 161. Provide a set of these markers for each child in the group.

If the activities involving the use of transparent paper, the work sheets marked off into 100 sections, and the oaktag chart (see "Applying the New Concepts and Skills," page 166) are to be used, prepare the necessary materials.

DEVELOPING VOCABULARY FOR PAGE 10

The work on this page provides opportunity for oral review of the words *top*, *bottom*, *right*, and *left*.

INTRODUCING PAGE 10

Tell the group to open their books to page 10. Direct the children's attention to the pictures by asking such questions as: "Do you see some things on this page that you would like to play with? Helen, which one of these things would you like to have? Is there a number on the toy? What is the number? Find the fireman's hat, Don. Is there a number on it? Do all firemen's hats have numbers? Why?"

USING PAGE 10

Do not attempt to complete all the work on this page in one lesson period. Even with the most able children it is wise to distribute the work over at least two, and possibly three, lesson periods. Keep in mind that the child is to learn how to locate a position by the use of numbers in two directions; that is, he must be able to determine the position of each row of boxes, proceeding either from top to bottom or from bottom to top. He also must be able to find a given box in a row, starting at either the left or the right side of the page.

For quick review on recognizing the numerals proceed somewhat as follows: "Find a picture with the number 1 on it. Put your finger on the picture. Joe, what does the picture show? Find another picture with 1 on it. What picture did you find, Helen? Find a picture with the number 2 on it. What picture did you find, Dick?" Continue until all the numbers from 1 through 10 have been found and identified.

Provide each child with one special marker and with a set of the number symbol markers. Then proceed to establish the idea of the horizontal rows. The directions and questions that follow suggest a way to do this: "What pictures are in the top row? Let's call this Row 1. Which pictures in Row 1 have numbers on them? What are the numbers? What number is on the fireman's hat? Find your marker with that number on it and put it on the fireman's hat. What number is the doll holding? Find your marker with this number on it and put it on the doll."

Continue with similar questions and directions for each of the succeeding rows, going from top to bottom. Be sure to refer to the rows by number.

As a final activity in this part of the work have the children number the rows in sequence first from top to bottom and then from bottom to top, using their number symbol markers.

Before proceeding to establish the position of the boxes, be sure that each child can distinguish his left hand from his right hand. Explain, if necessary, how the right side of page 10 can be distinguished from the left side. Then use questions and directions similar to the following: "Look at Row 1 at the top. Joe, tell what each box in this row shows. Helen, is there anything in the box at the left end of Row 1? Put your red marker [or if the special marker has some other distinguishing characteristic, mention it here] in this box." Be sure that each child marks this box with his special marker. Continue: "This is Row 1, Box 1. Now look at Row 1, Box 2. Move your red marker to this box. What does the picture in Box 2 show?" Proceed in this manner until each box in Row 1 (going across) has been identified and marked.

Pupils should understand clearly that there are 10 rows of boxes with 10 boxes in each row, and that the heavy black lines separate Rows 5 and 6 and Boxes 5 and 6. This knowledge is important, since it helps children to orient themselves to the positions of the boxes and the rows without counting. Work with the group along these lines: "Alice, point to Row 1. Peter, point to Row 10. How many boxes are there in Row 1, Alice? Peter, how many boxes are there in Row 10? Who can tell us how many boxes there are in each of the 10 rows?

"Is there anything that will help you to tell Row 6 from Row 5? What is it? Is there anything that will help you to tell Box 6 from Box 5 in each row? What is it?

"Find Row 1, Box 5. Put your red marker on this box. Now look at Box 5 in each of the other rows. Bob, tell us what the pictures are in these boxes. John, tell us what the pictures are in Box 6 in each row.

"Joe, point to Row 5. Tell us what the pictures are in Row 5. Dorothy, do the same for Row 6." Proceed in this manner until the children can identify Rows 5 and 6 and Boxes 5 and 6 without hesitation. Once this knowledge has been achieved, their previous experience with positional number (developed on pages 160-163) will help them determine the position of any row or box.

Next locate other rows in random order and identify various boxes in each row. Proceed somewhat as follows: "Find Row 7 from the top. Find Box 9 in Row 7. What is in this box? Find the telephone. Which row is it in? Which box is it in? What is in Row 7, Box 6?"

Exercises similar to the following will help to round out the children's experiences with page 10. "The train engine is in which row from the top? Who can tell the number of the box it is in from the left? Which row is the horse in? It is in which box? The block is in which row? It is in which box?

"George, find a picture that shows something you would like to have. Don't tell us what it is; just tell us which row it is in and which box it is in. Who can tell us what George chose?" Let each child choose an object he would like to have and state the position of each. Then let other children decide which objects have been chosen.

Similar questions and directions should be used until the children can identify, without counting, each row from bottom to top. Similarly, they should also learn to identify each box going from right to left.

APPLYING THE NEW CONCEPTS AND SKILLS

Have each child put a piece of transparent paper over page 10. Tell the children to find each picture with the number 1 on it and to write the number 1 on the paper. Do this for each number from 1 through 10. Watch to see that pupils do not trace over the numbers. In fact, it is desirable to have the children make each number as large as possible within the limits of the box. If any children are nervous about writing the numbers, allow them to use markers for their responses.

Give each child a work sheet marked off into 100 boxes, that is, 10 rows with 10 boxes in a row. Be sure that the fifth and sixth boxes and the fifth and sixth rows are separated by heavy lines. Then have the children make marks or draw pictures in various boxes as directed by the teacher. For example, give directions as follows: "Find Row 5, Box 3. Put a big red X in this box. Make a red circle in Row 9, Box 4."

One device that has been used with success and that can be adapted to other uses is a chart, or card-holder, made on a 24" x 36" sheet of oaktag. (It is later referred to as Card-Holder No. 2.) This chart should be ruled off into 10 rows of 10 boxes each, and a paper clip should be inserted in each box (note the similarity between this chart and the one described and illustrated on page 153). The children can paste or stamp pictures of toys or common objects on 2" x 3" cards to be fastened in each box by means of the paper clip. The activity can be carried on by the children themselves in the following manner. One child in the group is designated as the leader. Then each of the other children will choose a picture card. The leader will say, "John, put your card in Row 3 from the bottom, Box 2 from the left." John will put his card in the designated place. The leader will then give a direction to another child, and so on. See that each child has a chance to be the leader.

11 Cent, nickel, dime

KNOWING YOUR OBJECTIVE FOR PAGE 11

The child learns to identify the penny or cent, nickel, and dime and to count amounts of money up to a total of 10 cents. The cents' sign is also reviewed.

PREPARING FOR PAGE 11

If the poem "General Store" in *The Little Golden Book of Poetry* or *Let's Go Shopping with Peter and Penny* (items 19 and 16 in the bibliography) are available, read either (or both) to the children.

If you plan to use the full-page frames (see page 157), have enough of them on hand so that each child in a group can have one. Single-view frames (page 157) may be used if necessary.

Provide enough unnumbered markers so that each child in the group can have 8 or 9.

If the chart described under "Applying the New Concepts and Skills" (page 167) is to be used, prepare the materials.

Try to have on hand a few pennies, nickels, and dimes. 15 to 20 pennies, 4 or 5 nickels, and 3 dimes will be enough. Toy money is a poor substitute, since a child's familiarity with coins must come about through handling them. He must know the coins by their feel, appearance, size, etc.

DEVELOPING VOCABULARY FOR PAGE 11

The words *cent, penny, nickel,* and *dime* are to be used orally in as many situations as possible.

INTRODUCING PAGE 11

If the children have heard the poem "General Store" or *Let's Go Shopping with Peter and Penny,* let them talk about their impressions. Ask if any of the children ever go to the store to buy things either for themselves or for their parents. Let different children tell what they have bought and discuss how much some of these things cost.

USING PAGE 11

Tell the children to open their books to page 11. Explain that this page shows things that chil-

dren sometimes buy in stores, the price of each one, and also different amounts of money they might have to pay. If necessary, explain what the cents' sign means. Then ask each child to select one article shown on the page that he would like to buy and to tell how much it would cost.

If the full-page frame is to be used with this page, direct the children to place their frames on the page with the star at the top. (With the frame in this position only things to buy are visible.) Proceed somewhat as follows: "What is in the first picture, Joe? How much does it cost? Could you buy this box of animal crackers if you had a nickel? Why not? Could you buy it if you had a nickel and 5 pennies? Could you buy it if you had a dime?" Continue with similar questions until each child has had an opportunity to respond to at least one of the items shown.

Next have the children turn their frames so that the circle is at the top. (Then only the coins are visible.) Ask such questions as: "What is in the first picture? Who can find a picture of a coin that is worth just as much as the pennies in the first picture? What is this coin called? John, find a nickel among the coins I have put on the table. Put this nickel beside the picture of the nickel. Now take the nickel away and find just enough pennies to be worth as much as the nickel. Put them on the picture of 5 pennies."

Use similar procedures for the remaining pictures. Encourage any ingenuity the children show in recognizing equivalent amounts of money.

Now have the children turn their frames so that the star is at the bottom of the page. Deal with the visible articles and amounts of money in somewhat the following way: "Find something that costs a nickel. What did you find, Ann? Find a picture that shows just enough money to buy the ice-cream bar [or the whirler]." Be sure that the children find both items that sell for 5 cents and also that they find both the picture with the nickel and the picture with the 5 pennies.

Next, direct the children to turn the frames so that the circle is at the bottom of the page. The pictures now visible may be handled in much the same manner as that outlined immediately above. Encourage prompt recognition of the various coins and of equivalent values.

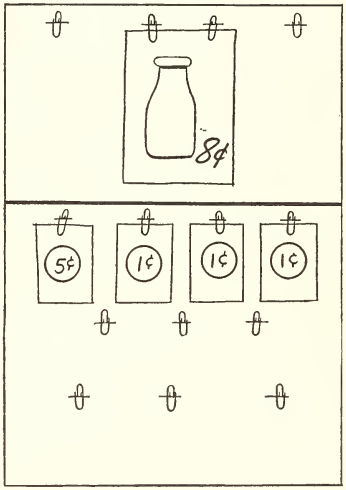
When each child has had a chance to respond to one or more situations with each position of the frame, continue as follows: "Take your frames off the page. Now see if you can find all the pictures that show just 5 cents. Put markers on these pictures. Take off your markers. Find all the pictures that show 10 cents. Put markers on them. Alice, if you could buy just one of the things shown on this page, what would you buy? How much would it cost? Each of you put a marker on the picture showing the right amount of money." Continue with this last activity until each of the eight purchases shown has been selected and the coins used to pay for it have been indicated by markers.

If you decide to use the single-view instead of the full-page frames, see that each child in the group has one. Have the children isolate one picture at a time, and then proceed with questions and directions similar to those suggested for the full-page frame. Only a few verbal adaptations will be necessary.

If no frames at all are available, pictures to which attention is to be directed may be isolated by means of markers. Then ask the questions and give directions, referring only to those pictures with markers on them.

APPLYING THE NEW CONCEPTS AND SKILLS

The chart shown below will be useful for the work on page 11. It is made from a large sheet of oaktag (24" x 36"), divided into two sections. (This chart, when referred to later, is called Card-Holder No. 3.) Since Card-Holder No. 3 will also



be used on succeeding pages, provide space for 10 paper clips (inserted in slits) on the bottom section of the chart. Space the clips as far apart as possible. Three or four paper clips should be inserted in slits in the top section.

Two sets of cards should accompany the chart. One set of large cards (6" x 9" or 5" x 8") should have pictures of toys or other common objects on them. (These may be cut from magazines and pasted, or they may be stamped on the cards.) Each card should carry a price not exceeding 10¢. On smaller cards (about 3" x 4½") draw circles to represent pennies, nickels, and dimes. This can be done easily and rapidly by using the coins as models and simply drawing around them. Each circle thus drawn should be marked with its denomination (1¢, 5¢, 10¢).

Each child in the group may choose some object that he would like to buy, insert the card under the clips on the top section of the chart (hung on the wall or on an easel), and then choose those coin cards that, in total, show the price he is to pay. These coin cards are inserted under the paper clips on the bottom section of the chart. Once this activity is initiated, a group can carry it on without teacher direction.

As a variation let the children "play store," using the cards bearing pictures of toys. However, in this case, use the real coins that were used earlier in the development of the lesson. One child may be a storekeeper, and the others, one at a time, may select a toy card and pay for it, using the actual coins laid out on a table or desk and counting out the correct amounts.

Charting the Course — The 5 group

For successful problem solving in arithmetic the child must learn the meaning of addition and subtraction. He must also know the addition basic facts and the subtraction basic facts. An important question to ask about any arithmetic program is: How are these elements organized to facilitate learning?

In a modern arithmetic curriculum great emphasis should be placed upon the group idea. The child should learn that two groups are often combined into a single group. If the objects are free to move of their own accord, one group may join the other, or both may move together to the same place. In many cases the objects in the two groups may not actually be combined, but they are put into one group mentally or by imagination. These combining actions, both actual and imagined, lead to the concept called *addition*. Statements like "4 pennies plus 3 pennies are 7 pennies" and "3 days plus 2 days are 5 days" symbolize the numerousness of the groups, the action, and the numerousness of the result.

The child should also learn that a single group is often separated into two subgroups. Part of the original group may move away or be moved or taken away. Sometimes the groups are not separated by actual movement, but the action of taking away some of the original group may be imagined. These actual or imagined separating actions lead to the concept called *subtraction*. A statement like "5 dolls minus 2 dolls are 3 dolls" symbolizes the numerousness of the original group and of the group taken away, the action, and the numerousness of the result.

In the primary stages of learning the fundamental concepts of addition and subtraction, only the basic number facts are involved. By using the group idea, all of the addition basic facts whose sums are the same may be taught together. Similarly, all of the subtraction facts which arise when a group is separated into two subgroups may be studied together. When this is done, the learning can be organized by both teacher and pupil. In contrast, if an order of presentation based on the experimental "learning difficulty" of the individual addition or subtraction facts is followed, no organization is evident to the learner.

The order in which the groups are studied is also important. When the basic number groups 4, 6, 8, 9, and 10 are studied, fundamental multiplication and division ideas arise. Thus, for example, six may be seen as "2 threes." It is therefore wise to defer study of these groups until after the 3, 5, and 7 groups

have been introduced. Moreover, for the 3 group, there are only two addition facts ($1 + 2 = 3$ and $2 + 1 = 3$) and two subtraction facts ($3 - 2 = 1$ and $3 - 1 = 2$) when the zero facts are not included. These four facts are too few, and these groups are too small, to give a good general idea of the meaning of addition and subtraction. For this reason, study of the 3 group should be deferred until after the general idea has been introduced in connection with the 5 group.

The organization adopted for the presentation of the basic addition and subtraction facts in *Numbers in Action*, and the reasons for this sequence, are outlined above. The addition and the subtraction basic facts are organized as properties of the group, and the groups are presented in the following sequence: 5, 3, 7, 6, 8, 4, 9, 10. Examples of the 2 group are included, but the two easy facts involved ($1 + 1 = 2$ and $2 - 1 = 1$) do not require special attention.

The extremely important first step in connection with the 5 group is taken on pages 12 to 19. Four addition facts and four subtraction facts for this group are here introduced. The pictures on pages 12 and 13 are designed to develop the idea of combining action. On page 14, which is the first page in the book requiring reading, this idea is then symbolized by numerals and words. Pages 15 to 17 follow a similar pattern to develop the idea of separating or "take-away" action and the symbolization of this action. Pages 18 and 19 present very simple problem situations in pictorial form. Since both additive and take-away actions are shown, experience in distinguishing between these two actions is provided.

12 The 5 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 12

With page 12 the child begins to study the addition basic facts for the 5 group. By means of pictures showing completed action (see page 148) he becomes acquainted with three of the facts ($2 + 3$, $4 + 1$, $3 + 2$). (See "Charting the Course" immediately above, which explains why the groups 5, 3, and 7 are presented before the groups 6, 8, and 10.)

PREPARING FOR PAGE 12

"Off to the Farm" from *Happy Days on the Farm* or *Come to the Farm* (items 11 and 8 in the bibliography) will be appropriate to introduce this page.

Provide a set of 5 or more plain markers (without numbers on them) for each child in the group.

Have the necessary materials on hand if you plan to use the activity described and illustrated under "Applying the New Concepts and Skills" (page 170).

DEVELOPING VOCABULARY FOR PAGE 12

All expressions and words that contain the idea of combining and coming together should be stressed in the work with page 12. It must be remembered, however, that these expressions and words are to be used orally *only*. The word *plus* is to be used orally in connection with this page. The symbol for *plus* (+) is introduced on page 30.

Among the words and phrases to be used orally are the following: "joining," "coming toward," "coming to meet," "together," "altogether," etc. In the work with this page, also, the children should begin to use such expressions as "2 boys and 3 boys are 5 boys," "2 boys plus 3 boys are 5 boys." There will be ample opportunity for oral use of such expressions, and since the children will soon encounter them in printed form, it is important to establish a background of oral familiarity.

INTRODUCING PAGE 12

If you have told the children either of the stories just mentioned under "Preparing for Page 12," give them time to discuss the story. Lead the discussion around to the kinds of animals that are to be found on farms and let the children discuss any farm animals they have seen or are familiar with through actual experience or through pictures, the movies, television, etc.

USING PAGE 12

Direct the children to open their books to page 12. Draw their attention to the three pictures across the top of the page, and tell them that these pictures are like a little movie that tells a story. Get them to notice that the pictures within

each "movie" are separated by colored lines, while the "movies" themselves are separated by heavy black lines. Ask such questions as: "Who are the children in the first picture in the 'movie'? [Nancy, Carol, Don] Do you think they might have come to visit on a farm? How do you know that they have just arrived? How many children are in this first picture? In the next picture how many children are running to meet Nancy, Carol, and Don? Are they glad to have visitors? Why do you think so? [They are running to meet the visitors.] What does the next picture show? [All the children are together.]

"How many children came in the car? How many children ran to meet them? How many children altogether walked away from the car? 3 children and 2 children are how many children?" At this point explain that the word *plus* can be used instead of *and* to show that the two groups came together or joined. Get the children to say: "2 children plus 3 children are 5 children."

Let the children dramatize this number story. Three of them can pretend that they are Nancy, Carol, and Don, and two others can pretend they are the farm children. Let them carry out the activity (that is, 2 children joining 3 children) so that they will clearly visualize a group of 2 joining a group of 3 to make a group of 5.

Next have all the children put enough markers on their desks to represent the children who came in the car. Then have them put down more markers for the children who ran to meet the visitors. Then, using a ruler, a stiff piece of cardboard, or his hand, have each child move the markers representing the farm children to join the markers representing the visitors, in this way showing again a group of 2 joining a group of 3. Encourage the children to verbalize this activity with expressions that use *and* and *plus*.

These dramatic activities and those with markers are designed to give the child physical experience in discovering what happens when two groups are combined.

Redirect attention to the pictures on page 12. Say: "Now let's look at the next 'movie'—the one that shows the little dogs. What are the dogs doing in the first picture? How many dogs are there? In the next picture what is the black and white dog doing? Why is he hurrying so? Look at the third picture. Where is the black and white dog now? Did he get anything to eat? How many dogs are there altogether in this picture?

"How many dogs were eating at first? How many dogs joined them? 4 dogs and 1 dog are how many dogs? 4 dogs plus 1 dog are how many dogs?"

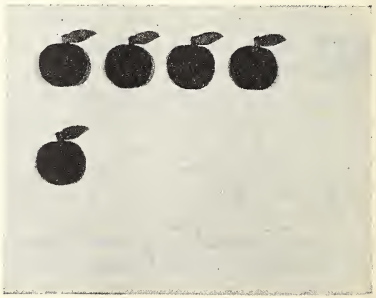
The children should again dramatize the situation and should move markers on their desks to give them the physical experience of actually combining groups, as was discussed earlier.

Now proceed to the last row of pictures. Ask: "Why are the pigs running so fast in the last little 'movie'? How many pigs are in the smaller group? How many pigs are in the larger group? In the last picture are all the pigs eating together? How many pigs are eating out of the trough in this picture? 2 pigs and 3 pigs are how many pigs? 2 pigs plus 3 pigs are how many pigs?"

Use again the dramatized activities and those with markers that were outlined for the "movies" of the children and the dogs.

APPLYING THE NEW CONCEPTS AND SKILLS

A device that may be used later for many combining and separating activities is illustrated below. A sheet of fairly heavy cardboard (which may be as large as you wish) is covered with flannel. The cutouts that are used with the board may be made from felt, or they may be made from heavy paper or light cardboard. If made from either of the last two materials, glue a small strip of coarse sandpaper to the back of each cutout. Then the cutout will stick to the board when given a very slight downward pressure. To use the device, ask one child to show, for example, 4 apples plus 1 apple. He responds by picking up first a group of 4 apples and placing them on the board, and then picking up 1 apple and placing it on the board. Get him to say: "4 apples plus 1 apple are 5 apples."



Alsa use every passible occasian that invalves the children, classraam equipment, ar any canvenient abjects ta illustrate aver and aver the cambining af the variaus graups to make the 5 graup. Encourage the children to use phrasealagy indicating the combining af graups, always including the ward *and* ar *plus*.

13 The 5 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 13

The actian of cambining twa graups ta make the 5 graup was shawn completed an page 12. On page 13 the graups are nat pictured as finally cambined. The child uses his imagination ta fuse the graups and arrive at their cambined tatal. This imagined actian is a step beyand the completed actian shawn an page 12 and precedes the intraductian of the basic additian facts far 5 in symbalic farm, which fallaws an page 14.

PREPARING FOR PAGE 13

The stary "Spring an the Farm" fram *Grandpa's Farm* ar *Hadie* (items 9 and 13 in the bibliagraphy) will be useful in giving the children backgraund for the wark an this page. If yau plan ta use a stary, have ane af these baaks (ar ane equally suitable) available.

Pravide far each child 5 small abjects to use as markers. These may be stanes, carks, small cardbaard disks, etc., as discussed earlier an page 151.

If the wark sheets described under "Applying the New Cancepts and Skills" (page 172) are ta be used, see that these materials are available.

INTRODUCING PAGE 13

If the children have been tald a stary, encaurage class discussian af it.

Then ask the children if they remember where Nancy, Caral, and Dan were the last time the baaks were used. Have the children apen their baoks ta page 13 and let them laak at the pictures far a few minutes. Ask if all af these pictures shaw animals that might be seen an a farm. Direct attentian ta each picture in turn by such questians as the fallawing: "Where are the ducks gaing? Are all the pigeans an the barn roaf? What da yau think the lambs are laaking at? What is the bay halding?"

USING PAGE 13

Help the children ta visualize ar imagine the combining actians by questions and directians similar ta the fallawing: "How many ducks are in line an their way ta the water? What is the 1 duck at the left doing? Put a marker an the duck that is alane. Put a marker an each af the ducks that are in the line. Naw push all yaur markers dawn inta the pand. When all the ducks ga swimming in the pand, haw many ducks will there be altagether? 1 duck and 4 ducks are haw many ducks? 1 duck plus 4 ducks is haw many ducks?[1]

1 Each farm below follows good English usage:
(a) 1 duck plus 4 ducks is 5 ducks.
(b) 4 ducks plus 1 duck are 5 ducks.
(c) 1 duck and 4 ducks are 5 ducks.
(d) 4 ducks and 1 duck are 5 ducks.
In (a) and (b) the ward *plus* is a preposition. In (c) and (d) the word *and* is a canjunctian. Consequently, in (a) the singular subject *duck* requires the singular verb *is*. In (b) the plural subject *ducks* requires the plural verb *are*. The correct farm will be used in this book, but children should not be required to observe the distinctian between the situations that control the number of the verb.

"Let's pretend that yaur markers are ducks and that there is a pand in the middle af yaur desk. Put 1 duck an ane side of yaur desk. Naw put 4 ducks an the ather side af yaur desk. With yaur hand [or ruler, cardbaard, etc.] push the ducks tagether into the pand. 1 duck and 4 ducks are haw many ducks? 1 duck plus 4 ducks is haw many ducks?

"Naw laak at the picture af the pigeans. Haw many pigeans are an the barn raaf? Put a marker on each af them. Haw many pigeans are flying taward the barn? Put a marker an it. Naw mave the marker from the flying pigeon dawn ta the barn roaf. When this pigean jains the others, haw many pigeans will be on the raaf? 4 pigeans and 1 pigean are how many pigeans? 4 pigeans plus 1 pigean are haw many pigeans?"

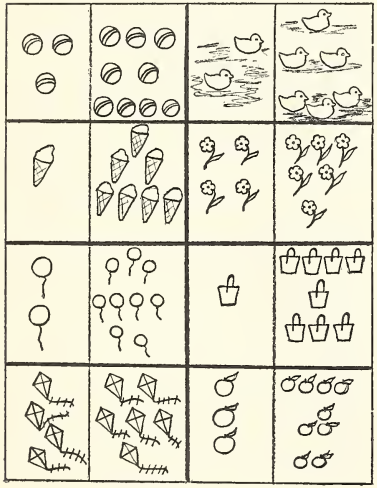
At this paint have the children pretend that their markers are pigeans. Direct each child ta put 4 pigeans on his desk and ta shaw haw 1 pigean flies dawn ta jain them. Be sure that the children first describe what happens in ordinary language, far example: "I had 4 pigeans an my desk. One pigeon flew down ta jain them. Then I had 5 pigeans an my desk." Next have the children use the statements "4 pigeans and 1 pigean are 5 pigeons" and "4 pigeons plus 1 pigean are 5 pigeans."

Cantinue with similar questions and directians far the remaining pictures an the page. In each case have the children use markers first an their baaks and then as a separate exercise an their desks. The children shauld pretend that the markers are the various animals in the pictures, and

they should be encouraged to make orally such statements as: "2 squirrels and 3 squirrels are 5 squirrels" and "3 chickens plus 2 chickens are 5 chickens." However, no child should be required to make such responses as "1 and 4 are 5."

APPLYING THE NEW CONCEPTS AND SKILLS

The work sheet illustrated below may be used to apply what the children have learned about combining groups to form a group of 5. The sheet ($8\frac{1}{2}$" x 11" will do) is marked off into 8 (or more, if desired) sections. Each section is divided into two parts. A key group of objects is drawn or stamped in the first part. Several groups of the same object are drawn in the second part. The child first finds the group which, when combined with the key group, will form 5. He then encircles the two groups, thus indicating that they have been joined together. In the first exercise he encircles the 3 balls and a group of 2 balls in the second picture.



14 Symbolism of the addition basic facts for the 5 group

KNOWING YOUR OBJECTIVE FOR PAGE 14

In this lesson the child is introduced to the symbolic form of the four addition basic facts for 5. This involves only the reading with understanding of such arithmetic statements as "3 dogs and 2 dogs are 5 dogs" and "3 dogs plus 2 dogs are 5 dogs." In this book such abstractions as "$3 + 2 = 5$" are not introduced until page 55.

PREPARING FOR PAGE 14

If you want to introduce page 14 with a story, *Smokey's Big Discovery* (item 29 in the bibliography) will be suitable.

Provide 5 plain (unnumbered) markers for each child in the group.

If it seems desirable to use the chart and cards described under "Applying the New Concepts and Skills" (page 173), see that the necessary materials are available.

DEVELOPING VOCABULARY FOR PAGE 14

The vocabulary list on page 144 of this book shows all the new words and the pages on which they are introduced. This list should be checked against the vocabulary of the reader program in use in your school so that any unfamiliar words can be handled according to the usual reading procedures.

Since expressions such as "3 dogs and 2 dogs are 5 dogs" and "3 dogs plus 2 dogs are 5 dogs" have been carefully developed orally on earlier pages, understanding should not present a serious problem. The technical word *plus* is introduced as a reading word on page 14. Every effort should be made to insure recognition and complete comprehension of this word.

INTRODUCING PAGE 14

If the story *Smokey's Big Discovery* has been read or told to the children, spend a little time talking about it. Then tell the children that Nancy, Carol, and Don stayed on the farm for several days and had a lot of fun on their visit. Ask the children to open their books to page 14 and let them talk for a few minutes about the pictures on the page. The children should identify the four different kinds of animals and should notice that in each right-hand picture the two groups of animals shown in the left-hand picture have combined to form one larger group.

USING PAGE 14

Direct the children's attention to the pictures, or "movie," of the dogs. Ask: "How many dogs are eating in the first picture? What are the other dogs doing? How many dogs are running? Let's pretend that your markers are dogs. Use your markers to show how many dogs are eating. Put them on one side of your desk. Now put markers on the other side of your desk to show how many dogs are running. Make them join the dogs that

are eating. How many dogs are eating together now?"

Next tell the children that they are going to read a story about these dogs. Be sure they locate the correct lines of reading matter at the right of the picture. Teach the word *plus* according to the procedures you ordinarily use for presentation of a new word.

After the proper five lines have been located and the children can identify *plus* (and any other new words), direct them to read this story (5 lines) to themselves. Then ask one child to read the story aloud to the group. Continue somewhat as follows: "John, read the first line about the dogs. Put markers on the pictures of these dogs in your book. Doris, read the next line. Put markers on these dogs. Helen, read the next line. Who can tell us what to do with the markers to show how many dogs were eating together? Joe, read the last two lines. Let's pretend that your markers are dogs. Show with your markers that 3 dogs plus 2 dogs are 5 dogs." Help the children to put 3 markers in a group and then to move a group of 2 markers to join the 3.

Use similar procedures for the pictures of the rabbits, the pigs, and the squirrels. Be sure that each child in the group has an opportunity to participate in the reading and that all of them carry out the book and desk activities with the markers. Encourage oral use of the words *and* and *plus* when the children make their responses.

APPLYING THE NEW CONCEPTS AND SKILLS

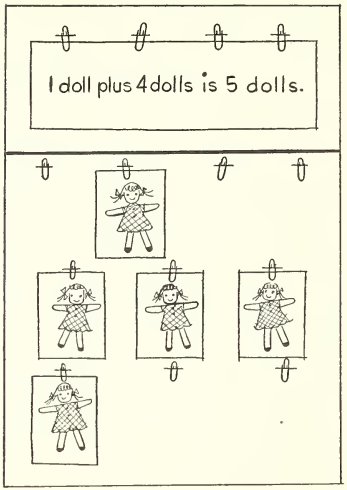
Use again Card-Holder No. 3 (described on page 167). Make cards on which common objects are drawn or stamped. Put only one object on each card and use only those whose names are to be found in the children's reading vocabulary. Provide enough of these cards so that the four basic addition facts for 5 may be shown with several different kinds of objects.

On another set of cards print stories, that is, arithmetic statements about the objects on the picture cards. For example, a story card might read either "1 doll and 4 dolls are 5 dolls" or "1 doll plus 4 dolls is 5 dolls." Let each child choose a story card, insert it on the top half of the chart, read it aloud, and select cards to illustrate his story on the chart in the way shown at the right. Be sure that the vocabulary of the story cards fits that of your reading program. Get the children to work with groups of cards rather than individual cards. For example, to illustrate the story above, the child should first select 1 doll (1 card) and insert it on the bottom section of the chart. Then he should select 4 dolls (4 cards) and place them beside (or near) the 1 doll already on the chart. The children may carry on this activity by themselves, once you have initiated it.

15 The 5 group — separating into two groups

KNOWING YOUR OBJECTIVE FOR PAGE 15

The child has learned that the 5 group can be formed by combining two smaller groups. Now, on page 15, he discovers that the 5 group can be separated into two groups and that, if one group is removed, the remainder can be determined. The



basic facts illustrated on page 15 with the action completed are 5 — 2, 5 — 1, and 5 — 3.

PREPARING FOR PAGE 15

On *the Farm* (item 24 in the bibliography) is suitable for use with this page. If you plan to use the book, see that it is available.

Provide 5 unnumbered markers for each child in the group.

If you wish to use the flannel board mentioned under "Applying the New Concepts and Skills" (page 174), have the necessary materials on hand. Several new sets of cutouts will make the activity more interesting for the children.

DEVELOPING VOCABULARY FOR PAGE 15

On pages 12 and 13 emphasis was placed upon developing the oral vocabulary necessary to understand the actions involved when two groups are combined. On pages 15 and 16 it is necessary to emphasize those words and expressions that are used to represent the actions involved when a group is removed from the 5 group and the remainder is to be found. Typical words and phrases expressing such actions are *went away from, left, lost, fell off, took away, ran off,* etc. The child should arrive at the generalization that the technical word *minus* is used to describe events whenever a subgroup is removed from a group.

INTRODUCING PAGE 15

If you have read *On the Farm* to the children, let them talk about it. Then have them open their books to page 15. Let them talk briefly about the three little "movies" of the farm shown on the page—what the lambs are doing, why the farm boy might want to put two of the lambs in another field, where the ducks are and what they are doing, and what the five children might be doing in the last "movie." Try to bring out the idea that in each "movie" one group is taken from the main group of 5, leaving a remainder.

USING PAGE 15

Direct the children's attention to the first picture of the lambs. Ask: "How many lambs are in the field? What are they doing? Look at the next picture. How many lambs are going through the gate? How many lambs are left in the field? When 2 lambs go away from 5 lambs, how many lambs are left?"

At this point explain to the children that the word *minus* can be used to show that one group leaves, goes away from, or is taken away from, another group. Get the children to say: "5 lambs minus 2 lambs are 3 lambs."

Carry out dramatic activities similar to those employed for addition in connection with page 12. Have 5 children pretend they are lambs and designate some spot in the classroom as the gate in the field. Then let 2 of the 5 children run out through the gate, showing by this action that when a group of 2 goes away from a group of 5, a group of 3 is left.

Also direct the children to place markers on each of the 5 lambs in the field and to move them over to the 5 lambs in the second picture. Then push 2 of the markers through the gate and off the page. Move the remaining 3 markers to the 3 lambs left in the field, as shown in the last picture.

Finally, have the children place 5 markers in the middle of their desks. With rulers, stiff pieces of cardboard, or their hands let them move 2 of these markers far to one side of their desks. During all of this work encourage the use of the social expressions mentioned earlier as well as the oral use of the statement "5 lambs minus 2 lambs are 3 lambs." Just as it was desirable for the children to use physical action when combining two groups, so it is desirable here to have the physical experience of separating a group from a larger group and associating the word *minus* with the separating action.

In somewhat the same way direct attention to the "movies" of the ducks and the children and carry out dramatizations and book and desk activities with these "movies." Be sure that the children make use of such expressions as: "When 1 duck goes away from 5 ducks, then there are 4 ducks," "5 ducks minus 1 duck are 4 ducks," "If there are 5 children and 3 children walk away, 2 children are left," "5 children minus 3 children are 2 children."

APPLYING THE NEW CONCEPTS AND SKILLS

The flannel-covered board and the cutouts (described and illustrated on page 170) may be used here, this time to show the separating, rather than the combining, actions for the 5 group. For example, you might direct a child to show 5 dogs minus 2 dogs. The child would place 5 cutouts of dogs on the board and would then remove 2 of them. Get him to say "5 dogs minus 2 dogs are 3 dogs" as he performs the action.

Again take advantage of every possible opportunity to involve the children, classroom equipment, and any convenient objects in illustrating the remainder when 1, 2, 3, or 4 leave a group of 5. Encourage the children to use the terminology suggested as appropriate for the separating of the groups.

16 The 5 group — separating into two groups

KNOWING YOUR OBJECTIVE FOR PAGE 16

In this lesson the child uses his imagination to complete the action of separating one group from a group of 5. He determines the remainder when a group of **1, 2, 3, or 4** is separated from a group

of 5. This imagined action is a step beyond the completed action of page 15 and precedes the introduction of the subtraction basic facts for the 5 group in symbolic form, which follows on page 17. The basic facts developed on page 16 are 5 — 1, 5 — 3, 5 — 4, 5 — 2. The work on this page follows a pattern similar to that established for the addition basic facts for 5 (pages 12 to 14).

PREPARING FOR PAGE 16

If you plan to use a story to introduce page 16, *Animals of the Farm* (item 1 in the bibliography) will be appropriate.

Provide 5 unnumbered markers for each child in the group. Remember that to avoid monotony in the use of markers (and their use is essential in these early number activities), it is important to vary the materials used for markers as much as possible. Any small objects (jacks, buttons, corks, etc.) may be used, and no child should have to use the same kind of markers day after day.

If you plan to use the flannel-covered board and cutouts (see "Applying the New Concepts and Skills" on this page), assemble the materials.

INTRODUCING PAGE 16

If you have used the story suggested, give the children time to talk about it. Direct the discussion so that some connection is made between the story and the visit of Nancy, Carol, and Don to the farm and the various things they saw and did there.

USING PAGE 16

Have the children open their books to page 16 and direct their attention to each picture in turn by asking them to identify the various animals. Try to develop the generalizations that each picture shows 5 animals and that some of these animals are leaving, or are being taken away from, the group of 5. Get the children to accept the idea that when this happens, some animals will be left.

Ask questions and give directions similar to the following: "Look at the picture of the geese. How many geese do you see in the picture? What are the 4 geese doing? What is the 1 goose doing? Put markers on the 4 geese that are standing still. Now put a marker down to show where you think the other goose was before he started to run away. Move that marker over to the goose that is running. How many geese ran away? How many geese were left? [The abler children will understand this concept readily. The slower ones may need more help. One way to help them is to have them cover up the goose that is leaving, either with their hands or with a piece of paper, before asking 'How many geese were left?']

"Now let's pretend that your markers are geese. Put markers on your desks to show the geese before one of them ran away. Now make one of them run away. [See that each child picks up 1 marker and removes it from the group of 5.] How many geese are left? If 1 goose runs away from a group of 5 geese, how many geese are left? 5 geese minus 1 goose are how many geese?"

Proceed in a similar way with the other pictures on page 16. Be sure that each child participates in the activity with the markers so that he experiences physically what happens when a group of 1, 2, 3, or 4 is removed from a group of 5. If it seems necessary or desirable, especially with the slower children, let them dramatize the action of each little picture. Let them pretend they are rabbits, etc., and show what happens when part of a group of 5 goes away.

APPLYING THE NEW CONCEPTS AND SKILLS

The board covered with flannel may be used again here. If it is at all possible, provide new cutouts (farm animals would be most appropriate here) from time to time, since children welcome variety.

Once more have the children use classroom equipment and any objects available to show concretely the subtraction basic facts for 5. Encourage the children to make statements about their activities using the technical word *minus* and all the social words and expressions indicating separation that have occurred in their work with pages 15 and 16.

17 Symbolism of the subtraction basic facts for the 5 group

KNOWING YOUR OBJECTIVE FOR PAGE 17

The child now learns how the four subtraction basic facts for 5 may be symbolized. This means only the reading with understanding of such an arithmetic statement as "5 dolls minus 2 dolls are 3 dolls." The reading and interpreting of such an abstraction as "5 — 2 = 3" is not required until later.

PREPARING FOR PAGE 17

Provide 5 unnumbered markers for each child in the group. Have a variety of markers so that

John may use corks, Mary may use cardboard disks, Joan may use buttons, etc.

If Card-Holder No. 3 and the picture and story cards are to be used (see "Applying the New Concepts and Skills," Column 3), have the materials available.

DEVELOPING VOCABULARY FOR PAGE 17

The technical word *minus* is introduced as a reading word on page 17. Consult the vocabulary list on page 144 to determine any other words that are new on this page and develop all of them according to the customary reading procedures.

INTRODUCING PAGE 17

Have the children open their books to page 17. Direct their attention to the four movies on the page and encourage them to talk about the toys the children played with when they were visiting on the farm. Draw attention to the fact that each right-hand picture shows how many were left after certain members of the original group of 5 in the left-hand picture either went away or were taken away.

USING PAGE 17

To call attention to the separating action in the first movie, direct the children's attention to the two pictures of the boys. Ask such questions as: "What do you think is happening in the first picture? How many boys do you think have been playing ball? How many of them are standing still? What are the others doing? How many are walking away? What does the next picture show?" [The 2 boys who were left after 3 boys walked away.]

Ask 5 boys to dramatize the story shown in the movie, and let one of them tell what happened. Statements such as the following are quite acceptable: "Five of us were playing. Three boys went home. Then there were 2 boys left."

Tell the children that they are going to read a story about the boys and what they did. Be sure they locate the correct four lines of reading matter and can identify *minus* (and any other new words). Tell them to read the story to themselves. Then ask one child to read the story to the group. Follow with more detailed instructions, somewhat as follows: "Janice, read the first line about the boys. Put a marker on each of the boys who have been playing ball. Joe, read the next line. Look at the boys you are reading about now and put your hand [or a piece of paper] over them. Charles, read the next line. What does the picture at the right show you? How many boys were left to play? George, read the last line of the story for us.

"Now let's pretend that your markers are boys. Put 5 boys on your desk. Make 3 of them go away. Helen, show us with your markers that 5 boys minus 3 boys are 2 boys." Instruct Helen to do this on the floor or on a table where all the children can see what she is doing.

Use similar procedures (that is, recognition of what is going on in the picture, dramatization of the activity, reading, and activities with markers in the book and on the desk) for the other three movies on page 17. Not all of the children, perhaps, can participate in the dramatized activities, but all of them should take part in reading and in the book and desk activities with markers. Encourage any verbalization indicating comprehension of the subtraction concept and use of the word *minus* in the children's responses.

APPLYING THE NEW CONCEPTS AND SKILLS

Card-Holder No. 3 (mentioned on page 173) may be used again, this time to apply the children's knowledge of the subtraction basic facts for 5. Remember that the picture cards should show only objects whose names are to be found in the children's reading vocabulary. (The same object or animal must appear on at least 5 cards.) On the story cards write in manuscript the four subtraction basic facts for 5. Use the names of the objects on the picture cards.

Each child should select one story, insert it in position on the chart, read it aloud, and then carry out the action, using the matching picture cards. If, for example, he chooses the statement "5 cats minus 2 cats are 3 cats," he should select 5 pictures of cats, put them on the chart, read the statement aloud, and then remove 2 of the cats.

Make use of every opportunity to utilize classroom equipment and other available objects to show concretely the four subtraction basic facts for 5. Encourage the children to use the word *minus*.

18 Pictorial problem situations

KNOWING YOUR OBJECTIVE FOR PAGE 18

The child will participate in three activities involving the 5 group: first, combining pairs of groups to form the 5 group; second, separating the 5 group into its various pairs of subgroups and

removing one subgroup to find the remainder; and third, distinguishing between combining and separating actions.

PREPARING FOR PAGE 18

Provide a frame for each child in the group.

If Card-Holder No. 3, with its accompanying materials, or the work sheet (described on page 178 under "Applying the New Concepts and Skills") is to be used, see that the necessary materials are available.

Also provide each child in the group with 5 markers.

INTRODUCING PAGE 18

Have the children open their books to page 18. Encourage them to talk about the animals pictured—what they are doing, which ones Nancy, Carol, and Don probably played with on the farm, which are like pets the children have at home, etc. Bring out the idea that, while each picture shows 5 animals, in some pictures 2 groups are coming together to make 5, and in others part of the 5 group is going away.

USING PAGE 18

Tell the children to place their frames on the page with the circle at the top. This first position of the frame leaves visible only groups that are combining to make 5. To bring out the combining actions shown, ask: "What are the 2 brown dogs doing? How many brown dogs are running? Where do you think they are going? When the 3 brown dogs join the other 2 brown dogs, how many dogs will be playing with the ball? 2 dogs and 3 dogs are how many dogs? 2 dogs plus 3 dogs are how many dogs?"

Proceed in similar fashion with each of the remaining pictures. Then give each child a chance to choose at least one picture (preferably more) and tell a story about it. Such a story might be: "1 pig was eating. 4 more pigs came to eat, too. Then 5 pigs were eating. 1 pig and 4 pigs are 5 pigs." Be sure he ends with "1 pig plus 4 pigs is 5 pigs." (See note on page 171 about the use of *is* and *are* with *plus*.)

The next position of the frame (with the star at the top) leaves visible only those situations where a group of 1, 2, 3, or 4 is removed from a group of 5. Questions and directions concerning these pictures should follow the general pattern outlined above, except, of course, that the wording should indicate the separating of groups and should include use of the word *minus*.

There are two other positions for the frame—with the star at the bottom and with the circle at the bottom. In each case the visible pictures show both the combining and the separating of groups, and their use will help the children to learn how to distinguish between the two actions. When the circle on the frame is at the bottom of the page, the visible pictures showing combining action are: the black kittens, the black hens, the black and white dogs, the light red pigs. Those showing separating action are: the black pigs, the black and white hens, the brown hens, the black dogs.

With the frame in either of these positions questions and directions such as the following may be used: "Find the picture of the black pigs. Tell what is happening in the picture. Put markers on your desk to show how many pigs there were before any of them went away. How many pigs went away? Take away enough markers to show how many pigs went away. Then how many pigs were left? 5 pigs minus 1 pig are how many pigs?

"Now let's pretend that your markers are the black and white dogs. Put enough markers on your desk to show how many dogs were eating. Now put enough markers on your desk to show how many dogs are running to eat. Who can show with markers what happened when the two groups of dogs joined? 1 dog and 4 dogs are how many dogs? 1 dog plus 4 dogs is how many dogs?" Proceed in this way for each picture.

Without using the frames, give each child a chance to choose at least one picture and have him tell the story and act it out with markers as he tells it. Be sure the children distinguish between the additive and the subtractive situations and use the words *and*, *plus*, and *minus* in making their responses.

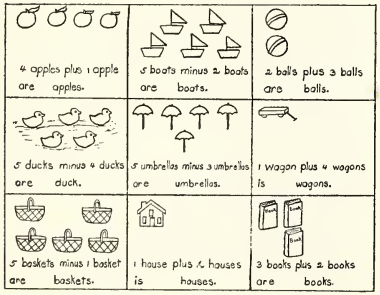
If the full-page frame is not available, use the single-view frame (described on page 157) to isolate, one after another, each picture that is to be talked about. If neither kind of frame is available, use some other means by which the children can isolate each picture under discussion. For example, if the picture of the black kittens (which shows combining action) is to be talked about, each child could put a marker on the picture to aid him in keeping his place.

APPLYING THE NEW CONCEPTS AND SKILLS

Use Card-Holder No. 3. Now, however, there should be story cards showing subtraction as well

as addition (for the 5 group only). The picture cards must fit the stories, as before. Mix up the addition and subtraction stories. Let each child choose one (for example, "1 apple plus 4 apples is 5 apples"), read it to himself, and insert it on the chart. He then should select 5 pictures of apples and insert on the chart first 1, then 4 more, reading his story as he performs the action. For a subtraction story (for example, "5 apples minus 1 apple are 4 apples"), he would insert 5 pictures on the chart and remove 1.

The illustration below shows a work sheet designed to give practice in applying the concepts just developed. A story that involves one of the addition or subtraction basic facts for the 5 group is written in manuscript at the bottom of each section of the work sheet. For addition the child completes the group to make 5. For subtraction he crosses out the subgroup that is to be removed. In either case he writes the answer in the space provided. Be sure to keep the objects very simple so that attention will be centered on the mathematical objective—that of discriminating between the combining and the separating actions called for in the stories.



19 Pictorial problem situations and practice

KNOWING YOUR OBJECTIVE FOR PAGE 19

In this lesson the child uses simple problem situations to practice combining groups to form the 5 group and separating a subgroup from the 5 group. He practices reading the technical words *plus* and *minus*. He also encounters, for the first time in the book, the incomplete arithmetic statement and learns to read such statements, supplying missing words and numbers as he does so.

PREPARING FOR PAGE 19

Provide 5 plain markers for each child in the group.

If Card-Holder No. 3 is to be used (see page 179, under "Applying the New Concepts and Skills"), have it and the appropriate picture cards available.

DEVELOPING VOCABULARY FOR PAGE 19

Check the vocabulary on this page against the vocabulary of your reading program and teach any new words according to the usual reading procedures. Continue using the technical vocabulary previously introduced.

In the work with this page begin to use orally the word *problem*. Tell the children that a problem is an arithmetic story that leaves something for them to tell or asks a question for which they are to find the answer. Explain that each story on page 19 (identified by a letter at the left of the page) is a problem, and that they will be asked to find the answer for each problem. The word *problem* will be used in this book both for situations described in words and for such abstractions as "5 − 3 = ▒" when they are introduced later.

Two special devices are used for the first time on page 19. The first, which occurs in Problem A, will hereafter be referred to in these notes as the "screen." It is generally used within a sentence to indicate the omission of a number which the child is to supply. The child is to decide what number the screen "covers up." The other device, found first in Problem D, is called the "wavy line." It is used to indicate that a statement is incomplete. The child is to complete the statement. On page 19 the completion requires him to supply a number and a word. Because the screen and the wavy line will be used frequently, take sufficient time to make sure that all the children understand how to respond when they encounter these devices in the lessons.

INTRODUCING PAGE 19

Have the children open their books to page 19. Direct their attention to the pictures and for a few minutes let them discuss what they see. Develop the generalizations that in some of the pictures groups are combining to form a larger group, while in others part of a group is leaving.

USING PAGE 19

In the work with page 19 the children should be able to decide whether the action in each picture is combining or separating. They should

locate the problem that applies to the picture, read it (supplying missing words and numbers), and indicate by the use of markers on their desks their understanding of the action involved. They should also read problems with no accompanying pictures and show, by marker activities, that they understand the action described in the problem.

Direct the children's attention to the first picture and tell them to be ready to explain what is happening. Proceed somewhat as follows: "Lee, tell us what is happening in this picture. [There are 3 oranges on a table. Someone is putting 2 more oranges on the table.] All of you show with your markers what is happening in the picture."

Before directing attention to the text, be sure the children understand the use of the screen, which is used to indicate a missing number. One way to introduce the screen is to put in manuscript writing on the blackboard "3 oranges plus 2 oranges are 5 oranges." Ask a child to read this; then cover the figure 5 with a small square piece of cardboard to serve as a screen. Have the sentence read again. Continue until the children understand that they can think and read the correct figure even when it is not shown. Then ask: "Who can find the problem at the left that tells what happened in the picture? John, tell us the letter of this problem. All of you read the problem to yourselves. What number belongs after the word *are*? That's right. The number 5 is covered by the little screen. Tim, read the problem aloud to the class. When you come to the screen, say the number that is covered up. Doris, show us with markers on the table what happened in Problem A."

The second picture (going down) should be handled in a similar way. However, this time the children will have to search for the accompanying problem, since it is Problem H. Here the children, for the first time, will encounter the wavy line; so after the problem has been found, say something like the following: "All of you look at the wavy line at the end of Problem H. This wavy line means that the problem is not finished. You are to finish it. Read the problem to yourselves and decide what you would say to finish it. The picture will help you. What number would you say, John? What word would you say, Helen? Jim, read Problem H aloud to the class. Martha, show us with markers on the table what happened in Problem H."

Continue with procedures like those just outlined for the remaining pictures on page 19. Go down the left-hand column first and then down the right-hand column, since this order will force the children to discriminate between combining and separating situations. Be sure each child can tell the number or the number and word that complete each problem.

The remaining problems (those labeled with red letters) have no accompanying pictures on page 19. Here the child encounters a somewhat more abstract type of practice on the 8 addition and subtraction basic facts for the 5 group. These problems may be dealt with in order from top to bottom or in mixed order by referring to them as Problem A, Problem D, etc. Always be sure that each child can supply the missing number and/or word indicated by the screen and the wavy line. Have the children carry out desk activities with markers to indicate their understanding of each problem.

If the children have difficulty working with the red-lettered problems in the way just outlined, use the pictures on page 18 to help them. Tell them to place their frames on the page with the circle at the top. Have a child read Problem A (red) and find the corresponding picture on page 18. Then, from the picture, he can supply the missing number and word indicated by the wavy line. Do the same for Problems D, G, H, J, and K. Have the children turn their frames so that the star is at the top, and work through Problems B, C, E, F, I, and L in a similar way. Next, without using the frame, have the problems read in order. The children should now be able to supply the missing numbers or numbers and words without hesitation and without referring to the pictures on page 18.

APPLYING THE NEW CONCEPTS AND SKILLS

Use Card-Holder No. 3 and the appropriate picture cards once more. Give directions similar to the following: "Joe, choose one of the problems with red letters on page 19. Which one did you choose? [Problem A, Problem G, etc.] Now read your problem for us. Show us with the picture cards what the problem says." The picture cards, of course, must show chickens, pigs, dogs, and kittens, and the child's actions with the cards will follow those outlined in the lesson notes for previous pages. Let other children take turns in choosing problems until all the problems have been used.

Charting the Course — The 3 and 7 groups

The ideas of combining action and separating action as introduced with and applied to the 5 group should now be reinforced by using them with the 3 group and then with the 7 group. The developmental pattern used earlier with the 5 group should again be followed with these groups; that is, completed action, imagined action, and symbolization for both addition and subtraction should be presented. There are 2 addition facts and 2 subtraction facts for the 3 group, and 6 addition facts and 6 subtraction facts for the 7 group. After these have been introduced, problem situations may call for facts from the 3, 5, and 7 groups.

Throughout this work all kinds of combining actions and related verbal expressions (for example, "joining," "2 *and* 3," etc.) should become generalized in the word *plus*. When children understand arithmetic, the plus sign (+), always read "plus," will be associated with this general idea of combining action. Similarly, expressions such as "take away" and "2 *from* 5" should be generalized in the word *minus*. In the same way, the minus sign (—), always read "minus," will be associated with separating or take-away action. The careful development of these action concepts given up to this point should insure that the introduction of these symbols on pages 30 and 31 will be a meaningful experience for the pupils. The meaning of these symbols and their use in abstract examples are important new ideas introduced on pages 30 to 34 inclusive.

20 – 21 The 3 group — actions; symbolism

KNOWING YOUR OBJECTIVE FOR PAGES 20-21

With pages 20 and 21 the child begins to study the addition and subtraction basic facts for the 3 group. The pictures show completed and imagined action for all of the facts ($2 + 1$, $1 + 2$, $3 - 1$, $3 - 2$). On page 21 these basic facts are symbolized.

PREPARING FOR PAGES 20-21

Provide 5 plain markers for each child in the group. He will need only 3, but if he has 5, more discrimination will be required in his responses. Do not give him 4 or 6, since these groups have not been taught.

INTRODUCING PAGES 20-21

Tell the children that on these pages they will see their friends Nancy, Carol, and Don again. Tell them also that they will see pictures of friends of the children. Direct the children to open their books to page 20. Let them pick out Don's friend on page 21. Tell them that this little boy's name is Billy and ask what he is doing in the picture. Then have them find Ellen, who is the little girl with braids on page 21. Both Billy and Ellen will appear later; so be sure the children know who they are. Let the children talk about what the five children are doing and also let them discuss the fun they themselves have when they play together.

USING PAGES 20-21

Since the work for page 20 is so similar to the work on completed action for the 5 group (pages 169 and 173 for Lessons 12 and 15), only a very brief overview of procedures will be given here. The three very easy facts involved on page 20 should cause no difficulty.

The three pictures in the first movie on page 20 show completed action for $2 + 1$. (Note again that pictures within a movie are separated by colored lines. The movies are separated by heavy black lines.) Ask questions to bring out the idea of completed action, such as: "Who are the girls in the first picture? What are they doing? How many girls are there? What is Don doing in the next picture? When he joins Nancy and Carol in the third picture, how many children are playing together in the sand box? 2 children and 1 child are how many children? 2 children plus 1 child are how many children?"

The children in the group should dramatize this movie to show what happens when 1 joins a group

of 2. Encourage the children to use the previously developed words that indicate the combining of groups.

Next have the children locate the story about this movie (the first 4 lines of reading matter on page 21). Be sure they know any new words. Then proceed somewhat as follows: "Jim, read the first line. Which picture shows what he has read? Pretend that your markers are children and put enough markers on your desks to show what Jim has just read. Doris, read the next line. Look at the picture that shows this. Put more markers on your desks to show what Doris has read. [Each child should move a marker to join the 2 previously put on his desk.] Now read the third line, Billy. Look at the picture that answers this question. Do your markers give you the answer? Read the last line, Bob. 2 children plus 1 child are how many children?"

Similar procedures may be followed for the other movies on page 20 and for the pictures on page 21. The last movie on page 20 and two of the pictures on page 21 show separating action ($3-1=2$, $3-2=1$, $3-1=2$); so the questions and marker activities will have to be adapted to show separating, rather than combining, action. Emphasize the word *minus* in all work with pictures showing separating action.

For the last two pictures on page 21 let the children tell the stories in the same way they are told in the book for the other pictures. Be sure to use the word *problem* when referring to the three incomplete statements at the bottom of page 21.

APPLYING THE NEW CONCEPTS AND SKILLS

Help the children to dramatize simple situations that illustrate the basic facts shown on pages 20 and 21. For example, 1 child in a group of 3 may be the narrator and say something like this: "We are the 3 Billy Goats Gruff eating grass on the hill. One goat went over the bridge. Then 2 goats were left. 3 goats minus 1 goat are 2 goats." The children should act out the story as it is narrated. You will probably have to make up the situations at first. Later on the children may be able to do this, as well as carry out the dramatic activities. Continue to encourage the children to use the words *and, plus,* and *minus* in their responses.

22 The 7 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 22

The child now begins to study the addition basic facts for the 7 group. The pictures show completed action for all the facts.

PREPARING FOR PAGE 22

Provide at least 7 markers for each child. These markers should be small enough to use on the objects shown in the pictures.

There are several stories that are appropriate for use in connection with page 22. *Ted and Nina Go to the Grocery Store* (item 33 in the bibliography) is especially good.

If the grocery store activity described under "Applying the New Concepts and Skills" (pages 182-183) is to be used, assemble the materials.

DEVELOPING VOCABULARY FOR PAGE 22

On this page you should begin to use the word *add* orally in as many different situations as possible. Oral use of this word should be maintained on succeeding pages so that when the child first encounters it in print (on page 34), he will know its meaning.

INTRODUCING PAGE 22

Read to the children the story mentioned above. Take time to talk about it.

Ask the children to name various kinds of foods that can be bought in grocery stores. Get them to mention as wide a range of foods as possible —different kinds of vegetables, fruits, canned goods, etc. Let the children discuss, also, how these foods are packaged, stored, and handled.

USING PAGE 22

Ask the children to open their books to page 22 and tell them that these pictures show the store where Carol's mother buys her groceries. Let the children talk, if they wish, about the grocer and what he is doing in the various pictures. Direct their attention to the fact that there are five movies on the page and call attention once more to the colored lines separating individual pictures and the heavy black lines separating the movies. The two large pictures at the top are one movie showing completed action for $5+2$ and $3+4$. The smaller movies show completed action for $2+5$, $4+3$, $6+1$, and $1+6$.

To direct the children's attention to the completed actions shown in the first movie, ask such questions as: "What is the grocer doing? [He is pushing 2 cans toward the other cans on the

counter.] What is Carol doing? [She is bringing 4 bananas to put on the counter.] Now put a marker on each of the cans that were on the counter first. How many cans were there? Put a marker on each can that the grocer is pushing. How many cans are there? Move your markers to the same cans in the next picture. How many cans are there altogether? How many cans are there if you put 2 cans with 5 cans? 5 cans plus 2 cans are how many cans?"

Tell the children that when you put 2 cans with 5 cans, you *add* the 2 cans to the 5 cans. Continue to use the word *add* in the procedures outlined below, but do not expect the children to use the term. If you use the word in talking with the children, they will gain a familiarity with it that will help them later.

Follow similar procedures with the combining action shown in the same pictures for $3 + 4$. Then have the children dramatize the two actions, using convenient classroom objects to represent the cans and the bananas. Finally, ask the children to put markers on their desks to represent the two groups of cans together and the two groups of bananas. Then have them push the groups of cans and the groups of bananas together to show the combining actions. Encourage the children to say "and" and "plus."

This photograph shows a grocery store activity in an arithmetic class at Public School 152, Queens, New York. Reproduced with the permission of "Curriculum and Materials," Board of Education of the City of New York.

Procedures for the four remaining movies on the page should follow those outlined above. Be sure that all the children participate, as far as is possible, in the dramatic activities. All of them should take part in the book and desk activities with the markers. Encourage the oral use of all expressions that indicate combining action.

APPLYING THE NEW CONCEPTS AND SKILLS

Ask the children to bring from home as many different kinds of containers for groceries as they can. These may include empty boxes that contained cookies, crackers, butter, small fruits; all kinds of empty cans; wrappers from loaves of bread; empty milk cartons, etc. With these con-

tainers a play store may be set up. It can be as simple or as elaborate as circumstances permit. Plan to keep these grocery store materials available, since the type of activity described here is very interesting to children and may be used in connection with later lessons.

Use no more than 7 of each kind of container and proceed somewhat as follows: "Today we are going to play that a delivery man is bringing different kinds of food to a grocery store. John, you may be the grocer. I am going to give you some cans of tomato soup to put on the counter. [Control the number of objects the children have in each activity so that the totals will be 3, 5, or 7.] How many cans of soup are on the counter, Alice? Joe, you may be the delivery man. I will give you some cans of tomato soup. Give your cans to the grocer so he can put them on the counter. How many cans of soup did the delivery man give the grocer, Tim? Who can tell me how many cans of soup are on the counter now? 4 cans plus 3 cans are how many cans?"

This activity may be carried out for all the addition basic facts for 3, 5, and 7. Emphasize the basic facts for 7, but the answer should not invariably be 7. Vary the activity from time to time so that the final group is 3, 5, or 7. Do not use 6, since the 6 group has not been taught.

If it is not feasible to have containers brought to school, use the same activity but substitute pictures of different kinds of foods for the actual containers. At all times stress the use of the combining words and encourage the children to verbalize the activity as much as possible.

23 The 7 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 23

In this lesson the child is expected to arrive at the combined total of the groups pictured by imagining that the groups are combined. All the addition basic facts for the 7 group are shown on this page.

PREPARING FOR PAGE 23

Provide at least 7 small markers for each child.

Have the grocery store materials (described on pages 182-183) available if you plan to use the activity mentioned on page 184 under "Applying the New Concepts and Skills." If the work sheets described on this page are to be used, have them ready.

INTRODUCING PAGE 23

Have the children open their books to page 23. Let them discuss the pictures, bringing out the fact that here, too, the grocer is at work. He is arranging products for display, waiting on a customer, filling orders, etc. Be sure the children understand that in each picture a group of objects is being joined to another group.

USING PAGE 23

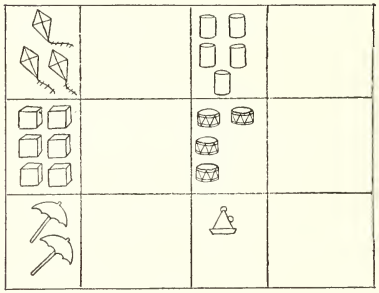
The combining actions indicated by the pictures on page 23 may be brought into focus by questions and directions similar to the following: "What does the grocer have on the counter in the first picture? What is he doing? Put markers on your desks to show how many apples were on the counter at first. How many were there, Dick? Now put down more markers to show the apples the grocer is going to put with the 5 apples. How many more apples is he putting with them, Linda? Show with your markers how he would put all the apples together. How many apples are there in all? 5 apples and 2 apples are how many apples? 5 apples plus 2 apples are how many apples?"

Explain again to the children that when they put two groups together, they add. Continue to use the word *add* when discussing the pictures.

The other five pictures may be handled in much the same way. Be sure all the children use markers on their desks to show the combining of 6 with 1, of 3 with 4, etc. Give each child an opportunity to respond with a statement using *and* or *plus* to one or more of the situations pictured. Remember, however, that no child at this point should be required to make an abstract response such as "3 plus 4 is 7."

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet, illustrated below, may be used to advantage here. A key group of very simple



objects is drawn or stamped in each of the small boxes. The child completes the 7 group by drawing the correct number of matching objects in the larger boxes.

The grocery store activity may be used again in the way that was outlined previously (see pages 182-183). So that the response will not invariably be 7, control the situations to produce occasional responses of 3 and 5. However, keep the emphasis chiefly on the addition basic facts for the 7 group.

24 Symbolism of the addition basic facts for the 7 group

KNOWING YOUR OBJECTIVE FOR PAGE 24

The child now learns how the six addition basic facts for the 7 group may be symbolized. The work here represents an advance over that of preceding symbolization pages, since the actions are not shown completed but are to be imagined.

PREPARING FOR PAGE 24

Provide at least 7 plain markers for each child in the group.

If you plan to use Card-Holder No. 3 with the picture and story cards, as suggested under "Applying the New Concepts and Skills" (see Column 3), assemble the necessary materials.

INTRODUCING PAGE 24

Have the children open their books to page 24. Ask them what the grocer is doing and bring out the idea that he is arranging various products to get them ready for his customers. Be sure the children understand that in each picture he is putting groups of articles together.

USING PAGE 24

Direct the children's attention to the first picture and bring out through discussion that the grocer is putting 4 cookies with the 3 cookies already in the big box and that then there will be 7 cookies in the box.

Now direct attention to the story about this picture. Be sure each child finds the correct story (the first 4 lines of reading matter). Proceed somewhat as follows: "Read the first line to yourselves. Tim, read this line to the class. Put enough markers on your desks to answer this question. [Make certain that each child does this.] How many cookies are in the big box, Janice? Peter, read the next line to the class. Put markers on your desks to answer this question. Jim, how many cookies is the grocer putting into the big box?"

Next tell the children to read the third line to themselves. Let each child show with markers how many things there are when a group of 3 is joined by a group of 4.

Before the children read the last line, be sure they understand that the wavy line means the sentence is not finished. Have them read the problem to themselves and decide what they should say to finish it. Then have one child read the line aloud and supply the number and word that complete the statement. Ask questions to bring out the fact that in this story the word *plus* means that the 4 cookies were put with the 3 cookies. Continue to use the word *add* in talking to the children about the picture and problem.

Follow somewhat the same procedures with the next picture and story. Be sure the children understand that the screen before the word *oranges* in the last line of the story means that a number is missing, or covered up, and that they must say the correct number when they read the line.

For each of the remaining four pictures, develop the story orally by asking questions like those outlined for the first two stories. In each situation interpret the word *plus* in terms of the action performed with the objects. Use the word *problem* whenever you can, on this and succeeding pages, so the children will become familiar with it.

APPLYING THE NEW CONCEPTS AND SKILLS

Card-Holder No. 3, which was described and illustrated on page 173, may be used again here. The story cards should show the addition basic facts for the 3, 5, and 7 groups, and the vocabulary should consist only of words the children know. The picture cards must show the objects mentioned in the stories, and there should be 7 of each kind of object. Each child should select a story card, read it aloud, insert it in the cardholder, and then choose the picture cards that will illustrate the story.

25 The 7 group — separating into two groups

KNOWING YOUR OBJECTIVE FOR PAGE 25

In this lesson the child learns that the 7 group, like the 5 group, can be separated in various ways into two groups, that one of these groups can be removed and the remainder determined. The six

subtraction basic facts for the 7 group are illustrated on this page with the action completed.

PREPARING FOR PAGE 25

Provide 7 markers for each child in the group.

Susan's Surprise (item 31 in the bibliography) is appropriate for use with page 25 if you wish to use a story for background.

If the grocery store activity discussed on this page under "Applying the New Concepts and Skills" is to be used, see that the necessary materials are available.

DEVELOPING VOCABULARY FOR PAGE 25

In the work with this page begin oral use of the word *subtract*. Do not expect the children to use the word, but work it into questions and discussions wherever you can to develop the familiarity with it that the children will need later on.

INTRODUCING PAGE 25

If the story mentioned above has been read or told to the children, take time to talk about it. Then ask them if they have ever helped with the grocery shopping. Let them talk about some of the groceries they have bought and about various activities they have observed in grocery stores.

USING PAGE 25

Tell the children to open their books to page 25. Be sure they can identify Carol and let them decide by discussion among themselves that the woman shown in the pictures is a clerk who helps the grocer in his store. The children should recognize that there are five movies, separated by heavy black lines, and that in each movie one group of objects is being taken away from a larger group.

Questions and directions similar to the following will help to point out the separating actions shown in the pictures: "Look at the movie at the top of the page. In the first picture, how many tomatoes are on the counter? What is the grocer doing? [Pushing 1 away]

"Let's pretend that your markers are tomatoes. Put enough markers on your desk to show all the tomatoes that were on the counter at first. How many tomatoes do you have on your desk? Now look at the second picture. What did the grocer do with one of the tomatoes? Show with your markers what happened. If 1 tomato is taken away from 7 tomatoes, how many tomatoes are left? 7 tomatoes minus 1 tomato are how many tomatoes?

"How many oranges does Carol have in the basket? What is she going to do with some of them?" [Put them on the table]

Next let the children pretend that their markers are oranges. Have them use the markers in a way similar to that just outlined to show that when Carol took 4 oranges from the 7 originally in the basket, 3 were left. Keep emphasizing the word *minus* and encourage the children to use this word in giving their responses.

Tell the children that when they take a group away from a larger group, they *subtract*. Continue using the word *subtract* in succeeding discussions whenever you can do so easily and naturally.

The remaining four movies on page 25 show completed action for 7—2, 7—5, 7—6, and 7—3. Use these movies for oral development of the facts as suggested for the two basic facts in the first movie. Encourage the children to use different expressions indicating that a group has been removed from a larger group and that a remainder is to be found.

APPLYING THE NEW CONCEPTS AND SKILLS

Use the grocery store equipment again. This time children may take the roles of grocer (or clerk) and customer. Have only 7 of each kind of product visible and let each customer decide how many he wants to buy. Then let him tell how many are left. A typical response might be: "The grocer has 7 boxes of oatmeal on the counter. I will buy 1 box. Then 6 boxes will be left. 7 boxes minus 1 box are 6 boxes."

If the practice becomes too concentrated on only a few facts, you may pretend to be the customer and ask various children to make responses that are appropriate to your actions. Vary the activity occasionally so that the original group is 3 or 5 instead of 7.

26 The 7 group — separating into two groups

KNOWING YOUR OBJECTIVE FOR PAGE 26

In this lesson the child uses his imagination to complete the actions shown in the pictures and to determine the remainder when groups of 1, 2, 3, 4, 5, or 6 are removed from a group of 7 objects.

PREPARING FOR PAGE 26

See that 7 markers are available for each child.

If the variation of the grocery store activity described under "Applying the New Concepts and

Skills" (see below) is to be used, have the necessary materials on hand.

INTRODUCING PAGE 26

Have the children open their books to page 26. Let them talk about the pictures—what the grocer is doing, what Carol's mother is buying, what may be in the various cans, boxes, paper bags, etc. Be sure the children understand that in each picture a group of objects is being taken away from a larger group.

USING PAGE 26

Questions and procedures for page 26 may follow those outlined for the lesson notes for page 25, but the wording of questions and statements will have to be adapted to suit the new situations shown in the pictures. Every child should carry out desk activities with markers to show the separating actions illustrated on page 26. With the first picture, for example, he may think of his markers as cans. He should put down 7 to show the original group and remove 6 to indicate the cans the grocer is about to take down from the shelf. Then he should make his response. Each child should have an opportunity to respond to one or two of the situations pictured.

Encourage use of words and expressions that indicate the separating of a group from a larger group and determining the remainder. In talking with the children, continue to use the word *subtract* whenever it seems easy and natural to do so.

APPLYING THE NEW CONCEPTS AND SKILLS

A variation of the grocery store activity may be used here. Provide collections of 3, 5, and 7 grocery containers and also a large paper bag. Let a child pretend he is the grocer and is filling an order. Different children may tell the grocer what the customer has ordered and make responses to show how many are left when the grocer puts the specified number of the various items into the paper bag. Typical responses might be: "Mrs. White wants 2 cans of cherries. There are 7 cans of cherries on the counter. When you put 2 cans in the bag, there will be 5 cans left." "She wants 1 pound of butter. Now there are 5 pounds of butter on the table. There will be 4 pounds of butter left when you fill Mrs. White's order. 5 pounds minus 1 pound are 4 pounds." Guide the activity so that the chief emphasis is placed on the subtraction basic facts for the 7 group.

27 Symbolism of the subtraction basic facts for the 7 group

KNOWING YOUR OBJECTIVE FOR PAGE 27

The child now learns how the six basic subtraction facts for the 7 group may be symbolized. He becomes increasingly familiar with the wavy line and the screen and has further experience in completing statements.

PREPARING FOR PAGE 27

Have markers available so that each child in the group can have at least 7.

If Card-Holder No. 3, mentioned under "Applying the New Concepts and Skills" (see page 187), is to be used, have it and the appropriate materials on hand.

INTRODUCING PAGE 27

Tell the children to open their books to page 27. Let them discuss the pictures as much as they wish and bring out the idea that each picture shows a group of objects being separated from a larger group. Direct the children's attention to the fact that there is a story about each picture.

USING PAGE 27

Ask the children to look at the first picture. Bring out through discussion that the grocer is taking 2 boxes away from the 7 boxes originally on the shelf and that when he finishes 5 boxes will be left.

Now have the children find the story that accompanies this picture. Be sure each child finds the first four lines of reading matter. Proceed somewhat as follows: "Read the story to yourselves. Doris, read the first line to the class. Now put enough markers on your desks to answer this question. [Be sure all the children do this.] How many boxes are there in all, Jack? Read the second line to the class, Tom. Show with your markers what the grocer is doing. Betty, read the third line aloud. Do the markers left on your desks answer this question? How many boxes are left?"

Before the children read the fourth line, be certain that they all understand clearly that the screen conceals a number and that when they read the line, they should say the number when they come to the screen. Work with the children until they understand that in this case the missing (or covered up) number is 5. Emphasize the fact that in this story the word *minus* means that the 2 boxes were taken away from the 7 boxes.

For each of the remaining pictures develop the story orally as outlined immediately above for the first picture and story. In the last four stories make certain that the children understand the purpose of the wavy line—that it indicates something is missing and that they should supply the number and word that complete the sentence. Always interpret the word *minus* in terms of the action performed with the objects in the pictures.

APPLYING THE NEW CONCEPTS AND SKILLS

Card-Holder No. 3, described and illustrated on page 173, may be used again here. The story cards should show the subtraction basic facts for the 3, 5, and 7 groups. These cards should involve only words that the children know from their reading vocabulary. The picture cards should show the objects mentioned on the story cards, and there should be 7 of each kind of object. The child is to select a story card, insert it in the chart, and then illustrate the action with the picture cards. The way in which this is done is fully described on page 176 in the lesson notes for page 17.

28 Pictorial problem situations for the 3, 5, and 7 groups

KNOWING YOUR OBJECTIVE FOR PAGE 28

In the work with this page the child learns to distinguish between combining and separating actions as shown in simple pictorial problem situations. He is also expected to describe these actions orally, using the symbolism (expressions and statements with the words *plus* and *minus*) that he has been taught.

PREPARING FOR PAGE 28

Provide one frame and 7 markers for each child in the group. One single-view frame or one special marker for each child will be needed if no full-page frames are available (see page 188, under "Using Page 28").

If Card-Holder No. 3 is to be used as described under "Applying the New Concepts and Skills" (see page 188), have the necessary materials on hand.

INTRODUCING PAGE 28

Have the children open their books to page 28. Encourage them to talk about the foods pictured —for example, what kinds of cookies there are, which foods they like, what may be in the various containers, etc. Try to bring out the idea that some pictures show groups being brought together, while other pictures show a group being separated from a larger group.

USING PAGE 28

First tell the children to place their frames on the page with the circle at the top. With the frame in this position only combining actions are visible, but the total group may be 3, 5, or 7. To bring out these combining ideas, ask such questions as: "How many apples are on the plate in the first picture? How many more apples are being put on the plate? Then how many apples will there be on the plate? 1 apple and 6 apples are how many apples? 1 apple plus 6 apples is how many apples? When you add 6 apples to 1 apple, how many apples are there altogether?"

Deal with the other pictures in a similar way. Then give each child at least one chance to tell a story about a picture of his choice. Such a story might be like this: "There were 4 cans on a shelf. The grocer put 3 more cans on the shelf. Then there were 7 cans. 4 cans plus 3 cans are 7 cans." Emphasize oral use of the word *plus*.

Next have the children turn their frames so the star is at the top. Now the visible pictures show only separating actions involving the 3, 5, and 7 groups. For these pictures follow procedures similar to those outlined immediately above, but adapt the wording of the questions to indicate the separating actions. Again give each child an opportunity to tell at least one story about a picture. Emphasize oral use of the word *minus*.

The two other positions of the frame (with the circle at the bottom and with the star at the bottom) leave visible pictures showing both the combining and the separating of groups of 3, 5, and 7. With the frame in each of these positions use questions and directions similar to the following: "Find the picture of the bottles of milk. Put markers on your desks to show how many bottles there were before any were taken away. How many bottles were taken away? Show this with your markers. How many bottles were left? 3 bottles minus 2 bottles are how many bottles? When you subtract 2 bottles from 3 bottles, how many bottles are left?"

Treat each picture in a similar way, taking them in random order. Then, without the use of frames, have each child tell a story for at least one picture of his own selection, acting it out with markers on a table or on the floor so the whole group can observe.

If the full-page frame is not available, it is possible to use the single-view frame described on page 157. Have the children use this frame to isolate one picture at a time and then use questions and directions similar to those suggested for the full-page frame. Only a few verbal adaptations will be necessary.

If no frames at all are available, isolate each picture to which attention is to be directed by means of a marker. Then ask questions and give directions that refer only to the picture indicated by the marker.

APPLYING THE NEW CONCEPTS AND SKILLS

Card-Holder No. 3 and its accompanying picture and story cards (see page 173) may be used again. The stories now may involve both the addition and the subtraction basic facts for the 3, 5, and 7 groups. The activities with the picture cards will therefore require a high degree of discrimination on the part of the children.

29 Pictorial problem situations and practice

KNOWING YOUR OBJECTIVE FOR PAGE 29

In this lesson the child combines two groups to form the 3, 5, and 7 groups and also separates a subgroup from these groups in simple problem situations.

PREPARING FOR PAGE 29

Provide each child with at least 7 markers.

If the Pocket Chart (described and illustrated under "Applying the New Concepts and Skills") is to be used, assemble the materials.

INTRODUCING PAGE 29

Tell the children to open their books to page 29 and direct their attention to the pictures. Let the children talk about what is shown in each picture and decide what is in each set of bags. Encourage the children to see that in some pictures groups of objects are being combined, while in others a group is being removed.

USING PAGE 29

The actions involved in eight of the basic facts for the 7 group are pictured on page 29. The problems lettered in blue deal with these eight basic facts. The basic facts involved in the red-lettered problems are selected from those belonging to the 3, 5, and 7 groups pictured on page 28.

Tell the children to look at Problem A (blue) and ask a child to explain what the screen means. [Something is missing, and it must be supplied when the problem is read.] Proceed somewhat as follows: "Read Problem A to yourselves. Find the picture that goes with it. John, show us with markers on the table what is happening in this picture and tell us the story. [7 bags were on the table. Someone took 5 bags away. Then 2 bags were left.] Jerry, read Problem A to the class. Be sure to say the number that belongs where the screen is."

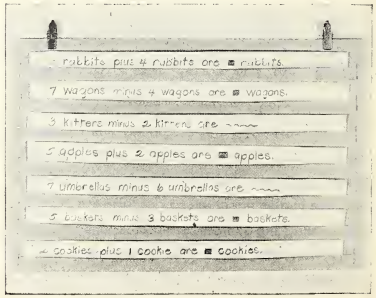
Deal with the remaining problems (blue B to H) in a similar way, letting different children participate. Make sure that each child identifies the picture that accompanies each problem. If it seems desirable, have each child show the action with markers on his desk instead of having one child demonstrate before the class.

Next take the pictures in random order. Select any one and ask a child to find the problem that tells what is happening in the picture. Have him read it aloud to the class, supplying the correct number or number and word as he does so. If necessary, have the children indicate with markers on their desks the appropriate action (combining or separating) called for in the problem.

Finally work through the remaining problems (red A to L) in a similar way. Have each child read the problem silently and illustrate the action with markers. Then call on a child to read the problem aloud, supplying the correct number or number and word as he reads. Let him find the picture on page 28 that shows the action in the problem.

APPLYING THE NEW CONCEPTS AND SKILLS

The Pocket Chart shown below is easy to make and to use. Strips of oaktag are folded up, as shown in the picture, and these folded strips are then stapled together at the ends, forming a



series of shallow pockets. Problems involving the basic addition and subtraction facts for 3, 5, and 7 are written on cards which are then inserted in the pockets. The child writes the missing numbers on a sheet of paper, proceeding from top to bottom. Of course, only words in the child's reading vocabulary should be used on the cards. This device can be used effectively with all the groups taught hereafter.

30 Symbolism of addition facts; use of plus sign

KNOWING YOUR OBJECTIVE FOR PAGE 30

The child now learns to recognize and use the plus sign. The word *plus* should by this time have become a general word for all the actions and expressions that involve the combining of two groups. The child now learns the use of the sign + as a general symbol for these actions. With the introduction of the sign it is possible, for the first time, to give the child experience with such abstractions as "5 + 2 is 7."

PREPARING FOR PAGE 30

The poem "Mary Ann's Luncheon" from the book *Here, There, and Everywhere* (item 12 in the bibliography) may be used to introduce this page.

Provide 7 markers for each child in the group. Remember that the objects used as markers should be as varied as possible.

Have available copies of the work sheet containing the basic facts mentioned on page 190 under "Using Page 30."

If the Pocket Chart mentioned under "Applying the New Concepts and Skills" (see page 190) is to be used, have the chart and the materials necessary for using it available.

INTRODUCING PAGE 30

If the poem suggested above has been used, let the children talk about it. Tell the children to look at the first picture on page 30 and let them talk about Nancy, Carol, and Ellen, what they may have bought, etc. Let them speculate, too, about what the other little girls may intend to buy. Discuss the picture at the bottom of the page also. Try to bring out the numerousness of the groups —that 3 girls were at the store and 4 more are coming; that 2 boys were on the playground and 3 more came to join them.

USING PAGE 30

Procedures outlined for previous lessons where reading matter was involved may be followed in developing the first four lines of text. (See the lesson notes for pages 19 and 29.) Be sure that all the children relate what they read to the picture and show the combining action with markers on their desks.

Then have the children look at the line reading "3 girls + 4 girls are 7 girls." Explain that the sign (+) means exactly the same as the word *plus*, which the children have been using for some time. Ask a child to read this line, reminding him to say "plus" when he comes to the sign. Have all the children show the action with markers on their desks.

The last two lines (3 plus 4 is 7 and 3 + 4 is 7) should also be read aloud. Then have various children illustrate the action, using as many different objects as can be assembled (markers, erasers, pieces of chalk, books, crayons, etc.). The action (combining 4 objects with 3 to make a group of 7) should be done in full view of the children and should be repeated until each child understands that when 4 objects are combined with 3 objects, the result is always 7. Use the word *add* in talking to the children whenever you can do so easily and naturally.

It is important to remember that on this page the child is shifting over from the concrete idea of 3 girls plus 4 girls are 7 girls to the generalized statement that 3 plus 4 is 7. This is a big step forward in developing the abstract thinking so essential in arithmetic.

Develop the reading matter that accompanies the picture of the boys in much the same way as that outlined above for 3 + 4 is 7.

For Problems A to N, the abstract practice at the bottom of the page, have the children read a problem silently first and say the missing number to themselves. Tell them that they all should be ready to illustrate with markers the action indicated. Then ask one child to read the problem aloud and illustrate the action, with markers or other objects, in full view of the group. Be sure that all the children participate in both the reading and the activity. Variety can be provided by first taking the problems in alphabetical order, from A to N, and then in random order. Ask one child, for example, to read and illustrate Problem H, another child to read and illustrate Problem C, etc.

Finally, supply each child with a work sheet on which the addition basic facts for the 3, 5, and 7 groups have been written in an order different from that in Problems A to N. Leave space for each answer and have the children write in the correct numbers. Allow them to use markers or other objects if necessary to determine the answers.

APPLYING THE NEW CONCEPTS AND SKILLS

The Pocket Chart (see page 188 for description and illustration) may be used again here. This time the cards in the pockets should show the addition basic facts for 3, 5, and 7 in the generalized form (that is, 2 + 1 is ▒). The children should write on their papers, in order, the numbers that belong in place of the screens.

31 Symbolism of subtraction facts; use of minus sign

KNOWING YOUR OBJECTIVE FOR PAGE 31

The child here learns to recognize and use the minus sign. The statements made regarding the objectives for page 30 apply also to page 31, except that on this page the actions considered are separating rather than combining.

PREPARING FOR PAGE 31

Provide 7 markers for each child in the group.

Have available copies of the work sheet containing the subtraction basic facts mentioned under "Using Page 31."

If either, or both, of the work sheets described on this page under "Applying the New Concepts and Skills" are to be used, have the materials on hand.

INTRODUCING PAGE 31

Ask the children what they do when they go to visit their friends. Let them talk for a few minutes about any toys, games, etc., mentioned and then tell them to open their books to page 31. Discuss what Don and Billy are doing and also what is happening in the bottom picture. Again, as on page 30, try to bring out the numerousness of the groups—that there were 7 cars in the train and Don is removing 2 of them; that 5 girls were playing, and 3 are going away.

USING PAGE 31

Follow the procedures outlined for the lesson notes for page 30 but make the necessary adaptations to fit the separating actions shown in the pictures. Be sure the children understand that the minus sign has exactly the same meaning as the word *minus*. Have all of them show the separating actions with markers on their desks and also have individual children demonstrate the subtraction facts shown with as many different objects as possible. Work for understanding of generalized statements, such as "7 — 1 is 6" and "3 — 2 is 1."[1] Use the word *subtract* in talking to the children whenever you can do so easily and naturally. Finally, give each child a work sheet containing the subtraction basic facts for the 3, 5, and 7 groups but in an order different from that in Problems A to J. The children should write the correct numbers in the spaces provided.

[1] The statements that were made when discussing the number of the verb to be used with *and* and *plus* apply, to a lesser degree, to the word *minus*. There is never any question about the number of the verb when *minus* is used in concrete statements (5 ducks minus 1 duck are 4 ducks), because the subject is always plural. However, when the abstract form is used (5 minus 1 is 4), the verb is always singular. This distinction will be maintained throughout this book, but the children should not be required to observe it.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one illustrated on page 178 may be used for further practice. The child indicates his understanding of the basic addition and subtraction facts printed on the sheet in two ways: (1) If the fact he is dealing with shows addition, he adds enough objects in each box to show the total; if the fact shows subtraction, he crosses out enough objects so that those left indicate the remainder. (2) He writes the correct number in the space provided.

The slower children may find this activity too complex. If so, they should be provided with very simple work sheets and with markers stamped with the picture of the object named on the work sheet. (A portion of such a work sheet is illustrated below. The notes for Lesson 4 show a type of marker suitable for use with this work sheet.) The child reads each problem, uses his markers to determine his answer, and then writes the correct number in the space provided.

7 rabbits minus 3 rabbits are rabbits.
5 rabbits minus 2 rabbits are rabbits.
2 rabbits plus 1 rabbit are rabbits.
2 rabbits plus 5 rabbits are rabbits.
6 rabbits plus 1 rabbit are rabbits.
2 rabbits plus 3 rabbits are rabbits.
7 rabbits minus 4 rabbits are rabbits.
3 rabbits plus 4 rabbits are rabbits.

32 – 33 Pictorial problems and practice

KNOWING YOUR OBJECTIVE FOR PAGES 32-33

The child now reviews and practices addition and subtraction with the 3, 5, and 7 groups, presented in simple pictorial problem situations. He also reviews the positional use of number. Page 33 presents as generalized statements all the addition and subtraction facts for the 3, 5, and 7 groups.

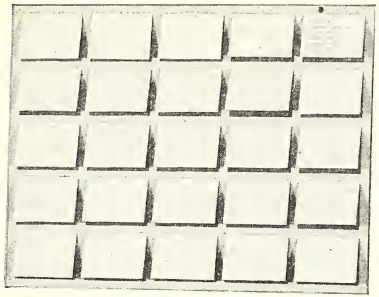
PREPARING FOR PAGES 32-33

The device illustrated at the right, called a "window," can be used to advantage here. The window makes it possible to conceal all the pictures except the one to which attention is to be directed in a particular instance. It also provides a simple way to practice positional use of the numbers 1 to 5.

The windows may be purchased,[1] or they may be made from oaktag. If they are to be made, use the picture on page 193 as a pattern, tracing the lines on transparent paper. (Copies may be duplicated from a master copy made with hectograph ink.) Then cut along three sides of each window with a razor blade or knife. Provide enough of these windows so each child in the group can have one.

A single-view frame similar to that described on page 157 may be used as a substitute for the window. The opening should measure 2 inches by $1\frac{1}{2}$ inches.

1 These windows may be purchased from Scott, Foresman and Company in packages containing 25 windows and 25 frames (see pages 157 and 159).



If neither windows nor frames are available, individual pictures may be isolated by means of markers. Provide one marker for each child to use in this manner.

The slower children may each need seven markers for their work with these pages.

If the activities involving the transparent paper and work sheets (see pages 192 and 194 under "Applying the New Concepts and Skills") are to be used, have the necessary materials on hand.

INTRODUCING PAGES 32-33

Before beginning work on these pages, briefly review the positional use of the numbers 1 to 5. Be sure the children can identify the middle object in a row of 5, the middle finger on each hand, etc. Then have them identify other objects in a row as Number 1, Number 4, Number 3, etc., without counting.

Now tell the children they are going to see a page of pictures showing many interesting things that Nancy, Carol, and Don saw when they went to a birthday party one day. Have them open their books to page 32.

USING PAGES 32-33

In the work with these two pages the children will use windows both to isolate individual pictures and also as a device to review the idea of positional number, starting at either top or bottom, left or right. They will distinguish between combining and separating actions in the pictures and will associate problems and pictures that have corresponding actions.

Let the children talk about what they see on page 32. Have them identify various objects and make sure they recognize the action (combining or separating) in each picture.

The suggestions that follow are based on the use of windows, but single-view frames or markers may be used by adapting the directions. (See the instructions on page 192.)

Show the children how to place the windows over the page. The edges of each window should be even with the corner of the page where the page number appears. It will be helpful to fasten the window to the page with a spring clamp or heavy paper clip. When the window is in the proper position on the page, a picture will appear under each small window as it is opened.

Ask different children to locate various windows by position. For example, give such directions as: "In Row 2 from the bottom open Window 3. What do you see? Tell the story." Try to get the child to say: "3 dolls were on a chair. 1 doll fell off." Any similar statement is acceptable as long as it indicates the action of 1 doll leaving 3 dolls. Con-

tinue by asking the child to finish the story "3 dolls minus . . . ." Get him to understand that he is to say "3 dolls minus 1 doll are 2 dolls."

After one or two pictures have been used in this way, the procedure can be varied somewhat as follows: "Susan, look at Row 5 from the bottom. Open Window 3 and tell us the story. [3 tops were on the floor. 2 more tops fell to the floor. Then there were 5 tops on the floor.] Now tell the story using *plus*. [3 tops plus 2 tops are 5 tops.]" Eventually the child may be required to make an initial response such as "5 place cards minus 4 place cards are 1 place card" (for Row 3, Window 5, for example).

Give the children practice in finding the rows from both bottom and top and the windows from both left and right.

If the window device is not available, give the children directions such as: "Show Row 3, Picture 2, with your frame" (the single-view frame) or "Put your marker [any small object or piece of paper] on Row 3, Picture 2." Then follow with questions like those suggested above.

The directions that follow suggest other ways to review positional number with the windows. "Ruth, open all the windows in the middle row one at a time. Begin at the right. Give the number of the row and of each window and tell what is happening in each picture. [Notice that the number of the row remains the same, but the numbers of the pictures change.] Peter, begin at the bottom and open the middle window in each row, one at a time. As you open each window, say the number of the row and of the window. Then tell what is happening in the picture." (Note here that the numbers of the rows change, while those of the windows remain the same.) Similar procedures may be used until each child can give the position of any window (with reference to any starting point) determined for him.

With slow groups it will be wise to do no more in one class period than review the use of numbers to show position. Then continue with the lesson on the following day as outlined above. When the children are ready to proceed, have the children remove the windows and direct attention to the problems with the blue and red letters on page 33. By questions get them to see that the problems with blue letters are about groups joining other groups, while those with red letters are about some groups being taken away from other groups.

Proceed somewhat as follows: "Put a marker on the first picture. [This is to help the children hold their places on the page.] Find the problem on page 33 that belongs with this picture. Should you look at the problems with blue letters or those with red letters? Why? Which problem belongs with the first picture?"

Deal with all the other pictures on the page in a similar way, taking them in either regular or random order. Be sure that each child has at least one chance to respond. It may be advisable for the slower children to use markers on their desks to show the actions indicated in the problems.

As a variation, especially with brighter children, let each child choose a problem and then find the picture that should accompany it. If a child selects Problem A (blue), which is not pictured, he can show with markers what is happening in the problem, but it is most unlikely that any child will have trouble with $1 + 1$.

Now draw attention to the problems with black letters (A to P). Tell the children to read Problem A to themselves. Remind them to think of the number that belongs where the screen is. Then have one child read the problem aloud. Continue with the other problems in order. Whenever necessary, allow the use of markers or other objects to show what the problem means. Or let the child find the picture on page 32 that fits the problem.

Finally, give each child a work sheet with the letters A to P written on it in columns. Opposite each letter have the children write the number missing in the problem.

The final set of problems (gray A to V) reviews the child's ability to recognize the number words and also his understanding of the words *plus* and *minus*. Use this set of problems in the same way as that outlined for Problems A to P (black). Note, however, that these problems cannot be solved by examining the pictures on page 32.

APPLYING THE NEW CONCEPTS AND SKILLS

Fasten a sheet of transparent paper over page 32 of each child's book with a large paper clip or a clamp. Then tell the children to mark each picture with either a plus sign or a minus sign, depending on which action is shown. For example, each picture that shows combining action should be marked with a plus sign and each one that shows separating action should be marked with

Cut each window along solid black lines.
Fold back along broken line

a minus sign. If the children use crayons for marking, the sheets will be easy to check.

To vary the activity just described, provide each child with a work sheet ruled off into 25 boxes (5 rows of 5 each). The child then marks each box with either a plus sign or a minus sign, depending on the action shown in the picture whose position corresponds with that of the box he is marking. Since the child must keep track of his position both in the book and on the work sheet, this procedure is considerably harder than the one with the transparent paper.

34 Introduction of terms *add* and *subtract*

KNOWING YOUR OBJECTIVE FOR PAGE 34

The child learns to use the words *add* and *subtract* in reading situations.

PREPARING FOR PAGE 34

If the story mentioned under "Introducing Page 34" is to be used, have the book available.

Provide 7 markers for each child in the group.

If you plan to use the work sheet described and illustrated under "Applying the New Concepts and Skills," prepare a copy for each child.

DEVELOPING VOCABULARY FOR PAGE 34

The words *add* and *subtract* occur in reading matter for the first time on this page. They should be taught according to the usual reading procedures for introducing new words. Since meaning should have been established by previous oral use, these new words should cause little difficulty.

INTRODUCING PAGE 34

Read or tell to the children the story *Nappy Chooses a Pet* (item 23 in the bibliography). Let the children talk about pets they have at home—what the pets eat, where they live, how they play, etc. Then tell the children that they are going to see some pictures of pets and read some problems about them.

USING PAGE 34

Have the children open their books to page 34. Let them discuss the pets shown. Bring out the fact that in the first picture two rabbits are running to join the others so that they, too, can get something to eat, and that in the other picture one dog is running away from the original group so that he can play with Don.

Work through the first four lines of reading matter in a way similar to that outlined for such pages as 19 and 29. Be sure all the children understand the purpose of the wavy line and can supply the correct number and word when they read the statement.

Then tell the children to read the next two lines silently. Be sure all the children understand the word *add*. Ask one child to read the lines aloud, and have him show their meaning with markers on a desk or table. Then ask another child to show with markers what is meant when he is asked to add 5 and 2.

Get the children to realize that when they are told to add 5 and 2, they should think "5 + 2 is 7." Problems A to D help to reinforce this idea. Tell the children to read each of these problems silently and then to show with markers or other objects what the problem means in terms of action; that is, have them combine the groups for each problem.

Proceed in about the same way with the reading matter and problems dealing with subtraction. Be sure the children use markers or other objects to illustrate each separating action. Also make certain they understand that when they are told to subtract 1 from 5, they should think "5 — 1 is 4." Problems E to H help to strengthen this type of thinking.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a work sheet like the one shown below. The child is to read each problem in the left-hand column and then supply the correct sign and answer in the right-hand column, as shown in the first problem above. Allow the children to use markers or other objects if they have any trouble determining the answers. Confine basic facts used to the 3, 5, and 7 groups.

Add 5 and 2.	5 + 2 is 7
Subtract 3 from 7.	7 − 3 is 4
Subtract 1 from 3.	3 − 1 is 2
Add 1 and 6.	1 + 6 is 7
Add 4 and 3.	4 + 3 is 7
Add 2 and 5.	2 + 5 is 7
Subtract 3 from 5.	5 − 3 is 2
Add 2 and 1.	2 + 1 is 3
Subtract 6 from 7.	7 − 6 is 1
Subtract 2 from 7.	7 − 2 is 5

Charting the Course — The number system to 99

An understanding of arithmetic depends upon a knowledge of the principles of the number system. Two ideas—namely, *grouping by tens* and *place value*—are basic. Thus in the symbol 47, the 4 written at the left of the 7 indicates "4 groups of ten." Children can learn the principles of the number system if they see how a large group of objects can be organized through grouping by tens, and if they go through the action of making such groupings themselves. They should also learn how written records of such groupings can be made by using tallies or numerals and the idea of place value.

In organizing learning experiences with the number system, the general ideas of grouping and place value should come first. Following this, attention to the decade words (*ten, twenty, thirty,* etc.) in standard order, and their symbolization by numerals (10, 20, 30, etc.), should emphasize the system that is involved. Then the "teen" numbers and the twenties should be studied, to emphasize the sequential principles through which numbers within the decades are expressed. These principles may be further developed by special attention to the different effects of increasing a given group by one or by ten. Similarly, study of the different effects of decreasing a given group by one or by ten helps to increase understanding of the number system.

It should be noted that the number words for the "teens" do not follow the general pattern found in the number words used within the other decades. For example, 74 is read "seventy-four," but the symbol 14 is read "fourteen" and not "onety-four," as the general pattern would suggest. Since the "teens" are an exception, they should be deferred until the general pattern followed in the other decades has been introduced.

On pages 35 to 42, only numbers smaller than 100 are studied. On pages 35 to 37 the numerousness meaning of the numbers 20 to 99 is developed. Page 38 presents the decade numbers 10, 20, 30, etc. Page 39 gives special attention to the "teen" decade and together with page 40 develops the order of the numbers within the decades. No chart displaying all of these is included because the development of such a number chart over a period of days is desirable. (See also "Charting the Course" on page 249.) A later section on the number system extends the principles introduced on these pages to cover numbers through 999.

35 – 36 Grouping by tens and ones

KNOWING YOUR OBJECTIVE FOR PAGES 35-36

The child learns the significance of place value in two-digit numbers. He also learns how to organize objects by tens and ones and how to use the symbolism for such organization.

PREPARING FOR PAGES 35-36

Have available a quantity of small objects which can be stacked or arranged in pyramid piles of 10. These objects might be small blocks, spools, corks, small cereal boxes of uniform size, small boxes made of paper, etc. Collections of several kinds of objects should be on hand. Each collection may have any number of objects from 21 through 99.

In this lesson the children should use small sticks for markers. Each child will need 18.

The work sheets described in "Using Pages 35-36" (see page 196) should be on hand.

If the exercises described under "Applying the New Concepts and Skills" (page 197) are to be used, prepare the necessary materials. Have the *Arithmetic Readiness Cards Set 2: Number System*[1] available if you plan to use them.

DEVELOPING VOCABULARY FOR PAGES 35-36

The child should learn to use the words *one, ten, ones,* and *tens* to indicate the organization of objects. He should be able to understand such statements as "The 7 means 7 ones" or "The 4 means 4 tens." In connection with these pages

1 *Arithmetic Readiness Cards Set 2: Number System,* by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Company.

the children will become familiar with various number words from *eleven* to *ninety-nine*.

INTRODUCING PAGES 35-36

Have the children open their books to page 35. Let them observe what Don is doing and discover the fact that he is putting his blocks in piles. If some of the children wish to talk about experiences they have had in playing with large numbers of objects (blocks, marbles, etc.), let them do so.

USING PAGES 35-36

The work on these pages requires much use of objects and tally marks. The child should organize objects into as many groups of 10 as possible and then represent the objects by tally marks in a one-to-ten correspondence for the piles of 10 and a one-to-one correspondence for any remaining ones. He should learn that a tally mark means 1 or 10 according to the position in which he puts it—that is, it means 10 when placed at the left of a designated line and 1 when placed at the right of the line.

The following will help the children to see that the blocks are being arranged in tens: "Look at the first picture. What is Don doing? Why do you think he is doing this? Can you tell how many blocks Don has? Don has found an easy way to count the blocks. How many blocks has he put in a pile? How does he know without counting when he has 10 in a pile?" Be sure the children understand that when Don puts 4 blocks in the bottom row, 3 in the second row, 2 in the third row, and 1 on top, he has a pile of 10. Make a pyramid pile of 10 objects and have the children look at it.

Next call attention to the picture at the right. Ask: "Now what has Don done? How many piles does he have? Does each pile have 10 blocks in it? [Get the children to notice that the last pile is not the same as the others.] How many blocks does he have in the last pile?" Make sure the children understand that Don did not have enough blocks to make another pile of 10.

Then draw the children's attention to Don's "work sheet" in the second picture. Explain that Don drew a line down the middle of his paper and that he made some tally marks on it. Point out that he made a tally mark at the left of the line for each pile of 10 blocks. Let the children decide whether or not he made the correct number of marks. Now call their attention to the tally marks at the right of the line. Explain that Don made a tally mark at the right of the line for each block that was not in a pile of 10. Ask: "Did he make the correct number of tally marks here?" Point to the tally marks at the left and ask: "What does each of these tally marks mean?" [10 blocks or a pile of 10 blocks] Point to the marks at the right and ask: "What does each of these tally marks mean?" [1 block]

Give each child a sheet of paper divided, either by folding or by drawing lines, into four sections. Each section should be separated into two parts by a vertical line. (These work sheets may be hectographed.) Draw attention to the first section and tell the children that they are going to use their little sticks in place of tally marks to show how many piles of ten and how many ones Don had. Explain that the sticks which stand for piles of ten belong at the left of the line. The sticks which stand for ones belong at the right of the line. Call attention to the piles of blocks that are shown in the second picture on page 35. Have each child place sticks in the first section of his work sheet to represent the tens and ones shown in this picture.

Proceed to the third picture. Call attention to the numbers that Don wrote. By means of questions get the children to see that the 4 shows how many tally marks he wrote on his paper for the piles of 10 blocks. Get them to see that the 7 tells how many tally marks Don made for the blocks that were not in a pile of 10. Ask: "What does the 4 mean? [4 tens] What does the 7 mean? [7 ones]" Have each child make the correct figures on his paper to show the tens and ones in the picture.

In the last picture let the children discover the new way in which Don wrote the number. Explain that this number tells how many blocks Don had. Tell them that this number is read "forty-seven." Explain that the 4 in forty-seven means 4 tens (the 4 piles of 10 blocks each) and that the 7 means 7 ones (the 7 blocks left over).

Finally, draw the children's attention to the work they have done on their papers. Help them to see that the figures they wrote tell what the sticks on their papers mean. Show them how to write these figures in the way Don did to show the number forty-seven. Again tell them what the number is —that they have combined the 4 that means tens and the 7 that means ones into the number that tells how many sticks there are in all.

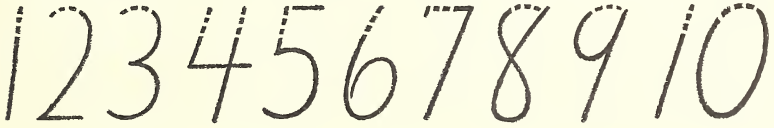
Now have one or two children arrange any suitable objects in as many pyramid piles of 10 as they can. The arrangements should be made on the floor or on a table and saved for later use.

The children are now ready for page 36. Have them notice that there are three series of pictures, or movies, showing how Don and his friends piled up objects in groups of 10 to count them. Call attention to the three pictures in each movie and handle these pictures in the way just outlined for page 35. Be sure the children use their sticks and make the numbers on their work sheets.

The activities outlined above are designed to give the children an opportunity to follow through what Don and his friends did. By this means they will have an understanding that cannot possibly be achieved by any amount of verbal explanation.

Finally, give each child another work sheet just like the one he has been using. This time, however, instead of using sticks, the child is to make marks for the tens and ones in each collection of objects. He is then to write the figures that represent the tally marks, and finally to write the entire number. Tell him how to read the number.

Great care should be taken to help the children develop a critical attitude toward the legibility of the figures they write. It is desirable, of course, to teach the children the proper direction of motion in making the figures, but care should be taken to keep this from becoming too artificial. The picture below suggests one way to teach children the correct beginning directions for the figures.

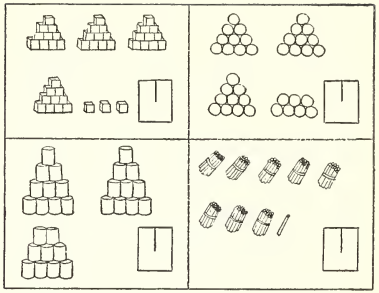


Do not force a child to write the figures until he can approach such a writing situation with confidence and assurance. If a child is not able to write figures easily, do not require him to do so when he is learning any new skill. Learning to write the figures should be a special, separate job. Permit the children who are not able to write figures easily to use number markers in connection with the new topics instead of requiring them to write the figures. For an illustration of markers suitable for such use, see page 161.

APPLYING THE NEW CONCEPTS AND SKILLS

Use cards which show objects arranged in groups of 10 and additional single objects (fewer than 10). Display these cards by standing them against a pile of books on a table or against the blackboard where all can see them. Give each child a work sheet like that described in "Using Pages 35-36." Each sheet should be divided into as many sections as there are cards. Explain to the children that in the first section they are to make tally marks and numbers for the objects on the first card. Be sure they know where to make the tally marks for the piles of 10 and for the single objects. Tell them to use the second section for the second card, and so on.

If *Arithmetic Readiness Cards Set 2: Number System* are available, all pictures except those



numbered 1-5, 11, 16-18, 28, 33-36, 46, 52-55, 60, 70-72, 79, 88-96 may be used instead of the cards described above.

For another device use work sheets similar to that shown above. In each section draw simple objects in piles of 10 and additional single objects. Provide spaces as shown in which the child can write his tally marks and numbers to show how many objects are in each section.

37 Grouping by tens and ones; writing numbers to 99

KNOWING YOUR OBJECTIVE FOR PAGE 37

This lesson, which continues the work begun on pages 35 and 36, gives the child additional experiences to enrich his understanding of two-digit numbers.

PREPARING FOR PAGE 37

If you plan to use any or all of the activities described on the next page under "Applying the

New Concepts and Skills," have the necessary materials on hand.

Provide the same collections of small objects that were suggested in the lesson notes for pages 35 and 36. If possible, use objects that can be made into bundles or put into boxes.

Have available the work sheets mentioned below under "Using Page 37."

DEVELOPING VOCABULARY FOR PAGE 37

When suitable opportunities arise in working with this page, casually use the word zero in talking to the children. Do not expect the children to use the term, however. Further work in developing the meaning of this word will be done on page 38.

INTRODUCING PAGE 37

When the children open their books to this page, let them observe that they are still dealing with objects that have been counted by first arranging them in as many piles of 10 as possible. Let the children identify the various objects shown in the twelve pictures—boxes, spools, bags of candy, jars of paint, boxes of lollipops, and bundles of sticks, pencils, etc.

USING PAGE 37

On this page, not all the objects are in pyramid form. The children should learn to accept without counting groups of 10 in other arrangements. For example, the bundles of sticks should be accepted as containing 10 sticks each, the bags of candy as containing 10 pieces each, and so on. It is not intended that the child should count the objects within a group of 10.

Call attention to the first picture. Use questions to help the children conclude that there are 3 groups of 10 boxes each and also 2 single boxes. Have them look at the work sheet showing tally marks and observe that the tally marks at the left of the line mean the groups of 10. Have them make sure that the number of tally marks for the tens is correct and also that the correct number of tally marks for the ones is on the right side of the line. Talk about the figures that represent the number of tally marks. Finally, draw attention to the way these figures are written together to make a number. Tell the children that they should read this number as "thirty-two." Ask questions that will cause the children to give such responses as: "The 3 in 32 means 3 tens. It tells about the 3 piles of 10 boxes. The 2 means 2 ones. It tells about the 2 boxes that are by themselves."

Proceed in this same way with the first eight pictures on the page. With slower groups it may be necessary to use objects arranged in piles or bundles of 10, with extra single objects, to reinforce the pictures.

When you come to the third picture in Row 1, it is necessary, for the first time, to use the zero symbol. Call attention to the fact that there are no tally marks for the ones and tell why. To write the figure 7 alone as the number to represent the 70 pieces of candy, without the line to show that it means tens, is not satisfactory, since it would then be read as 7, meaning 7 ones, when it means 7 tens. The children will soon realize that a symbol is necessary if they are to indicate that the number of pieces of candy is 7 tens. Tell the children that the symbol we use and that they see in their books is called zero. A similar situation arises when you come to the second picture in Row 3. Further work with the decade numbers is done on page 38.

For the last four pictures, for which neither tallies nor numbers are shown, have the children make tallies, on work sheets supplied for this purpose, for the tens and for the ones. These work sheets should be like those described on page 196. Then have the children write the number symbols that represent the number of tally marks. Make sure the children understand that these figures represent the number of objects shown in the pictures. Pay particular attention to Picture 2 in Row 3, which shows 40 blocks.

APPLYING THE NEW CONCEPTS AND SKILLS

The cards showing pictures of groups of 10 and single objects that were used with the previous lesson may be used again here. Work sheets divided into as many sections as you have cards will be necessary if you use the cards.

If the *Arithmetic Readiness Cards Set 2: Number System* are available, use pictures except those numbered 1-5, 16-18, 34-36, 52-54, 70-72, 88-95.

38 Symbolism of the decade numbers

KNOWING YOUR OBJECTIVE FOR PAGE 38

The child learns the names and the symbolism of the decade numbers (10, 20, 30, 40, etc.) on this page. He learns to say these numbers in their proper sequence. He learns both the positional and quantity meanings of these numbers and the function of the zero in the ones' column.

PREPARING FOR PAGE 38

A series of picture cards can be used to advantage, although such cards are not necessary. There should be at least one card for each of the decade numbers 10 through 90. On each card draw or stamp the required number of very simple objects, arranged in pyramid form. If the *Arithmetic Readiness Cards Set 2: Number System* are available, they may be used instead of the cards just described.

Also provide for each child two work sheets ruled or folded into eight or more sections. Draw a vertical line in the middle of each section to establish position for the tens and ones.

If you plan to use the exercise with transparent paper described under "Using Page 38," have the paper available.

You may wish to use the work sheet described under "Applying the New Concepts and Skills" (page 200). If so, provide the necessary materials.

It is wise to have available enough markers (checkers or small pieces of cardboard will do) so that each child in the group can have one. If other markers are to be used, as described in "Applying the New Concepts and Skills" (page 200), provide a set of markers for each child.

DEVELOPING VOCABULARY FOR PAGE 38

The decade names (*ten, twenty, thirty, forty,* etc.) should be used orally in as many situations as possible in the work on page 38. The word zero should also be used in talking with the children.

INTRODUCING PAGE 38

Have the children open their books to page 38. Let them identify and talk about the various objects shown in the pictures—boxes, cans, paper cups of ice cream, lollipops, jacks, spools, birthday candleholders, chalk, logs.

Get the children to notice that some of the objects on this page are grouped by tens in the pyramid arrangement, some are in bundles of ten, some are in boxes, and some are arranged on cards. As was suggested for page 37, the child should accept these groups of 10 without counting.

USING PAGE 38

Lead the children to discover that each picture on page 38 shows only groups of 10 and that there are no objects not in a group of 10. Let them tell how many groups of 10 there are in each picture. The children should observe that the pictures show 1 ten, 2 tens, 3 tens, etc., in order.

Next draw attention to the tally marks and numbers shown for the first picture. Explain to the children that when Don put the zero at the right of the line, he did so to show that he had not forgotten to make a tally mark for the ones. Then explain that when Don wrote the number 10 below the line, he put the zero after the 1 so that he would know that the 1 means *ten* and not *one*. Take great care at this point to make clear to the children that when a number is written on either side of the up-and-down line, we know what it means; but when we write a number without using the line we are not sure whether it means tens or ones unless we know how to use the zero symbol correctly. Proceed in the way just outlined with the other two pictures in Row 1.

For each of the remaining pictures on the page, get the children to say the number (40, 50, etc.) that represents the number of tens in the picture. Then on work sheets provided for this purpose have them make the necessary tally marks for the tens. Next they should symbolize the tally marks by writing the correct figure at the left of the vertical line. Allow the slower children to write the zero symbol at the right of the line if this seems to help them. Finally, the children should write the number below the line to symbolize the quantity shown in the picture. Keep stressing the necessity of writing zero. Show the children what would happen if they did not use it.

To insure recognition of the names and symbols for the decade numbers, give each child a marker. Tell him to place his marker on the first number at the top of the page. Then have him move the marker to the corresponding picture. First take the numbers in order, from 10 to 90. Then call the numbers in random order (80, 30, etc.) and repeat the activity with the markers. Finally, have each child choose a picture, tell, without counting, how many objects are in it, and indicate the correct number at the left with his finger or a marker.

Let those children who write numbers with ease cover page 38 with a sheet of transparent paper. Then for the six pictures without numbers, they can write over each picture the number that shows the correct number of objects.

Do not leave page 38 until every child can say the decade numbers in order and can recognize them when they are pointed out in random order.

APPLYING THE NEW CONCEPTS AND SKILLS

Use the picture number cards described under "Preparing for Page 38" or the *Arithmetic Readi-*

ness Cards Set 2: Number System (Pictures 1, 11, 28, 33, 46, 55, 60, 79, 96). The children's responses should be written on work sheets. The cards and work sheets may be used in the manner suggested in the lesson notes for pages 35-36.

Another useful exercise is to arrange the decade numbers on a work sheet, omitting some of them. Tell the children to write in the missing numbers.

Each child may be provided with a set of nine markers showing the numbers 10, 20, 30, etc. Some that are easy to make and use are illustrated below. Direct the children to arrange them in order

on their desks, first horizontally, then vertically. A game can be played with these markers, also. One child covers his eyes, while another takes one or more markers from his set. The child from whose set the markers were taken then puts his markers in proper order to discover and announce which ones were taken.

39 The "teen" numbers

KNOWING YOUR OBJECTIVE FOR PAGE 39

The child now discovers that in the second decade of numbers (the "teens") the tens' figure remains the same, while the ones' figure changes successively from 1 to 9. On the basis of what he discovers on this page and on page 40, the child learns that this situation exists in each decade. This enlarges his understanding of the "system" of the number system.

PREPARING FOR PAGE 39

If you can, provide two or three series of picture cards illustrating the numbers 11 to 19. Each series should show different objects. The *Arithmetic Readiness Cards Set 2: Number System* (see page 201) may be used for this purpose.

Provide two work sheets for each child. These work sheets should be so arranged that the children can put on them tally marks and numbers indicating the number of objects in each picture on page 39 and also in the picture cards if you decide to use them.

Have available a quantity (19 or more of each) of several kinds of small objects for counting.

A number chart that will be helpful may be started now. This chart can be made from a large sheet of oaktag. On it write or stamp the numbers 1 to 99. For the work of this lesson only the decade numbers and the numbers 1 through 19 need to appear on the chart. As the work progresses in future lessons, the numbers up to 99 should be placed on the chart. A picture of a completed chart is shown at the right.

Note that this chart is arranged so that the first column shows the numbers from 1 to 9, the second column shows the numbers from 10 to 19, and so on. Reading across the top of the chart, the numbers are 10, 20, 30, 40, 50, 60, 70, 80, 90. Other arrangements of number charts can be used to advantage, but the one pictured here is especially helpful. Since it shows the decade numbers across the top, the name of that decade (twenty, for example) indicates the decade name for all the numbers in the column.

If you plan to use the work sheet mentioned on page 201 under "Applying the New Concepts and Skills," prepare a copy for each child.

If the game mentioned under "Applying the New Concepts and Skills" (page 201) is to be played, provide each child with a set of markers showing the numbers 1 through 19.

DEVELOPING VOCABULARY FOR PAGE 39

The number words from *eleven* through *nineteen* are to be used orally on this page.

INTRODUCING PAGE 39

Have the children open their books to page 39. Encourage them to look at all nine pictures, to

	10	20	30	40	50	60	70	80	90
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

talk about the objects shown in each picture, and to speculate as to the contents of the boxes and cans. Help them understand that each picture shows single objects and objects in a group of 10.

USING PAGE 39

Ask the children such questions as "What do you see in the first picture? There are 10 pads of paper in the pile. How many pads are not in a pile of 10?" On the work sheets already distributed have the children make tally marks for the pile of 10 pads and for the single pads not in the pile of 10. Be sure the children place their tally marks correctly, to the left and the right of the vertical line. Next have them write the symbols for the tens and for the ones. Finally, they should write the number itself. Tell them that this number is read "seventeen" and that we say "teen" for *ten*. Ask them to find the number 17 at the right of the page. Continue discussing the number 17. "What does the 1 mean? In this picture it means one pile of 10 pads—1 ten. What does the 7 mean? It means 7 pads—7 ones."

Proceed in the same way with the other "teen" pictures on the page, giving special attention to 11 and 12, which present a verbal difficulty because they do not follow the same verbal form as 13, 14, 15, 16, etc. When the work with tallies and numbers has been finished for the nine pictures, have the children match the numbers at the right of the page with the correct pictures. Then let them read these numbers consecutively.

Finally, have available on the table or draw on the blackboard 19 or more objects for the children to count. Let them take turns counting from 1 to 19, stopping when they get to numbers like 12, 16, 17, 19. Ten of the objects may then be grouped together and the counting started with 10.

APPLYING THE NEW CONCEPTS AND SKILLS

Use the picture number cards described under "Preparing for Page 39" or the *Arithmetic Readiness Cards Set 2: Number System* (Pictures 2, 3, 4, 5, 91, 92, 93, 94, 95), along with work sheets. The cards and work sheets may be used in the way suggested in the lesson notes for pages 35 to 38.

Another useful exercise is to arrange the "teen" numbers on a work sheet, omitting some of them. Ask the children to write in the missing numbers.

The game suggested in the lesson notes for page 38 can now be used with the numbers 1 through 19.

40 Symbolism in the higher decades

KNOWING YOUR OBJECTIVE FOR PAGE 40

The child learns that the numbers in the ones' column go through the same sequence from 1 to 9 in all the decades. He thus becomes more conscious of the "system" of the number system.

PREPARING FOR PAGE 40

If you wish to use picture cards, prepare two or more series illustrating the numbers 20 to 29. Use different objects for each series. If the *Arithmetic Readiness Cards Set 2: Number System* are available, the pictures listed under "Applying the New Concepts and Skills" (page 202) may be used.

Work sheets similar to those used for the preceding pages should be used again here. Each work sheet should have 10 sections.

Have enough objects on hand so that the children will have an opportunity to count to 99.

If you plan to use the work sheets with the rows of numbers, described in "Applying the New Concepts and Skills" (page 202), have the necessary materials available.

DEVELOPING VOCABULARY FOR PAGE 40

Use orally all the number words up to *ninety-nine* as often as possible to insure familiarity.

INTRODUCING PAGE 40

Ask the children to look at the pictures on page 40. Be sure they accept the fact that some of the objects are arranged in groups of 10.

USING PAGE 40

In working with this page the child will learn first to say and write the numbers 20 to 29. This will lead to further work with the higher decades on subsequent days, when he will learn to say and write all the numbers to 99.

Call attention to the first picture. Ask such questions as: "What things are being counted in this picture? How many piles of ten are there? How many pennies are not in the piles of ten?" Direct the children to use their work sheets and in the first section to make tally marks for the piles of ten pennies and for the single pennies. Instruct them to write the symbols representing the tens and the ones and then to write the number that represents all the pennies in the picture. Tell the children that this number is read "twenty-six." Be sure they understand that "twenty" means 2 tens.

Continue with the other nine pictures in a similar manner. When the children have made tallies and numbers for all the pictures, have them match

each number at the left with the correct picture. They may do this by pointing, by reading the number and describing its picture, or by using markers. Then ask them to read the numbers consecutively from the page.

At this point write or stamp the numbers 20 to 29 on the number chart that was started with the work for page 39.

On subsequent days give the children opportunity to discover that the ones in each decade go from 1 to 9 (31, 32, 33, etc.). As each decade is developed, add those numbers to the number chart. Use the chart to help focus attention on the system of the number system—that the numbers in each decade go from 1 to 9 and that then a new "ten" number is used (39, 40, etc.).

APPLYING THE NEW CONCEPTS AND SKILLS

To make sure that each child can begin counting at any point and continue counting to 99, use procedures similar to the following: "There are 44 sticks [stones, buttons, or whatever objects you are using] in this box, and here are some more on the table. Let's count to see how many there are in all. We'll begin with this stick on the table and say 'forty-five.' John, count all of them. Put them in the box as you count." Give each child one or more opportunities to count. Vary the beginning point and direct the other children to listen and watch. Be sure that the child begins counting with the next number after the one representing the number of objects in the box.

Use the pictures described under "Preparing for Page 40" (page 201) or, if they are available, *Arithmetic Readiness Cards Set 2: Number System* (Pictures 6, 7, 8, 9, 10, 82, 96, 97, 98, 99). The work sheets with spaces for tally marks for the tens and ones (if these are still necessary) and places in which to write numbers may be used along with the picture cards.

Give each child a work sheet on which numbers within each decade are written in a row. Some of the numbers should be out of order and some should be missing. Direct the children to show the correct position of the numbers and to write the missing numbers in their proper places.

41 Increasing groups by 1 and by 10

KNOWING YOUR OBJECTIVE FOR PAGE 41

The child learns to change the number symbol when a quantity is increased by 1 or by 10. He achieves this understanding by imagining the action of adding 1 object or a group of 10 objects to a previously symbolized group of objects. The child also learns to count by tens and by ones.

PREPARING FOR PAGE 41

Provide work sheets for all the children. Each work sheet should be ruled off into 8 sections. It is wise also to have available (especially for slower groups) collections of small objects. If possible, provide up to 99 objects in each collection.

If you plan to use the exercises described under "Applying the New Concepts and Skills" (page 203), prepare the work sheets described there.

The picture cards previously prepared for pages 35 to 40 or the cards from *Arithmetic Readiness Cards Set 2: Number System* will be useful.

INTRODUCING PAGE 41

Ask the children to look at this page. Since you will need to distinguish the pictures by color, have the children notice the different colors of the candy sticks. Draw their attention especially to the two pictures enclosed by orange lines.

USING PAGE 41

The pictures are to be identified as Pictures 1 to 7, going from left to right. The two pictures at the upper right enclosed by orange lines are not included in this numbering.

Give each child one of the work sheets ruled off into 8 sections. Tell the children to look at the first picture. Ask such questions as: "How many bundles of 10 sticks of candy are there? How many sticks of candy are there that are not in a bundle of 10? How many tens are there? How many ones are there? In the first box on your work sheet write the number that tells how many sticks of candy there are in Picture 1. Read your number." Make sure that each child has written the number 42.

Now draw the children's attention to the single stick of candy in the upper right corner of the page. Refer to it by color. Tell them to imagine that this stick of candy has been placed with those in Picture 1. Ask questions to bring out the fact that while there are still 4 tens in Picture 1, there are now 3 ones. The new number of candy sticks is 43. Have the children write this new number in the first section of their work sheets under the 42 they have just written.

Now tell the children to think of the 1 stick as having been put back in the corner box. Then tell

them to imagine that the bundle of 10 sticks of candy at the upper right of the page has been added to the candy in the first picture. Let them discover that now there are 5 tens and 2 ones in Picture 1. Have them write the number 52 in the first section of their work sheet under the 42 and 43.

Tell them to put the bundle of 10 sticks back in its box. Then proceed with Pictures 2 to 7 in a manner similar to that outlined for Picture 1.

For some children it may be necessary first to go through the entire page, symbolizing the pictures as they are and writing the numbers on the work sheet; second, to go through the page again, adding one stick of candy to each picture and writing the proper numbers; and, finally, to go through the entire page a third time, adding 10 sticks of candy to each picture and writing the proper numbers. Very slow groups will be helped if you use objects to illustrate what happens when 1 thing is added to a given group or when a group of 10 things is added to the given group. If possible, however, get the children to the point where they do not need objects but can imagine the action producing the change in the number.

When the children are reasonably proficient in increasing a given quantity by either 1 or 10, have them take turns in counting the objects in the pictures by tens and ones. For example, in Picture 1 they count the objects by saying "10, 20, 30, 40, 41, 42." Encourage them to touch the groups of 10 and the single objects as they count. This same type of counting can be done with objects on a table by those children who need additional experience.

Each child should now be able to write numbers from 1 to 99 from dictation—that is, he should be able to write the numbers when they are dictated in random order. Give occasional exercises of this kind from now on.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a work sheet containing a column of numbers in a mixed order. Allow enough space at the right of these numbers so the children can write new numbers. Direct them to write opposite each number on the work sheet the number that follows it in the number sequence.

Another type of exercise may be provided on the same work sheet by including a second column of numbers. The child writes the corresponding number of the following decade at the right of each number on the work sheet. For example, to explain the activity to the children, refer to a number, such as 23, and say: "Play that a group of 10 has been put with the 23. How many would you have then?" Have one child give the answer and direct all the children to write 33 beside the 23. Be sure they understand that they are to do this for each number in the column.

42 Decreasing groups by 1 and by 10

KNOWING YOUR OBJECTIVE FOR PAGE 42

The child learns how to change the number symbol when a quantity is decreased by 1 or by 10. He achieves this understanding by imagining the action of removing 1 object or a group of 10 objects from a previously symbolized group.

PREPARING FOR PAGE 42

Work sheets should be provided for all the children. Each work sheet should be divided into 9 sections. In addition, have available collections of small objects for use with the slower children. Have 99 objects in each collection, if possible.

Decide which of the exercises described under "Applying the New Concepts and Skills" (page 204) you wish to use and prepare the materials you will need.

The picture cards previously prepared for pages 35 to 40 or the *Arithmetic Readiness Cards Set 2: Number System* will also be useful.

INTRODUCING PAGE 42

Tell the children to open their books to page 42. Help them become familiar with the objects shown in the pictures.

USING PAGE 42

Give each child one of the work sheets marked off into nine sections. Call attention to the first picture on page 42. Direct the children's activities by questions like the following: "How many piles of 10 spools are there? How many spools are there that are not in a pile of 10? How many tens are there? How many ones are there? In the first box on your work sheet write the number that tells how many spools there are in Picture 1. Read your number." Make sure that each child has written the number 54.

Tell the children to imagine that one spool has been removed from Picture 1. Ask questions to help them see that while there are still 5 tens in the picture, there are now only 3 ones. The new number is 53. Have them write this new num-

ber in the first section of their work sheets under the 54 that they have just written. Tell them to imagine that the one spool has been put back.

Now tell the children to imagine that a pile of 10 spools has been removed from the spools in Picture 1. Let them discover that there are now 4 tens and 4 ones. Have them write this number in the first section of their work sheets under the other two numbers. (Note that in this case there is no need to put back the 10 spools.) Deal with Pictures 2 to 9 in a manner similar to that just outlined for Picture 1.

With slow groups it may be necessary first to go through the entire page, symbolizing the pictures as they are by writing the numbers on the work sheet; next, to go through the entire page again, removing one object from each picture and writing the proper numbers; and, finally, to go through the entire page for the third time, removing one pile of 10 objects from each picture and writing the proper numbers. Very slow groups will be helped if you use objects to illustrate what happens when 1 thing or a group of 10 things is removed from a given group. Some children may need to use a small piece of paper to cover 1 object or a group of 10 objects in a larger group. Try, however, to get them to the point where they can imagine the action that produces the change in the number.

Continue to give the children experiences in counting the objects in the pictures by tens and ones.

Writing the numbers 1 through 99 from dictation (in random order) should be continued.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a work sheet on which appears a column of numbers in a mixed order. There should be enough space at the right and left of these numbers to permit the child to write new numbers on each side. Tell the children to write at the left of each number on the work sheet the number that comes before it in the number sequence and to write at the right of each number on the work sheet the number that comes after it.

Another type of exercise may be provided on the same work sheet by including a second column of numbers. The child writes the corresponding number of the preceding decade at the left of each number on the work sheet and the corresponding number of the following decade at the right.

Another work sheet that is easy to make and to use is illustrated at the right. For the boxes above the heavy black line tell the children to imagine what number would belong in each box if 1 object were added and to write that number. That is, they would write 39 in the first box, 41 in the next, and so on. Then ask them to imagine what number would belong in each box if 10 objects were added and to write that number in the box.

38	40	74	21
52	69	33	15
80	31	17	86
42	89	26	95

The same procedure should be followed for the boxes below the heavy black line, except that in this case first 1 and then 10 should be removed from the number indicated in each box.

Charting the Course — Money (cent, nickel, dime)

Among the practical uses of number are those associated with money. Children must learn to recognize the coins and know their names, such as one cent or "penny," five cents or "nickel," and ten cents or "dime," and the relationships among them. They must also learn how to count money.

A child's understanding of the amount represented by a collection of coins will be greater if, in counting the money, he uses his knowledge of the principles of the number system. Thus in a collection of pennies, nickels, and dimes, the coins may be organized into piles of 10 cents each. The collection

may then be easily counted by using the decade names (*ten, twenty, thirty,* etc.), and finally counting the value of any ungrouped pennies "by ones." This procedure calls for knowledge of the relationships among the coins, such as the fact that 2 nickels are equivalent to 1 dime.

The introduction to these ideas provided in *Numbers We See* is reviewed and extended on pages 43 to 45 of *Numbers in Action.* The idea of organizing coins by tens and ones for ease in counting is emphasized on these pages. The principles developed enable the pupil to count amounts up to 99 cents in dimes, nickels, and pennies. Simple problem situations are also provided on page 45.

A more extended treatment of money which includes counting by fives, and which introduces the twenty-five cent coin, or "quarter," will be given later in connection with pages 98 to 103.

43 Counting money by tens and ones

KNOWING YOUR OBJECTIVE FOR PAGE 43

The child learns to count money to 99¢ by tens and ones. He identifies the cent (penny), nickel, and dime and learns the value interrelationships of these coins.

PREPARING FOR PAGE 43

Have sufficient coins on hand so that the children can represent different amounts of money with various combinations of coins. One dollar in dimes, fifty cents in nickels, and fifty cents in pennies should be sufficient. Play money may be used, but it is a poor substitute since children need many experiences in handling real coins.

DEVELOPING VOCABULARY FOR PAGE 43

Many oral experiences with the words *penny, nickel, dime, coin, less than, more than,* etc., should be provided.

INTRODUCING PAGE 43

Ask the children about the different coins they have used when buying things at a store. Let them discuss the different amounts required to buy different kinds of things. Have them identify the dimes, nickels, and pennies on page 43 and make sure they are able to recognize these coins.

USING PAGE 43

Draw the children's attention to the picture of Don and Carol. Ask questions somewhat as follows: "What are Don and Carol doing? [Counting money] They have just finished putting the pennies in piles of 10. How many piles of ten pennies each do they have? How many pennies are left over?" Bring out the idea that 10 pennies and 10 cents will buy the same thing, that they have the same value. Then have the children look at the "work sheet" at the lower right in the picture. Proceed as follows: "Don made a tally mark at the left to show each pile of 10 pennies. Each tally mark means 10 cents. Did he make the correct number of tally marks at the left of the line? What does each tally mark at the right mean? [1 cent] Why did Don make 5 tally marks there? What number did Don write at the left side of the paper? Why? What does the 3 mean? [3 piles of 10 pennies, or 30 cents] What number did Don write at the right side? Why? What does the 5 mean? [5 cents]" Direct attention to the 35¢ that Don wrote. Be sure the children recognize the cents' sign and know how to write it.

Now have the children look at the first picture at the upper right. Say: "This picture shows the children's money after they had put one coin in place of each pile of 10 pennies. What is this coin called? Does this picture show as much money as they had before? Let's count the money to find out." Show the children how to count by tens and ones: "10, 20, 30, 31, 32, 33, 34, 35; they have 35 cents. That is just as much money as they had before." Allow the children to use tally marks on a work sheet, if necessary.

In connection with the second picture from the top, ask questions like the following: "What kinds of money do you see in this picture? How many nickels are there in each pile? Here we have 2 nickels to make one pile worth 10 cents. How many piles worth 10 cents each are there? How many ones?" See that the children count "10, 20, 30, 31," etc.

In the third and fourth pictures be sure the children understand that the piles of two nickels and the pile of one nickel and five pennies are each equivalent to 10 cents and that they can each be counted as ten.

Finally, the children should conclude that there are many different combinations of coins that will make 35¢.

APPLYING THE NEW CONCEPTS AND SKILLS

If sufficient coins are available, let the children show combinations of coins that equal 35¢ but are different from those shown on page 43. Then direct one child to choose any amount he likes (up to 99¢) and to put coins in piles on the table to represent this amount. Tell him to put the money in piles with values of 10¢ and 1¢. Let another child go to the table and change some of the coins, keeping the coins in piles worth 10¢ and 1¢ and also keeping the same amount of money. A third child should verify the work by counting the money. Let the next child choose a different amount and show it with coins. Other children may then change the coins, and so on.

44 Counting money by tens and ones

KNOWING YOUR OBJECTIVE FOR PAGE 44

The child has additional experience in counting amounts of money by tens and ones up to 99¢. He also learns about the various ways in which amounts of money can be represented with dimes, nickels, and pennies.

PREPARING FOR PAGE 44

If at all possible, have on hand about one dollar in dimes, one dollar in nickels, and fifty cents in pennies for the work with this page.

Good use can be made of the full-page frame (see pages 157-159). Provide one frame for each child. If the full-page frame is not available, a single-view frame (described on page 157) or a marker (any small object) may be used.

If you plan to use the set of cards or the sheets of transparent paper suggested in "Applying the New Concepts and Skills," have the necessary materials on hand.

INTRODUCING PAGE 44

Ask the children to examine page 44. Get them to notice that nickels, dimes, and pennies are shown. Be sure they realize that the arrangement of the coins makes it possible to count them by tens and ones.

USING PAGE 44

Ask the children to place a frame on the page so that the circle is at the top. Be sure the frames are in position. If necessary, they may be fastened at the top with clips or clamps. When the frame is placed with the circle at the top, groups of coins amounting to 23¢, 37¢, and 70¢ are shown.

Proceed somewhat as follows: Ask a child to count the money in the first picture by tens and ones. When he has given the correct amount, ask another child to find another picture showing 23¢. Continue the activity by having another child count the coins in the next picture visible in the first row. Let him (or someone else) find a second picture showing 37¢ and a third picture showing 37¢. Then ask someone to count the money in the last picture in the second row and to find two more pictures showing 70¢.

Now ask the children to place the frames so that the star is at the top. In this position amounts of 19¢, 55¢, and 61¢ are shown. Ask a child to count the money in the first picture; then see if another child can find a picture showing the same amount (61¢). Continue in the same manner as with the first position of the frame. Notice that three pictures show 55¢ and three show 61¢.

Place the frame with the circle at the bottom of the page. This position shows amounts of 19¢, 37¢, 55¢, 61¢, and 70¢. Let the children count the money in each picture and try to find another picture showing the same amount. They should discover that 19¢, 37¢, and 55¢ each appear in only one visible picture.

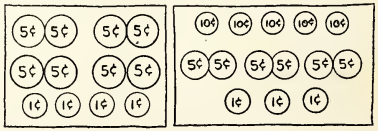
Now place the frame with the star at the bottom of the page. Coins in the amounts of 19¢, 23¢, 37¢, 55¢, and 61¢ are now visible. Use procedures similar to those described above.

A single-view frame may be used if a full-page frame is not available. With this frame have the children isolate one picture at a time. Then ask them questions and give them directions similar to those suggested for the full-page frame.

If it is not possible to provide either the full-page frames or the single-view frames, markers may be used to isolate individual pictures.

APPLYING THE NEW CONCEPTS AND SKILLS

Prepare a set of cards, each of which shows a different amount of money. (Two such cards are illustrated in the picture below.) Represent the coins on these cards by circles, labeling each circle 1¢, 5¢, or 10¢ to indicate pennies, nickels, and dimes. Group the coins so they can be



counted by tens and ones. Give each child one of these cards. Let one child take his card to the table (or desk) and tell him to stack up, in piles of 10¢ and 1¢, the amount of money shown on the card, using pennies, nickels, and dimes but in a different arrangement from that shown on the card. He should then count the money. See that each child gets a turn. Another activity with these cards can be carried out by showing the cards one at a time to the group and requiring the children to write the number (with the cents' sign) that tells how much money each card shows.

Give each child a sheet of transparent paper. Place it over page 44 in the book. Then have the children write on the paper over each picture the number that tells how much money is shown. Be sure that they use the cents' sign.

45 Problems involving money

KNOWING YOUR OBJECTIVE FOR PAGE 45

The child learns how to compare amounts of money to determine which are more (or less) than others. Money is used for these first problems in comparison because the child has had practical experience with similar situations.

PREPARING FOR PAGE 45

Have on hand enough coins for the children to make the combinations called for in the problems —about a dollar in dimes, fifty cents in nickels, and ninety cents in pennies.

It may be necessary to provide each child with a work sheet divided into six sections on which he can write the amount of money shown in each picture. (See the section headed "Using Page 45.")

If you plan to use the activity suggested in "Applying the New Concepts and Skills," prepare the work sheet described there.

DEVELOPING VOCABULARY FOR PAGE 45

The child here encounters in print the expressions *more than* and *less than*. Teach these expressions according to your usual reading procedures.

INTRODUCING PAGE 45

Explain that the children whose banks are shown on page 45 have been counting the money they have saved. Be sure to point out that the money has been arranged so that it can be counted by tens and ones.

USING PAGE 45

Give the children time to look the page over carefully. Then proceed somewhat as follows: "On this page we have some problems and also some pictures that will help us find the answers. Look at Problem A and read it to yourselves. Which picture shall we use to help us find the missing number? [Let the children discover that they are to look at the first picture.] Let's count Don's money." Be sure they count "10, 20, 30" and say "30 cents" for the amount of money that Don has. Now let one child read the problem aloud, saying the missing number when he comes to the screen. If the child says the wrong number, help him use the picture again.

Proceed in this manner with all the other problems on the page. When the children come to problems like Problem C, show them how to use two pictures to answer the question. Use real money, if necessary. Some of the children may find it helpful, when comparing amounts, to use work sheets divided into six sections. In the first section they can write the amount of Don's money, in the second, the amount of Carol's money, and so on. Then they will have the amounts clearly visible before them and will not have to remember so much.

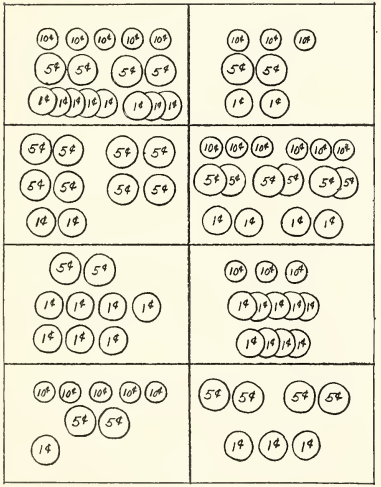
These problems can be enriched for the abler children by asking such questions as: "How can you make the money beside Don's bank equal to Carol's?" Work for such answers as "Take away one of Don's nickels," "Give Carol 5 pennies." The answers to such questions are to be found by counting, not by subtraction or addition. In answering problems like Q, in which the money in two pictures must be counted, be sure that the children first count the groups of 10¢ in both pictures and then count the single pennies in both pictures. Let the slower children use actual coins for problems like these. Have them first put down the amount of Don's money and then the amount of Carol's. Be sure they use the arrangement by tens and ones shown in the pictures. Then let them count the coins as a combined arrangement. Do not leave the page until you feel that the children have a reasonably good understanding of the comparison concepts developed here.

APPLYING THE NEW CONCEPTS AND SKILLS

To give further practice in counting dimes, nickels, and pennies, provide each child with a work sheet containing pictures of groups of coins. The work sheet may contain as many as eight exer-

cises on each side. The coins should be arranged in groups of 10¢ and 1¢ in value and can be represented by circles labeled 10¢, 5¢, 1¢. (A sample work sheet is illustrated below.) The children are directed to write for each picture the number telling how much money there is. Be sure they write the cents' sign.

If you have enough coins on hand, give each child in the group a different amount of money. Let each child count his money by tens and ones in front of the group. The children should then figure out who has the most money, how much more money Billy has than Ann, etc.



Charting the Course — The 6 group

Up to this point, the concepts of addition and subtraction have been developed in connection with the 5 group, the 3 group, and the 7 group only. The 6 group can now be introduced. The same organization of learning experiences that was used earlier should be followed. That is, the sequence of learning experiences should begin with combining actions and proceed from (1) completed actions through (2) imagined actions to (3) the symbolization of the actions, using the basic facts for the 6 group. The same sequence should then be followed for separating actions.

As noted earlier (page 168), a new situation arises with the 6 group. This may be formed by combining 3 twos and also by combining 2 threes. Attention may thus be focused upon (1) the equality of groups which are to be combined, and upon (2) the number of these equal groups. When these special features of certain combining actions are noted, a special name—that is, multiplication—is used to call attention to the nature of the situation. It is customary to emphasize the multiplication point of view in the symbolization. Instead of saying "3 plus 3 is 6," the statement may become "2 threes are 6" when attention is directed to the equality of the groups. As before, the action may be either actual or only imagined.

A new situation also arises with separating actions. The group of 6, unlike the 5, 3, and 7 groups, may be separated into equal subgroups. Moreover, this may be done in two different ways; that is, as two groups of three or as three groups of two. Attention may be focused upon (1) the equality of the groups into which 6 is being separated, and upon (2) the number of these equal groups. When these special features of certain separating actions are noted, a special name—that is, division—is used to call attention to the nature of the situation. The division point of view is indicated by changing the symbolization. Instead of saying "6 minus 3 is 3," the statement used may suggest division by saying "6 is 2 threes" when attention is focused on the equality of the groups.

It is obvious that these multiplication and division situations occur naturally in the lives of young children. When the group idea is used as a basis for organizing the learning experiences with numbers, situations involving equal groups occur in a natural way in connection with such groups as 4, 6, 8, 9, and 10. Experience with equal groups, recognized as such, should be included. There is no need to defer any introduction of the multiplication and division concepts until a later grade. It should

be noted, however, that it is neither necessary nor desirable to introduce the word *multiplication* or the word *division* during the first informal consideration of these concepts. Neither should the special symbols used to indicate them ($\times$, $\div$) be introduced until the time for a more complete study of the concepts is reached in a later grade. On the other hand, the symbol for equality ($=$), read "equals" or "is equal to," can be introduced in connection with the 6 group and used regularly thereafter.

In *Numbers in Action* the 6 group is introduced on pages 46 to 57. The 5 addition and 5 subtraction basic facts are developed by procedures now familiar. As preparation for later work in multiplication and division, special attention is given to equal groups which combine to make 6. Special attention is also given to the ways in which the 6 group can be separated into equal groups. The division situations are confined to the sort sometimes called the "measurement" type or non-sharing type of problem, in which the numerousness of the equal groups is known while the number of such equal groups is to be found. On page 55 the important symbol for equality ($=$) is introduced.

46 The 6 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 46

The child begins to study the addition basic facts for the 6 group. Completed action is shown for all of the five facts encountered in the 6 groups.

PREPARING FOR PAGE 46

If you wish to use a story, the book *White Snow Bright Snow* (item 34 in the bibliography) is appropriate.

Each child will need 6 small markers.

The work sheet described on this page under "Applying the New Concepts and Skills" will be useful in teaching this page. Each child will need at least one copy.

DEVELOPING VOCABULARY FOR PAGE 46

Begin oral use of the words *equals* and *equal* in place of *is* and *are*. The words *add* and *plus* should also be practiced frequently in the work with this page.[1]

INTRODUCING PAGE 46

If you have read or told the story *White Snow Bright Snow* to the children, let them talk about it. They might also enjoy talking briefly about games that they play in the snow or that they have read about. Then have them open their books to page 46. Direct their attention to the movies on the page and get them to generalize that in each movie one group is joining another group or is being added to another group. Some of the children may notice that the combined groups in each movie equal 6.

USING PAGE 46

Direct the children's attention to the first movie. Ask them what is happening in the first picture. [Four children with sleds are standing at the top of a hill. Two more children with sleds are running up the hill to join them.] Continue with directions such as: "Put markers on the children at the top of the hill. How many markers did you use? Now put markers on the children coming up the hill. How many markers did you use? How many markers have you used altogether?

"Now look at the second picture. What has happened in this picture? [Work for responses such as 'All the children are together at the top of the hill' and 'The 2 children have joined the 4 children at the top.'] How many children are at the top of the hill now? When one group joins another group, we say that one group is *added* to the other group. In this movie, 2 is added to 4."

Now have the children move their markers together on the first picture to show what has happened as shown in the second picture. Then get them to make such statements as "4 children and 2 children are 6 children," "2 children added to 4 children equal 6 children," "4 children plus 2 children are 6 children," and "4 plus 2 equals 6."

Follow similar procedures for the rest of the pictures, which show the facts $5 + 1$, $3 + 3$, $2 + 4$, and $1 + 5$, in that order. Emphasize the fact that in each movie groups are being added. Encourage the children to use the words *add*, *plus*, *equal*, and *equals* in their responses.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one described and illustrated on page 157 of these notes may be used in connection with page 46. On this work sheet the children are to encircle 6 marbles at a time,

[1] See the footnotes on pages 171 and 190 that refer to the use of *is* and *are*. The same rules apply to the words *equals* and *equal*.

trying to make as many groups of 6 as they can. Their circles must not intersect. Draw the marbles in groups of 2, 3, 4, and 5, with single marbles scattered here and there. It is desirable to have some extra work sheets on hand for those children who may get off to a bad start and spoil their papers.

47 The 6 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 47

The child imagines the combined group that results when the action indicated in each picture is completed. All the addition basic facts for the 6 group are shown.

PREPARING FOR PAGE 47

The book *The Snow House* (item 30 in the bibliography) is suitable for introducing the page. Have it available if you wish to use it.

Provide 6 small markers for each child.

Collections of small objects (dolls, toy automobiles or airplanes, blocks, pencils, toy animals, pennies, etc.) will also be useful. Provide at least six each of several different kinds of objects.

INTRODUCING PAGE 47

If you have read or told *The Snow House* to the class, let the children discuss the story. Then tell them that the pictures in this lesson show more games the children played in the snow. Have the children open their books to page 47 and let them talk about the pictures. If the games "Fox and Geese" (first picture) or "Angels in the Snow" (second picture) are unfamiliar, explain them to the children. Be sure they see that in each picture one group is being added to another group.

USING PAGE 47

Direct the children's attention to the first picture. Ask questions designed to establish the facts that 5 children are ready to play "Fox and Geese"; that 1 more child is about to join them; and that it is necessary to combine or add the two groups to find out how many children in all are going to play the game. Then direct the children to use markers on the picture or on their desks to represent the action of 1 child joining 5 children. They should be encouraged to make the responses "5 children and 1 child are 6 children," "1 child added to 5 children equals 6 children," "5 children plus 1 child are 6 children," and, finally, "5 plus 1 equals 6."

The other pictures on the page may be handled in much the same way. These pictures show the facts $3 + 3$, $2 + 4$, $4 + 2$, and $1 + 5$, in that order. Throughout the work with this page, make frequent use of the words *equal, equals, add, adding,* and *plus.* (For example, "The boys are adding 2 snowballs to the 4 snowballs.")

APPLYING THE NEW CONCEPTS AND SKILLS

From the collections of objects mentioned earlier give each child several of the same kind of object. Give most of the children 6 objects of a kind, but provide an occasional child with 5 or 7 objects. Using his own collection of objects, each child is to make up a problem that shows two groups being combined or added. Let each child tell his problem to the others and show the action involved. He should finish with statements such as "4 airplanes plus 2 airplanes are 6 airplanes" and "4 plus 2 equals 6." If you find too many children using the same basic fact, give them a problem of your own and ask a child to work it out for the class.

Another way to control the combinations is to give groups of the same kind of object to two children and have them put the groups together. That is, you might give Ann 2 cars and Mary 4 cars. One child would say, "I have 2 cars." Then the other would say, "I have 4 cars. 2 cars plus 4 cars are 6 cars. 2 plus 4 equals 6."

48 Symbolism of the addition basic facts for the 6 group

KNOWING YOUR OBJECTIVE FOR PAGE 48

The child learns how the five addition basic facts for the 6 group may be symbolized. He visualizes the action indicated in the pictures as completed, and he uses the pictures to answer the questions in the problems.

PREPARING FOR PAGE 48

Each child will need 6 small markers.

If the Pocket Chart (see page 211 under "Applying the New Concepts and Skills") is to be used, see that the necessary materials are ready.

DEVELOPING VOCABULARY FOR PAGE 48

While working with this page, continue oral use of the words *equal* and *equals* wherever possible.

INTRODUCING PAGE 48

Ask the children to open their books to page 48. Let them talk about what they see in the pictures. Encourage them to generalize that in each

of these pictures one group is joining another group or is being added to another group.

USING PAGE 48

Direct the children's attention to the first picture. Tell them that Carol and Don made some snowmen. Carol finished hers first and then went away. Ask: "How many snowmen did Carol make? How many will Don have made when he has finished the one he is working on?" Now tell the children to look at the first story (the first 5 lines of reading matter), and explain that it belongs with the first picture. Continue with questions and directions like these: "Read the whole story to yourselves. John, read the first line aloud for us. All of you put markers on Carol's snowmen. How many markers did you use? Read the second line aloud, Betty. All of you put markers on Don's snowmen. How many markers did you use? Read the third line aloud, Peter. All of you show with your markers how to answer this question. How many markers do you have? How many snowmen are there in all?"

Before having the fourth and fifth lines read aloud, remind the children that the wavy line and the screen indicate that something is missing. Also discuss the meaning of the plus sign. When you have worked through the five lines, ask the children "4 plus 2 equals what number?"

The other pictures and stories may be handled in the same way. Remember to ask the children to describe in detail what is happening in each picture. Get the children to make up questions for the last three pictures before they read the two lines of text that belong with each picture.

APPLYING THE NEW CONCEPTS AND SKILLS

The Pocket Chart that was described and illustrated on page 188 of these notes may be used to advantage with this page. The addition basic facts used on the problem cards should include all the facts for the 6 group and a few facts from the 3, 5, and 7 groups. Remember to restrict the words in the problems to words in the children's reading vocabulary. See the complete word list on page 144.

49 The 6 group — separating into two groups

KNOWING YOUR OBJECTIVE FOR PAGE 49

The child learns that the 6 group, like the 3, 5, and 7 groups, can be separated into two groups and that he can determine the remainder if one of these groups is removed. The pictures on page 49 show, by completed action, all the subtraction basic facts for the 6 group in the following order: 6—2, 6—1, 6—3, 6—4, and 6—5.

PREPARING FOR PAGE 49

Provide 6 small markers for each child.

If the work sheet described on this page under "Applying the New Concepts and Skills" is to be used, have a copy ready for each child.

DEVELOPING VOCABULARY FOR PAGE 49

The words *equal, equals, minus,* and *subtract* should be used as often as possible in the work connected with page 49.

INTRODUCING PAGE 49

Have the children open their books to page 49 and direct their attention to the movies on the page. Let them talk about what is happening in the pictures—why the children in the first picture are running away, that the boy in the second movie is throwing snowballs, and so on. Through discussion bring out the fact that in each movie one group is leaving or is being taken away from a larger group.

USING PAGE 49

Direct the children's attention to the first picture in the first movie. Then ask questions designed to establish the facts that a group of 6 children were playing in the snow; that 2 children are running away; and that when 2 children go away from a group of 6 children, there are 4 children left (second picture). Have the class show this action with their markers on their desks. Remind them that they are *subtracting* 2 from 6. Then have them make such statements as "6 children minus 2 children are 4 children" and "6 minus 2 equals 4."

Use the same procedures for the other movies on the page. Encourage the children to use as many expressions as possible that indicate separating actions.

APPLYING THE NEW CONCEPTS AND SKILLS

Supply each child with a work sheet divided into eight sections. Tell the children stories each of which illustrates one of the subtraction basic facts for the 6 group and one fact for the 3, 5, or 7 groups. As you tell a story, the children should draw objects, cross off a number of them, and write the number symbol that tells how many are left. For example: "Don made 6 snowballs. [The children draw 6 snowballs in the first section of the

work sheet.] He threw 3 of them at Bill. [The children cross out 3 snowballs.] How many snowballs did Don have left? [The children write the number 3 below the snowballs.]" The objects that the children are to draw must, of course, be very simple—balloons, pennies, kites, etc.

50 The 6 group — separating into two groups

KNOWING YOUR OBJECTIVE FOR PAGE 50

The child imagines that the separating actions suggested by the pictures have been completed, and he "sees" the remainder. All the subtraction basic facts for the 6 group are used.

PREPARING FOR PAGE 50

Provide 6 small markers for each child.

The collections of small objects suggested for use in the lesson notes for page 47 (see page 210) will be useful.

INTRODUCING PAGE 50

Have the children open their books to page 50. Let them talk about the pictures—why the boys in the first picture are using brooms, what the children are doing with the big snowballs, etc. Develop the idea that in each picture one group is being separated from a larger group.

USING PAGE 50

Call the children's attention to the first picture. By means of questions and directions get the children to respond that a group of 6 boys have been sweeping the ice; that 4 of the boys are going away; and that when 4 boys leave a group of 6 boys, there are 2 boys left. Have the children show the separating action with markers, either on the picture or on their desks. Then encourage them to make such statements as "6 boys minus 4 boys are 2 boys," "When you subtract 4 boys from 6 boys, 2 boys are left," and "6 minus 4 equals 2." The word *minus* is to be used as a generalized term for the separating actions, as was done for the 3, 5, and 7 groups.

The other pictures may be handled in the same way. Let the children dramatize the pictures, either before or after their work with markers. Continue to encourage use of the words *equal, equals, subtract,* and *minus* and try to employ a variety of expressions indicating separation of groups.

APPLYING THE NEW CONCEPTS AND SKILLS

The collections of small objects mentioned earlier may be used as was suggested in the lesson notes for page 47. This time, instead of making up problems showing combining, the children should make up problems showing separation.

51 Symbolism of the subtraction basic facts for the 6 group

KNOWING YOUR OBJECTIVE FOR PAGE 51

The child learns how the five subtraction basic facts for the 6 group may be symbolized. He completes the action indicated in the pictures, and he uses the pictures to answer the questions in the problems.

PREPARING FOR PAGE 51

If you plan to use a story, *Billy's Picture* (item 3 in the bibliography) will be suitable.

Each child will need 6 small markers.

If the work sheet described and illustrated on page 213 under "Applying the New Concepts and Skills" is to be used, be sure there is a copy for each child.

DEVELOPING VOCABULARY FOR PAGE 51

The words *equals* and *equal,* which have previously been used orally in place of *is* and *are,* occur here in printed form for the first time. Teach these words according to your usual reading procedures for new words.

INTRODUCING PAGE 51

If you have read or told the story *Billy's Picture* to the children, let them talk about it. Then tell the class that the children in Don's room had a party at school. Tell them that their books will show them some of the things that happened at the party. Let the children talk, if they wish, about parties they have had at school. Then have them open their books to page 51. Explain that the pictures show decorations that Don and Carol and their friends made for their room. Let the children identify the objects in the pictures. Encourage them to recognize the fact that in all these pictures a group of objects is being removed or subtracted from a larger group.

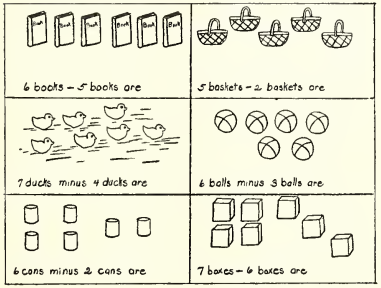
USING PAGE 51

The suggestions for teaching page 48 apply to this page also. The questions and directions, of course, must be adapted to each picture. When the children come to the last line in the first problem, review the use of the minus sign if necessary. Throughout the work with the page encourage the children to use the words *equal, equals, subtract,* and *minus* in their responses.

As suggested far page 48, have the children make up questians abaut the last faur pictures befare they read the twa lines of text that belang with the picture.

APPLYING THE NEW CONCEPTS AND SKILLS

Divide a sheet af paper inta 6 sectians. In each sectian draw ar stamp a graup af 3, 5, 6, ar 7 abjects. Below each graup print a statement such as "6 balls minus 1 ball are_____." The children are ta crass off abjects ta indicate the anes "taken away" and write in the missing wards and numbers. The illustratian below shaws a sample wark sheet.



52 The 6 group — combining equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 52

The child facuses his attentian an the cambining of equal graups to farm a larger graup and begins to acquire the ideas that gradually became the concept af multiplicatian. He learns ta inspect graups ta discaver whether ar nat they are equal and, if they are equal, ta nate haw many groups there are. He then observes actians that bring these equal graups tagether. He inspects the resulting graup ta discaver haw many abjects there are. He alsa imagines the equal graups as ane graup. The child uses such expressians as "2 groups af 3 equal 6" and "2 threes equal 6."

PREPARING FOR PAGE 52

Pravide 6 small markers far each child.

If Card-Halder No. 3 and the apprapriate picture cards (see page 214, "Applying the New Cancepts and Skills") are ta be used, see that these materials are available.

INTRODUCING PAGE 52

Tell the children that an page 52 they will see more pictures shawing Dan and his friends getting ready far their winter party at schaal. Let the children apen their baaks ta page 52 and talk abaut the pictures. Get the children to natice that the mavies and the twa pictures at the battam af the page all show equal graups caming tagether.

USING PAGE 52

Ask the children to look at the first picture in the first mavie and have them tell what is happening. Accept any reasanable respanse. The abler children may respand immediately that 2 children are warking at each table and that there are 3 tables, ar even that 6 children are warking in graups af 2. Whatever the respanse, direct the discussian sa the class clearly sees that the picture shows the children arranged in graups with the *same number* af children in each graup and alsa that it shaws 3 graups.

Cantinue with such questians and suggestians as the falfawing: "What da yau suppose the children are making? Let's laak at the next picture and find aut. What are the children daing in this picture? [They are getting ready ta ga ta the bulletin baard.] What are they gaing ta da with their snawflake pictures?" Bring aut the fact that they are gaing ta the bulletin baard in graups of 2 children each and that there are 3 graups.

Now direct attentian ta the last picture of the mavie and bring aut the fact that the children are naw all tagether in ane graup—a graup af 6 children. Wark for understanding af the statement "3 graups of 2 children each are 6 children." When yau are sure the children understand, begin to use the ward *equal* in place af are. Finally, arrive at the statements "3 graups af twa equal 6" and "3 twos equal 6." Nate that the wards *times* and *multiply* and the times sign (×) are nat intraduced in this baak.

Let the children act aut this movie and alsa shaw with markers an their desks that 3 twas equal 6.

Handle the secand mavie in the same way as the first. Be sure the children see that this time the abjects in the picture are arranged in groups af 3 and that there are 2 graups. Canclude the activities with the statements "2 graups af 3 snawmen are 6 snawmen," "2 graups af 3 equal 6," and "2 threes equal 6."

Notice that the twa pictures at the battam af the page suggest cambining actians that the

children are to complete by imagination and with their markers. The procedures just described can be used with these two pictures.

APPLYING THE NEW CONCEPTS AND SKILLS

The basic multiplication concept can best be reinforced by activities such as dramatization and work with markers and objects. Let the children act out simple multiplication stories, using books, chairs, pencils, and other objects in the room. It might be wise to tell the stories to the children for them to dramatize.

Card-Holder No. 3 and the picture cards described on pages 167 and 173 may be used in connection with this page. Give each child 6 cards, each having the same object or animal drawn or stamped on it. Tell a multiplication story. The child with the appropriate picture cards inserts them in the card-holder in such a way as to perform the combining action. The other children may supply orally such statements as "3 groups of 2 rabbits are 6 rabbits," "2 groups of 3 balls are 6 balls," "2 threes equal 6," and so on.

53 The 6 group — separating into equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 53

The child focuses attention on the idea of separating a group of objects into smaller groups that are equal. When he sees that these smaller groups are equal, he then determines how many of these equal groups there are. The child is thus prepared for later work in division. After he has used pictures and markers, he becomes acquainted with the abstract expressions "6 equals how many twos?" "There are 3 twos in 6," and "6 equals 3 twos." The pictures on this page show both completed and imagined action.

PREPARING FOR PAGE 53

Each child will need 6 small markers.

Card-Holder No. 3 and the picture cards suggested for use with page 52 may be used with this page also.

DEVELOPING VOCABULARY FOR PAGE 53

Continue the oral use of *equals* and *equal* in place of *is* and *are*. Employ various expressions that indicate separating or arranging into equal groups. Use the word *divide* informally to indicate the separating actions.

INTRODUCING PAGE 53

Have the children open their books to page 53. Explain that the pictures on this page are also about the party. Let the children talk about what is happening in the pictures—what the children in the first movie may have been eating, what the boys in the second movie are doing with the chairs, whether or not the children in the last two pictures are getting ready to go home. Lead the children to see that the pictures show a group separating or being arranged into smaller groups, but do not mention the size or number of the smaller groups at this point.

INTRODUCING PAGE 53

Direct the children's attention to the first picture in the first movie. Proceed with questions and directions like these: "How many children are sitting around the table? Look at the next picture. What are the children doing? [They are getting up from the table. The boys are going off in one direction and the girls in another.] How many boys are there? How many girls are there? Are there as many boys as girls? How many children are there in each little group? Now look at the last picture. What do you see? [Work for such responses as 'Two groups of children are playing a game,' 'Two teams of children are playing a game. There are 3 children on each team,' 'The children have made 2 groups of three,' etc.] Can 6 children be separated into 2 groups of 3 children each?"

Now let 6 children act out this movie. Encourage the children to make such statements as "You can separate 6 children into 2 groups of 3 children," "There are 2 threes in 6," "6 equals 2 threes," etc. Conclude the work on this movie by having the children show the separating action with markers on their desks.

Use similar procedures for the other movie. When the children have discovered in the second picture that the boys are arranging the chairs into groups of 2, ask them how many groups of 2 chairs can be made from 6 chairs. Then direct their attention to the last picture in the movie and explain that this time a group of 6 has been arranged into 3 groups of 2 each.

The result of the actions suggested in the two pictures at the bottom of the page is to be imagined by the children. Use similar procedures with these two pictures.

APPLYING THE NEW CONCEPTS AND SKILLS

The activities suggested for page 52 may be adapted for use with this page. The problems, of

course, must show the separation of a group of 6 into groups of 2 or 3. The children's concern should always be to find how many groups of 2 or 3 there are in 6. The basic division concept must be acquired by the children through varied experiences including dramatic activities and much manipulation of concrete objects.

54 The 6 group — combining and separating equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 54

The child learns to distinguish between the combining and separating actions involved in multiplication and division. He reacts to the symbolism that describes these actions by reading problems associated with pictures and uses the pictures to answer the questions in the problems.

PREPARING FOR PAGE 54

Provide 6 small markers for each child.

If Card-Holder No. 3 and the accompanying picture and problem cards (see "Applying the New Concepts and Skills") are to be used, have the necessary materials ready.

INTRODUCING PAGE 54

Have the children open their books to page 54. Direct their attention to the four movies on the page and let them discover what is happening in these movies. They should decide, from a brief inspection of each movie, which show combining action and which show separating action.

USING PAGE 54

Direct the children's attention to the first picture in the first movie. Ask them what they see in the picture. Their responses should indicate that they see *groups* of ducks, that there are the same number of ducks in each group, that the ducks are arranged by twos, that the groups of ducks are coming together, etc. Now tell them to read to themselves the story that belongs with the movie and to be ready to answer the questions. Continue with questions and directions like these: "Read the first two lines aloud for us, Paul. Let's all look at the picture to find the answer. Tell us the answer, Sue. Read the third line aloud, Bob, and tell us the answer. After Sally has read the next line, let's all look at the second picture to find the answer." In connection with the last line, be sure the children understand that the word *equal* is being used instead of *are*. After the story has been read and the pictures discussed, the children should use their markers to show that they understand the combining action.

Use similar procedures for the other movies on the page. Always stress the fact that in each movie equal groups are combining to form one large group or that a large group is breaking up into equal smaller groups.

APPLYING THE NEW CONCEPTS AND SKILLS

Card-Holder No. 3 may be used to advantage with this page. The picture cards suggested for pages 52 and 53 may be used again. On another set of cards print simple problems using both the multiplication and division facts for the 6 group. Examples of appropriate problems are: "2 groups of 3 dogs equal ——————," "6 balls equal ▤ groups of 2 balls each," or "3 groups of 2 cats are how many cats?" Give each child a problem card and 6 or 7 picture cards. He is to find the answer for his problem and show the class the action involved in the problem by inserting the correct number of picture cards in the card-holder. The advantage of giving the child 7 picture cards rather than 6 is that he is forced to make a decision as to the total number needed.

55 Pictorial problem situations; use of the equals sign

KNOWING YOUR OBJECTIVE FOR PAGE 55

The child learns to recognize and use the equals sign. He also learns to recognize basic facts in completely abstract form ($4 + 2 = 6$). He continues to practice reading problems, getting information about the situation from pictures, recognizing which process corresponds to the problem situation, and supplying missing words and numbers. The basic facts used in the problems have been selected from addition, subtraction, multiplication, and division.

PREPARING FOR PAGE 55

Provide 7 small markers for each child.

If you plan to use the Pocket Chart and appropriate problem cards (see page 216 under "Applying the New Concepts and Skills"), assemble the necessary materials. The work sheet described on page 216 may be used instead of the Pocket Chart.

INTRODUCING PAGE 55

Ask the children to open their books to page 55. Let them examine the pictures and identify the animals. Some of the children may notice that the pictures show hens and young chickens,

tame rabbits and wild rabbits, ducks and ducklings, robins, and bluejays.

USING PAGE 55

Ask the children to read the first four lines to themselves. Tell them that as they read they should find the accompanying picture and use the picture to answer the questions. Then have the children take turns reading a line aloud and answering the question or supplying the missing word and number. Be sure the children understand that the action is that of combining one group with another. Let them show the action with their markers if that seems necessary.

Before proceeding with the next two lines, which introduce the equals sign (=), point out the sign and explain that it means exactly the same as the words *equal* and *equals*. (Do not attempt to distinguish between the singular and plural forms of this word. See the footnote on page 209.) When the children can identify the sign and understand what it means, proceed first with the silent and then the oral reading of the last two lines.

The other stories on the page may be handled in much the same way as the first one. It is especially important for the children to describe the action indicated in each picture, since the actions for addition, subtraction, multiplication, and division are all represented on this page. If the children have any trouble distinguishing between addition and multiplication, or between subtraction and division, direct their attention to the groupings as well as the actions. Explain that when the groups being combined are the same we can say "2 threes = 6" instead of "3 plus 3 = 6." The words *multiplication* and *division* should not be used.

APPLYING THE NEW CONCEPTS AND SKILLS

The Pocket Chart described on page 188 may be used to give the children more practice in responding to abstract problems and in using the basic facts. Make a set of problem cards using any of the basic facts taught so far. The problems may be patterned after those suggested in the lesson notes for page 54. Appropriate problems might be "7 cats − 4 cats = ▒ cats," "3 twos = ▒," "1 duck + 5 ducks equals ▒ ducks," and so on. The children are to write the missing numbers on their papers.

A work sheet with simple problems printed on it may be used instead of the Pocket Chart. Leave a space for the missing numbers. The children can then write the numbers on the work sheets.

56 Pictorial problem situations for the 5, 6, and 7 groups

KNOWING YOUR OBJECTIVE FOR PAGE 56

The pictures on page 56 present problem situations involving addition, subtraction, multiplication, and division. The facts used are from the 5, 6, and 7 groups. The child should recognize the groupings and the actions shown, and should respond by giving the appropriate basic fact in abstract form. He also has an opportunity to practice locating positions from two directions.

PREPARING FOR PAGE 56

This page is designed to be used with or without the windows. (See page 191 for a description of this device.) If windows are to be used, see that each child has one. A single-view frame (see page 191) may be used as a substitute for the windows.

If neither windows nor frames are available, provide a marker for each child to use in isolating individual pictures.

The collections of small objects suggested for use with page 47 (see page 210) will be useful in teaching this page. Be sure to include one or two collections of 7 like objects.

Provide enough small markers so that each child can have 7 if he needs them.

If you plan to use the transparent paper activity mentioned on page 217 under "Applying the New Concepts and Skills," have the paper available.

INTRODUCING PAGE 56

Ask the children to open their books to page 56. Let them examine the pictures and identify the objects and animals. Encourage them to talk about the actions shown in several of the pictures. Be sure they notice that some of the pictures show combining action, some separating action, some the combining of equal groups, and some the separating of a quantity into equal groups.

USING PAGE 56

The suggestions that follow are based on the use of windows, but single-view frames or markers may be used by adapting the directions. For a complete description of the use of the window, see "Using Pages 32-33" on pages 191-192.

Have the children place their windows over the page. Be sure that the windows are in the correct position. The children will need to have the

windows fastened to the top of the page with a clamp or paper clip.

Have the children agree on a starting point for counting rows and windows. You might begin by calling the top row Row 1 and the first window at the left Window 1. See that all the children can locate Row 1, Window 1. Then proceed somewhat as follows: "Now find Row 2 and open Window 3 in that row. What do you see? Bob, tell us what is happening in the picture." Try to get the child to say "7 blocks were on a box. 5 blocks are falling off." Then encourage him to make the statements "7 blocks minus 5 blocks are 2 blocks" and "7 minus 5 equals 2."

After several pictures have been used in this way, have the children tell what they see as they open each window and state immediately the basic fact that applies to the picture. Let the slower children show the action with markers if necessary.

After the children have identified the actions and stated the basic facts for many of the pictures, let them think of the bottom row as Row 1 and the first window at the right as Window 1. They can then start counting from that point. The abler children should, of course, be required to change their starting points more often than the slower group, but all children should have some practice in locating rows from both bottom and top and windows from both right and left. It might be wise to mark your pictures in some way to make sure that each picture is used at least once.

If the windows are not available, give the children such directions as "Find Row 4, Picture 2. Frame this picture." (The children are to put the single-view frame over the picture.) Or ask the children to put a marker on Row 5, Picture 1. Then proceed with the picture as suggested above.

APPLYING THE NEW CONCEPTS AND SKILLS

The collections of small objects mentioned earlier can be used along with cards or slips of paper on which have been printed basic facts in abstract form. Any of the basic facts illustrated on page 56 may be used. Only one fact should be printed on each card. Let each child choose one of these problem cards and then select enough objects of one kind to act out his problem. He reads the problem to the group and then demonstrates the action with the objects.

Another exercise that is valuable, especially for the abler children, is to clip a sheet of transparent paper over page 56 in each child's book. He should identify the action and write on the paper over each picture the basic fact it represents. For example, Picture 1 in Row 1 shows the basic fact $5 + 1 = 6$. For those pictures that show the combining of, or separating into, equal groups, do not be disturbed if the children treat them as addition or subtraction. It will be hard for most children to think and write, for example, 3 twos $= 6$.

57 Practice for the 3, 5, 6, and 7 groups

KNOWING YOUR OBJECTIVE FOR PAGE 57

The child reviews the basic facts he has learned so far. The child is to respond to the problems both orally and in writing.

PREPARING FOR PAGE 57

Supply each child with a small object to be used as a marker.

Provide 7 small markers for each child.

If the work sheets described on page 218 under "Applying the New Concepts and Skills" are to be used, prepare a copy for each child.

USING PAGE 57

Have the children open their books to page 57 and direct their attention to the problems with the blue, red, and gray letters at the left of the first vertical gray line. Try to get the children to notice that addition problems are lettered in blue, subtraction problems in red, and those showing the combining of, or separating into, equal groups in gray. The children should also be made aware of the arrangement of the problems to help them locate the one they need for each picture.

Now tell the children to put a marker on Picture 1 in Row 1, page 56. (The marker is used so the child can keep his place.) Ask one child to find the problem on page 57 that fits this picture. Since he is to make his selection from the problems at the left of the gray line, remind him of the distinction between the red, blue, and gray letters. Get the children to see that the action in Picture 1 necessitates the response "$5 + 1 = 6$."

Have the children move their markers to another picture and continue the procedures outlined immediately above. Give each child as many opportunities to respond as you can. Continue this work until the children have developed reasonable facility in identifying the action in each picture with its corresponding basic fact.

When such facility has been acquired, direct the attention of the children to the problems with gray letters at the right of the line. Ask them to read a problem to themselves and to supply the missing number. Then have a child read the problem aloud. The slower children may need to use markers to find the answers. The column of problems with black letters may be handled in the same way. For variety, take the problems in random order.

After the children have answered the problems orally, have them write the letters A to V on a sheet of paper. Then direct their attention to either the column with gray letters or the column with black letters and ask them to write the numbers that belong where the screens are. Be sure they understand that they are to write the answer for Problem A beside letter A on their papers, and so on.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one described and illustrated on page 178 may be used to give the children further practice with addition and subtraction facts. The child is to either draw more objects (to indicate addition) or cross off objects (to indicate subtraction) and then write the correct number in the blank space. Be sure to include facts from each of the groups studied so far.

A work sheet with selected facts from page 57 printed on it also may be used. Write the facts entirely in words—"Three plus one equals ▒," "Six minus two equals ▒," etc. Ask the children to write each fact in symbols, supplying the missing number.

Charting the Course — Measurement

One of the ways in which arithmetic touches the lives of everyone is in connection with measurement. Children meet many measurement situations in their play and in their school work. They need to learn early that measurement requires, first, choosing a unit and, second, finding how many times the unit is contained in the quantity being measured.

During the introductory stages of instruction on measurement, it is neither necessary nor desirable to use standard units. The emphasis should be upon the idea of a *unit*, and any convenient measuring object (stick, pencil, string, strip of paper, cup, bottle, etc.) may be used. The children should learn the process of measurement in two stages. In the first stage, several examples of the nonstandard unit are applied to measure the quantity, and these individual units are then counted. In the second stage, a single example of the unit is applied repeatedly, and the number of times it is used must be counted. Children should also learn to use phrases such as "more than" or "a little less than" to deal with situations in which the unit does not fit a whole number of times.

When the basic ideas of measurement are understood, children may be made aware of the need for standard units, and become familiar with a few of them. The inch, foot, pint, and quart are standard units which come within the ordinary experiences of children often enough to warrant early attention. The fact that 12 inches equal one foot and the fact that 2 pints equal one quart should be brought out naturally as these units are introduced. Some children may be familiar with other units, such as the yard and the gallon, but systematic instruction on these units may be deferred to later grades.

The basic concepts of measurement were introduced in *Numbers We See*. On pages 58 to 62 of *Numbers in Action* these measurement ideas are reviewed and extended. The activities suggested in the lesson notes are designed not only to provide meaningful instruction on the concepts, but also to make a beginning toward the ultimate development of skill in measurement.

Children in the primary grades are expected to learn how to tell time by the clock and how to use a calendar. However, no pictures of clocks and no sample calendar are included in this book. The telling of time by the clock and the calendar should be learned through the regular classroom use of these devices in connection with the various normal activities of the day, the week, the month, and the season.

58 The unit in measurement

KNOWING YOUR OBJECTIVE FOR PAGE 58

The child measures distances by laying several sticks or other objects, each representing the same nonstandard measuring unit, end to end and counting the units. He also uses the same stick or object repeatedly and counts the number of times he uses it. He learns to distinguish between distances that are, for all practical purposes, exact multiples of the nonstandard measuring unit and distances that are more or less than exact multiples of it. The child also has experiences that reveal the need for standard units. This page reviews the concepts of linear measurement that were introduced and developed in *Numbers We See.*

PREPARING FOR PAGE 58

Provide each child in the group with 4 sticks or narrow strips of cardboard 2 inches long. He will use a 2-inch stick as his measuring unit in many of the activities connected with the page. Several 1-inch and 4-inch sticks should also be available.

If the work sheets described on page 220 under "Applying the New Concepts and Skills" are to be used, they should be prepared.

A ring-toss game, a few bean bags, or a simple rubber horseshoes (jar rings) game will make the basic measurement concepts more concrete and interesting for the children. A pole or stick between 2 feet and 3 feet long should be provided also to serve as a measuring unit if it is possible to use such materials in the classroom. Sticks of other lengths should also be provided to show the children why it is desirable to use an agreed-upon measuring unit. Avoid the use of a yardstick or foot ruler, since the inch markings will confuse the children at this point.

INTRODUCING PAGE 58

Begin by asking the children if they have ever wanted to know how far away something was. Let several of them relate their experiences with distance. If none of them mentions games, ask if they have ever played a game in which they wanted to know how far they had run or had thrown a ball. Try to find out how they would go about measuring such a distance. Children who have had previous experience with measurement may suggest the use of a stick or other nonstandard measuring unit. If no one suggests a unit, do not mention it until actual work with the page begins.

Give each child 4 of the 2-inch sticks just described. Tell the children to open their books to page 58. Ask what game the children in the picture are playing. Tell the group that the sticks are to be used to find out how far the children threw the rings and how far away the board is from the starting line.

USING PAGE 58

In the first picture the children should notice first of all that the boy has thrown most of the rings too far. Continue with questions like these: "How far from the board is the ring with the blue bead? [Show the children how to use the stick to find the answer and how to respond, 'About 1 stick.' They are to measure from the bead on the ring to the edge of the board.] How much too far did the boy throw this ring? Which ring did he throw closest to the board? How far from the board is it? [A lot less than 1 stick] Which ring didn't go far enough? How far is it from the board? [1 stick] How far did the boy throw this ring?" Here the distance is to be measured from the starting line to the bead on the ring. Be sure that the children place their sticks end to end in a straight line when they measure a distance of more than 1 stick. Since the children cannot mark the length of a stick on the page, most children should use as many sticks as they need. Now ask them how far the boy would have to throw the rings in order to hit the pegs. [Just about 3 sticks] Suggest that since he usually throws the rings farther than 3 sticks, a good idea would be to move the board farther from the starting line.

Direct the children's attention to the next picture. They should immediately see that the board has been moved and that the girl did not throw most of the rings far enough. Have the children find the ring that is on the peg and measure how far from the starting point that ring is. [Almost 4 sticks] Continue with such questions as: "Which ring is farthest from the board? How far did the girl throw this ring? How far is it from the board? Which ring came closest to the board without hitting it? How much farther should the girl have thrown this ring? Find the ring that is just about 3 sticks from the starting line. Find the ring that is between 1 and 2 sticks from the board."

Then ask questions about the third picture that are designed to get responses such as "be-

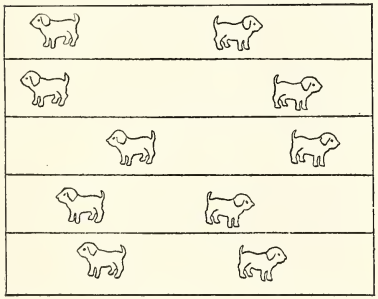
tween 3 and 4 sticks," "a little more than 1 stick," "a little less than 3 sticks," etc.

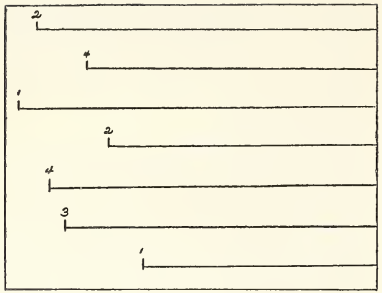
Finally have the children decide which of the children in each picture was the best at playing ring toss.

It is important for the children to understand that they cannot talk to each other about measuring distances unless they are all using the same measuring unit. Give each child in the group several 1-inch sticks and several 4-inch sticks to use in place of the 2-inch sticks. Then ask questions about distances in one of the pictures on the page. The children will be interested to learn that the same measurements, when made with 1-inch and 4-inch sticks, do not agree with measurements made with the 2-inch sticks. Lead them to see that distances cannot be compared unless the same measuring unit is used.

APPLYING THE NEW CONCEPTS AND SKILLS

If possible, let the children play ring toss or horseshoes or a bean-bag game. They can then use





a pole or stick to measure how far the target is from the starting point, how far different children can throw, etc. Have them make chalk marks on the floor as they measure. Do not mention any standard unit of measurement, such as foot or yard, but state distances in terms of 4 sticks, 3 poles, etc. The necessity for using one agreed-upon model for measuring can be illustrated by having two children try to compare their measurements of the same distance when one child uses a stick of one length and the other uses a stick of a different length.

The two work sheets described and illustrated on this page will reinforce the measurement concept.

The first work sheet is divided into five or six horizontal sections. Animals are stamped or drawn in each section in different locations. Some are 2 sticks (4 inches) apart, others are a little more than 1 stick apart, etc. Direct the children to color brown the animals that are 2 sticks apart, put a big X on the animals that are a little more than 1 stick apart, color blue the animals that are a little more than 3 sticks apart, and so on. Encourage the children to use only one measuring stick and mark at the end of it as they measure.

The second work sheet can be used with directions such as these: "The little up-and-down lines at the left with numbers above them are starting lines for a ring-toss game. Find the first starting line and notice the number there. The number tells how many sticks away to put the peg. Measure the distance and draw an up-and-down line with a crayon to show where to put the peg."

59 Foot and inch

KNOWING YOUR OBJECTIVE FOR PAGE 59

At this time the child learns that the inch is a standard unit of measurement and that there are 12 inches in 1 foot. He also learns to measure in inches objects that are less than 1 foot long. The use of the foot ruler marked in inches is not taught until page 60.

PREPARING FOR PAGE 59

If the book *The Size of It* (item 28 in the bibliography) is to be used in introducing the page, have it available.

Provide each child in the group with 12 sticks or cardboard strips, each exactly 1 inch in length. Each child will also need one 2-inch and one 3-inch stick.

Have ready a small collection of easily measured objects that are less than 1 foot long. Suit-

able objects might be small books, boxes, crayons, or blackboard erasers.

If the work sheet described on page 222 under "Applying the New Concepts and Skills" is to be used, see that there is a copy for each child in the class.

DEVELOPING VOCABULARY FOR PAGE 59

The words *inch, inches, long, longer* are introduced in the reading matter on this page. Be sure to use these words orally with the children before requiring their recognition in print. Also start oral use of the word *foot*, which the children will be required to read on page 60. Emphasize the understanding and use of such expressions as "longer than," "as long as," "shorter than," etc.

INTRODUCING PAGE 59

The book *The Size of It* will stimulate the children's curiosity about comparative sizes and the words used to describe size.

Distribute 12 of the 1-inch sticks to each child. Direct the children to open their books to page 59. Let them look at the objects on the page. Explain that the objects are pictures of toys and that they are going to use the little sticks to find out how big the pictures are.

USING PAGE 59

This page requires the child to measure the pictured objects with 1-, 2-, and 3-inch sticks, giving the lengths in inches and forming judgments about the comparative lengths of the objects.

Begin the lesson by asking the children if they have ever heard the word *inch*. Let several of the children tell what they know about the word. If no one in the group is familiar with the concept of measuring in inches, explain that children's heights are often measured in inches. Tell them that each of the little sticks they have is *1 inch* long. Throughout the work with this page try to establish in the children's minds the fact that the word *inch* is used and understood by everyone because it always means the same length or distance.

Continue like this: "Find the hammer. Use a stick to see how long the hammer is. How long is it? Do you see anything else that might be just as long as the hammer? [Toy car, pencil, comb] Measure them with your stick and tell us how long they are. [The comb is 1 inch long; the pencil and toy car are more than 1 inch long.] Find the baseball bat and measure it. How long is it? [At this point the children should place sticks end to end to measure objects longer than 1 inch.] Is the bat longer than the car? Is it longer than the hammer? Do you think the umbrella is just as long as the bat? How can you be sure? How long is the umbrella? Find the picture with the house in it. Do you think it looks as long as the umbrella? Let's measure it. How long is it? [Less than 2 inches] Is the picture shorter or longer than the umbrella?"

The children should then measure the remaining objects on the page with their sticks, giving the responses "more than 2 inches," "less than 3 inches," "just 2 inches," etc. Give special attention to the formulation of such judgments as "more than 2 inches" or "less than 3 inches." Such decisions require discrimination which must be taught. Pay special attention to the ladder, envelope, and doll bed. These objects are exactly 1½ inches or 2½ inches long. Work for such responses as "just between 1 inch and 2 inches," or "It's in the middle."

Develop the idea that the length is midway between 1 inch and 2 inches (or 2 inches and 3 inches). Do not introduce the expressions "halfway," "1½ inches," etc., but do not discourage their use by children who understand them.

The children will probably express curiosity about the green strip across the page. Explain that each little section of the strip is 1 inch. Have a child lay his sticks end to end on a table, matching each stick with a section and counting as he does so. Then tell the children that 12 inches make a foot. Explain that the foot ruler is used to measure longer objects, which might be hard to measure in inches. Let them suggest objects in the room that could be measured in feet. Actual measuring in feet is taught on page 60.

On a subsequent day give each child a 1-inch, a 2-inch, and a 3-inch stick. Let the children discover the lengths of these sticks by laying them along the unmarked ruler on the page. Then have them measure some of the objects on the page. Ask them questions similar to those used on the previous day. Try to get responses that indicate measurement judgment, such as "a little less than 3 inches," "a lot more than 2 inches," "just 1 inch."

Now direct the children's attention to the problems at the top of the page. Give instructions somewhat like these: "Read the first problem to yourselves. Now, Tom, please read the problem

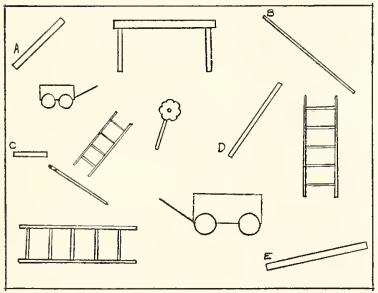
to all of us and show us how to find the answer." Continue in the same way for the rest of the problems on the page. Be sure that each child reads and answers at least one problem.

Try to interest the children in drawing lines (freehand) that are 1 inch long. Have one child draw a line and let another child measure it with a 1-inch stick. All the children should take turns. This practice should be continued frequently throughout the remainder of the year.

APPLYING THE NEW CONCEPTS AND SKILLS

Let each child in the group choose an object from the collection mentioned earlier and measure it by placing it along the unmarked ruler on page 59 and counting the inches. Then let him tell the group, for example, "My book is a little more than 5 inches long," while the other children check his measurement. The children can then exchange objects and measure them.

The work sheet described and illustrated here is to be used with the 1-, 2-, and 3-inch sticks.



Simple objects, such as tables, ladders, wagons, or sticks, or lines labeled "A," "B," "C," etc., are drawn on the page. These objects should be of various lengths up to 3½ inches. Several objects should be exactly 2 inches long. Directions may be as follows: "Color green (or put a green X on) any object that is more than 3 inches long. Color red (red X) any object that is between 2 and 3 inches long. Put a blue X on any picture that is just 2 inches long."

60 Foot and inch

KNOWING YOUR OBJECTIVE FOR PAGE 60

The child learns that the foot is a standard unit of measurement. He also learns to use a foot ruler marked in inches to measure objects shorter than 1 foot or longer than 1 foot.

PREPARING FOR PAGE 60

If you plan to use a story, *Tall-Enough Tommy* (item 32 in the bibliography) is appropriate to introduce page 60.

It is desirable for every child in the class to have a foot ruler with the inches marked. However, rulers showing the inch divided into fractions should be avoided, since the subdivisions of an inch are confusing to young children. If rulers are not available, you may make cardboard rulers similar to the one shown on page 60.

The ring-toss game or bean bags, the collection of objects, and the 1-inch sticks used in the activities connected with pages 58 and 59 will be useful in teaching this lesson.

If the work sheet described under "Applying the New Concepts and Skills" (page 224) is to be used, prepare enough so that one copy is available for each child.

DEVELOPING VOCABULARY FOR PAGE 60

The technical word *foot* is introduced as a reading word on this page. Begin oral use of the word *feet* in measuring situations to provide familiarity with it as an arithmetic word before the children encounter it in reading on page 72.

INTRODUCING PAGE 60

If you have read or told the story *Tall-Enough Tommy* to the class, take time to talk about it. Then discuss with the children what they learned about *foot* in the preceding lesson (that a foot is much longer than an inch, that people use the foot when measuring larger objects or longer distances, etc.). Do not expect the children to remember that there are 12 inches in 1 foot, but remind them of the fact. Then let them tell what they know about rulers. Explain that the most commonly used ruler is 1 foot or 12 inches long. Give a ruler and twelve 1-inch sticks to each child and then tell the group to open their books to page 60. Tell them that they are going to use rulers to measure the toys shown in the pictures.

USING PAGE 60

On this page the child measures the pictured objects with a foot ruler, reading the measurements from the ruler in inches and deciding whether an object is more or less than a multiple of an inch. He also measures objects around him that are more than 1 foot long, giving the

measurements in feet. He reads the problems and answers them by measuring with a foot ruler.

Begin the lesson by calling the children's attention to the numbers on the ruler on the page and on their own rulers. Help the children to understand that they can read the number of inches from the ruler instead of having to count the inches. This can be done by having the children put the 1-inch sticks end to end along the ruler on the page or on their own rulers. They can see then that when they have laid down 3 sticks, the number at the end of the third stick is 3, etc.

Now have the children measure the objects on the page with their rulers. Be sure that they know how to lay the edge of the ruler straight along the edges of the objects. Ask them questions like these: "Find the toy blackboard in the picture. Measure it with your ruler. How long is it? Do you see anything else that looks just as long as the blackboard?" The children will suggest several objects, which may or may not be 2 inches long. Let them measure any object suggested to see how long it really is. The toy seesaw and toy ironing board are the only other objects 2 inches long. Then continue: "Do you see a toy that looks just about 1 inch long? What is it? Measure it to see how long it really is. What is the longest toy on the page? How long is it?"

Continue to pay special attention to the measuring of objects that are more or less than a whole number of inches long, getting the children to decide whether a measurement is a little less than 2 inches, a lot more than 1 inch, etc. The hairbrush, knife, table, and blotter are exactly 1½ inches long. As was done in the work with page 59, lead the children to see that the length of each of these objects is just halfway between the inch marks on their rulers.

Now have the children measure objects in the room (desks, tables, window sills, blackboards, etc.) with their rulers and give the measurements in feet. This should be a group activity, since more than one ruler will be needed. One child can place the rulers, another decide on the length, and so on. As in the work with inches, encourage such responses as "a little more than 3 feet," "almost 2 feet," "between 4 and 5 feet," etc.

To prepare the child for the kind of measuring he eventually will have to do, provide such experiences as the following. Direct the children to measure a rather long distance—for example, the length of the room or the distance between two chalk marks on the floor. For this activity supply two children with enough rulers to cover the distance when the rulers are laid end to end. See that they put the rulers down in a straight line, neither overlapping them nor leaving gaps between them. Let them count the rulers and learn that the number tells how many feet long the distance being measured is. Then let them measure shorter distances on the floor, using just one ruler and making a chalk mark at the end of it each time they lay it down. The children should keep track of the number of times they put their rulers down, either by counting or by the use of sticks or tally marks. They should verify this number by counting the spaces shown by the marks on the floor.

A simple way to provide still more measuring experience is to cut pieces, of various lengths, from a roll of adding machine tape and let the children measure the pieces.

Continue to have the children draw freehand lines 1 inch long and check their lines by measuring with a ruler. The objective of such practice is to develop a fairly accurate concept of an inch. Gradually extend this practice to drawing lines 2 inches and 3 inches long. The same kind of practice should be given in drawing lines 1 foot long or in marking off distances 1 foot long. The lines may be drawn or the distances indicated on the blackboard. Let the children estimate the lengths of various objects in the room (1 inch, more than 1 inch, 1 foot, less than 1 foot, etc.).

Follow the procedures described for page 59 with the problems on this page. Be sure each child participates.

APPLYING THE NEW CONCEPTS AND SKILLS

If the ring-toss game or bean bags are available, have the children measure in feet how far they can throw bean bags or how far they should stand from the pegs.

Encourage the children to take their rulers home and measure some selected object around the house—the table, for example. Suggest that they find a ruler at home and see if it is the same length as their own ruler. Let the children discuss the measuring they did at home. Ask several children to show on the schoolroom floor how long the table is. Encourage them to compare the lengths of the same object in the different homes, always stressing the fact that it is possible to

compare lengths only when they are measured in the same unit.

A work sheet similar to the one described and illustrated on page 222 may be used for this page. The objects and lines should be of various lengths under 12 inches. The children should measure the lines or objects with their rulers and write under each line or object its length in inches. If you want the children to use the work sheet independently, the lengths should probably be restricted to multiples of an inch. Many children, however, are capable of measuring to the *nearest* inch. The objects can then be more than or less than a whole number of inches. Lengths requiring half inches should be avoided.

61 The standard unit in measuring capacities

KNOWING YOUR OBJECTIVE FOR PAGE 61

The child reviews the concepts involved in measuring volume and capacity that were introduced and developed in *Numbers We See.* He is made aware of his inability to judge quantities unless the containers are the same size and shape. He thereby learns the necessity for a standard measuring unit. He also learns that the quart and pint are standard units of measurement, but these measures are not taught formally until page 62.

PREPARING FOR PAGE 61

Have the children bring containers of various shapes and sizes to school. These containers may be fruit jars, pitchers, measuring cups, coffee cups, and jelly or honey glasses. Be sure that the collection of containers includes several quart and pint fruit jars or milk bottles. Provide, if possible, several kinds of dried material suitable for measuring, such as peas, beans, small stones, shell macaroni, popcorn, or sand.

If the work sheet described and illustrated on page 225 under "Applying the New Concepts and Skills" is to be used, prepare the number needed.

DEVELOPING VOCABULARY FOR PAGE 61

Introduce the words *quart* and *pint* orally in connection with the work on this page.

INTRODUCING PAGE 61

Let the children talk about the measuring their mothers do when they cook. Try to guide the discussion away from measures of weight toward measures of capacity. Ask them what kinds of things come in quarts and pints and encourage them to discuss their own experiences with these measures. Then have them open their books to page 61. Explain that the containers hold grape juice and tomato juice. Let the children identify as many of the containers as they can, but do not compare sizes at this point. Notice that the same hand and pitcher appear with each set of containers. This was done to keep the pictures in the same scale so that they can be compared.

USING PAGE 61

Begin the lesson by calling the children's attention to the fact that there are four pictures on the page and that each picture shows two rows of bottles or jars. Then direct attention to the picture in the upper left section of the page. Give directions such as these: "Look at the jars and bottles in the first row. Which one do you think holds the most grape juice? Why do you think so? [Try to get responses like 'The first one, because it's big around and straight up and down.' 'You can't tell because they're all different sizes and shapes,' etc.] Which jar or bottle in the second row holds the most grape juice?" Children will probably choose the last jar, saying that it is about as tall as the milk bottle and much bigger around.

"Which of the two rows of jars do you think shows more grape juice? Can you tell without measuring? Why? What do you see that you could use so that you would know which row of jars shows more grape juice?" Accept any suitable answers to this question. Children may suggest any one of the containers or the pitcher from which the last jar is being filled. Be sure they see that if they knew how many times the pitcher had been used to fill the containers in each row, they could tell which row shows more. Guard against the misconception that the total amount of grape juice in the lower row of containers is greater than the total amount in the upper row simply because there are more containers in the lower row.

Continue in a similar manner with the two rows of containers at the upper right. Then ask the children which of the two top pictures shows more grape juice. Be sure they understand why a decision by inspection is impossible.

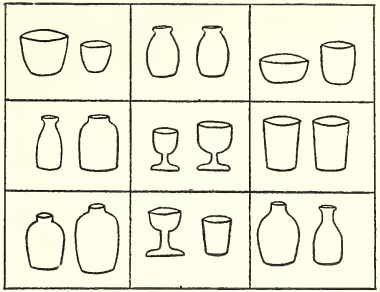
Now have the children look at the two pictures at the bottom of the page. Ask them questions designed to bring out the fact that now

they can tell which row of jars shows more tomato juice. [The jars are all the same size and shape.] Be sure they realize that when the last jar in each picture has been filled, the two rows within a picture will show the same quantity. Then ask them to compare the amounts of tomato juice in the two pictures. Explain to the children that these are *quarts* of tomato juice, and that one quart of tomato juice is always the same amount as any other quart of juice, milk, etc.

The work will have more meaning for the children if they do some actual measuring themselves. Fill two large containers of different shapes with some dry material. Let the children decide whether or not the amounts in the two containers can be compared without measuring. Then give a measuring cup or other convenient measure to each of two children. Let them measure the contents of each container, keeping track of the number of times they fill their own measuring containers by making tally marks or by using markers. Stress the idea that now they can tell which container holds more. This procedure should be repeated with various containers until each child in the class has had a chance to participate. The activity can be continued independently by the children.

APPLYING THE NEW CONCEPTS AND SKILLS

The work sheet described here will provide further practice in judging which of two containers holds more. Divide the sheet into nine sections. In each section draw a pair of containers. Draw some pairs of containers the same shape but not the same size. Draw one or two pairs of containers exactly alike. Draw a few pairs of containers different in shape but about the same size. Tell the children that if one container in a section would hold more than the other, if both were full, to draw a line under it. If it is impossible to decide without measuring, they should cross off the whole picture. If both containers would hold exactly the same amount, the children should connect them with a line.



62 Quart and pint

KNOWING YOUR OBJECTIVE FOR PAGE 62

The child learns that 1 quart equals 2 pints and has experience in changing quarts to pints and pints to quarts. In connection with the lesson he also should have experience measuring with pint and quart measures.

PREPARING FOR PAGE 62

The collection of containers used in the preceding lesson will be useful again here. Be sure to have at least 3 quart bottles and jars and 6 or 7 pint bottles and jars. Several quarts of material for measuring should also be available.

Each child will need 12 small markers.

If the work sheet described on page 226 under "Applying the New Concepts and Skills" is to be used, see that there is a copy for each child.

DEVELOPING VOCABULARY FOR PAGE 62

The words *quart* and *pint* are introduced as reading words on this page.

INTRODUCING PAGE 62

Ask the children to tell what they have bought by the pint or quart. If some children mention things like berries or cherries, do not try to distinguish between liquid and dry measure, but keep the discussion confined to liquid measure, if possible. Stress again the fact that it is convenient to measure in quarts and pints because everyone knows what amounts these measures mean. Have the children open their books to page 62 and examine the pictures. Tell them that the pictures show quart jars and bottles and pint jars and bottles. Ask them how they can tell the quarts from the pints. Ask them if they think a pint milk bottle holds as much as a pint jar. If they seem confused by this idea, demonstrate by pouring a pint of water from one pint container into another pint container of a different shape.

USING PAGE 62

In this lesson the child uses markers to establish a two-to-one correspondence between pints and quarts. The problems on the page require him to change measures from one unit to the other.

Direct the children's attention to the first picture. Tell them that the boy, Don, is going to pour all the tomato juice from the quart jars into pint jars. Proceed somewhat like this: "You can see that Don has just finished emptying one quart jar. How many pint jars has he filled from the quart jar? How many pints are in a quart? What would happen if Don poured the pint jars of juice back into the quart jar? Does Don need more pint jars for the juice? Let's see if we can figure out how many more pint jars he will need for the rest of the juice. Pretend that your markers are pint jars. Put 2 markers on each quart of tomato juice. Why should you put 2 markers on each? [Because each quart will fill 2 pints] How many more pint jars does Don need?" The most important idea here for the children to grasp is that a quart will fill 2 pints. Do not leave this picture until you are sure all the children understand this.

"Now look at the next picture. Are the jars of orange juice quarts or pints? What size are the empty jars? [Pint jars] Let's imagine that Don is going to pour the orange juice into the pint jars. How can you use your markers to find out if there are enough pint jars?" Direct the children to put 2 markers on each quart and to move one marker to each pint. Let the children decide whether there are more than enough, just enough, or not enough pint jars. The children may use their markers in different ways to indicate the two-to-one correspondence. (See page 155 of these notes for a discussion of the various ways markers may be used to show this correspondence.)

Ask the children similar questions about the other two pictures on the page. Notice that in the third picture they are changing pints to quarts and that there are not enough quart bottles. Be sure to have them put one marker on each pint and then move two of these markers to each quart. Let them discover that there are not enough quart bottles.

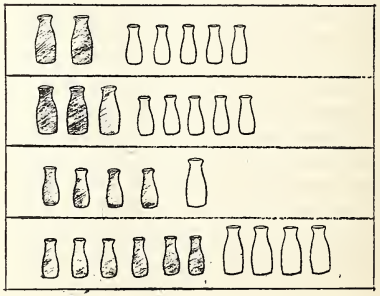
The work with pictures and markers should be supported and enriched by measuring with actual quart and pint bottles and jars. At this point let the children use the quart and pint containers and the measuring material available to prove to their own satisfaction that one quart really will fill two pints.

Next direct the children's attention to the problems on the page. Allow the slower children to use markers if necessary to answer the problems. The abler children may be able to give the answers without using markers, but they should be required to show with markers or containers that their answers are correct.

APPLYING THE NEW CONCEPTS AND SKILLS

The children should have much practice in measuring with pint and quart containers to help them form fairly accurate concepts of a pint and a quart. Put different amounts of material in several large, differently shaped containers and let the children measure these amounts with pint and quart measures. Work for responses indicating judgment, such as "more than 2 pints," "a little more than a quart," "almost 2 quarts," "a little less than 3 pints," etc.

The work sheet below may be used to give further practice in changing measures. The quart and pint containers at the left are shown filled. The containers at the right are empty. The child is to show how many bottles at the right can be filled from the bottles at the left. If there are too many empty bottles, with his crayon he crosses off the bottles that are not needed. If there are not enough empty bottles, he draws as many more as are needed.



Charting the Course — Comparison by subtraction

One of the commonest uses of number occurs when one group is compared with another group. Suppose, for example, that Don owns 5 puppies, and Carol owns 3 kittens. How many more puppies than kittens are there? The number of puppies is to be compared with the number of kittens. It has been customary to tell children to use the subtraction process in this case. If they are able to remember to subtract, they can obtain correct results. Very rarely, however, are they given any real help in understanding *why* subtraction gives the correct result.

The question is: What method of manipulating these objects not only solves the problem but also connects the process used with the child's previous experience with subtraction situations? A comparison situation is not a subtraction problem of the kind studied earlier. In those earlier situations a single group was given. A subgroup was taken away, and the remainder was then found. In the example above, the group of 3 kittens is not a subgroup of the group of 5 puppies, and there is nothing in the situation to suggest the subtraction process. Something must be done to show the child why he can process this situation by subtraction. What is done must make clear that he cannot subtract 3 kittens from 5 puppies. Moreover, the logical and psychological issues involved here cannot be avoided by thinking that both kittens and puppies are animals, and hence saying "Subtract 3 animals from 5 animals."

The actions that are natural in such comparison situations make clear to the child why the process of subtraction is used. Members of the two groups may be matched or paired, as is done in setting up a one-to-one correspondence, until all the members in one of the groups have been used. The corresponding members in the larger group may then be *set aside* or *taken away*, and the number of members in the remainder determined. The result tells "how many more" are in the larger group. Thus, 3 of the puppies may be matched with the 3 kittens, and if these 3 puppies are taken from the group of 5 puppies, then 2 puppies remain. The matching action serves to determine how many members of the larger group are to be subtracted from it because they have been matched by the members of the smaller group.

The analysis of comparison by subtraction given above is the basis for the treatment which follows on pages 63 to 66. The learning experiences are organized as in earlier sections. The action is first shown completed. In the second stage the child must complete the action by imagination. These steps are followed by the symbolization stage and by pictorially presented problem situations.

63 Comparing two groups

KNOWING YOUR OBJECTIVE FOR PAGE 63

The child learns to compare two groups to find how many more there are in one group than in another. He learns how to present the problem situations orally and learns also why he can subtract to find the answers for such problems.

PREPARING FOR PAGE 63

Provide two different kinds of markers for each child, seven of each kind.

A collection of small objects that can be put into groups and compared will be useful in connection with this lesson. Such objects might be toy automobiles or airplanes of different colors (several of each color), small dolls, blocks, pennies, or marbles of different colors.

DEVELOPING VOCABULARY FOR PAGE 63

No new words are to be introduced with this page, but the children should have much practice with such expressions as "There are 5 more drums than horns," "6 horns minus 2 horns are 4 horns," and "6 minus 2 is 4."

INTRODUCING PAGE 63

Begin by asking the children if they have ever wanted to know how many more pennies one toy cost than another, or how many more marbles one child had than another. Let them talk about their experiences with "how many more," but try to restrict the discussion to comparisons of groups that can be seen and counted. Then have the children open their books to page 63 and examine the pictures. Tell them that the pictures show things that were used by a band at Don's

school. Let them identify the objects on the page. Identify for them the wrist bells at the lower left.

USING PAGE 63

Direct the children's attention to the movie (the 3 pictures of hats) at the top of the page and have them notice that there are both red and blue hats. Proceed somewhat like this: "Look at the first picture. Are there more red hats than blue hats? We want to find how many more red hats there are. How are the red hats arranged?

"In the next picture what has been done with the blue hats? [Try to get the response 'They are in a line under the red hats.' Notice that this arrangement makes it easier to match the red hats with the blue to see if any red hats are left over.]

"In this second picture can you see without counting how many more red hats there are than blue hats? Let's use markers to help find the answer. Put a marker on each red hat. Move a marker from a red hat to the blue hat under it until there is a marker on each blue hat. How many markers were not moved? There are how many more red hats than blue hats?"

Notice in the third picture that attention is focused on subtraction as a way to find how many more red hats there are than blue hats. To make this clear to the children, proceed somewhat as follows: "The last picture shows another way to find how many more red hats there are than blue hats. What is happening in this picture? [Some red hats are being moved away.] How many red hats are being moved away? Why should 5 red hats be moved away? [Work for answers that show an understanding of the idea that the number of red hats moved away must be equal to the number of blue hats.] How many red hats are left? How many red hats were there to begin with? How many were moved away? How many are left? Seven hats minus 5 hats are 2 hats. 7 minus 5 is 2."

Direct the children to use markers or objects in the room to show why they can subtract 5 from 7 to find how many more a group of 7 is than a group of 5. Here they will use two sets of markers, one set for one group of objects and the other set for the group being compared with it.

Work with the children to establish understanding of why they can *subtract* after using a matching procedure to find how many more there are in one group than in another.

Use the same procedures (matching and subtracting) with the second movie that you did with the first. Notice that the first picture sets up the problem: "How many more green tambourines are there than yellow tambourines?" The second picture shows the tambourines lined up in two rows ready for matching. The third picture shows how subtraction can be used to find how many more green ones there are than yellow ones.

The second step has been omitted in the last two movies. The problem is presented in the first picture; the subtractive action is shown in the second picture. The children match the two groups of objects visually or use markers for matching.

APPLYING THE NEW CONCEPTS AND SKILLS

Have the children make up problems about objects in the room. (For example, "How many more windows does this room have than doors? How many more chairs are at this table than at that table? How many more children are at this table than at that table?") Supervise this activity so that the larger number of objects will be 3, 5, 6, or 7. If the objects being compared cannot be moved, have the children use markers to represent them. The children should show both the matching and the subtraction actions with their markers. The two different kinds of markers can also be used to advantage here. Let one kind represent one group of objects and the other kind the other group of objects. If the children can act out the problem or move the objects involved, let them.

You can also use the collection of small objects mentioned earlier to set up problems similar to those on page 63, giving each child a chance to solve at least one.

64 Comparing two groups by subtraction

KNOWING YOUR OBJECTIVE FOR PAGE 64

The child learns to solve, by subtraction, problems involving comparison (how many more in one group than in another). The child learns to imagine the actions necessary to solve the problem with objects or the actions that show why he can subtract. The child supplies the actions, either in his imagination or by means of markers.

PREPARING FOR PAGE 64

The pictures on this page are based on *Peter Rabbit*, an operetta (item 25 in the bibliography). The children might dramatize the story *Peter Rabbit*.

Provide 14 small markers for each child, seven of one kind and seven of another kind.

The small objects (dolls, toy automobiles, toy airplanes, etc.) suggested for page 63 will be useful when teaching this lesson.

INTRODUCING PAGE 64

Have the group open their books to page 64 and explain that the children in the pictures are giving the operetta. Let the group talk about how the children are dressed and how the objects on the page might be used in giving the operetta. Encourage them to notice that each picture shows two different groups of children or objects. Then ask what kinds of problems could be made up about the pictures. Some children may suggest problems that involve combining of groups as well as problems that involve comparing. Accept any reasonable suggestions but emphasize that they are finding out how many more children or objects there are in one group than in the other.

USING PAGE 64

Direct the children's attention to the first picture. Ask them what the two groups of boys are doing. [One group is sitting, the other is standing.] Note also that one group has red hats, the other, blue hats. Then ask the children to make up a problem about the two groups of boys. [They will probably suggest several problems: "There are how many more boys with red hats than boys with blue hats? How many more boys are standing than sitting down?"] Continue with directions such as these: "Are there more boys with red hats than there are boys with blue hats? Let's find out how many more there are. How can you find out? [Remind them, if they have forgotten, that they solved similar problems with markers in the preceding lesson.] First put a marker on each boy with a red hat. Then move a marker from a boy with a red hat to a boy with a blue hat until there is a marker on each boy with a blue hat. How many markers were not moved? There are how many more boys with red hats than with blue hats?"

At this point tell the children to place on their desks enough markers from one set to represent the boys with red hats and enough from the other set to represent those with blue hats. Tell them to pretend their markers are boys and match the boys with red hats with those wearing blue hats. Draw attention to the unmatched markers. Then again ask the question, "There are how many more boys with red hats than with blue hats?" The answer should be determined by inspection of the markers that are left unmatched.

Now ask the children to show another way to use markers to find the answer. Be sure the children understand why they can line up 7 markers to represent the boys with red hats and then move 3 of them away. Bring out the idea that they are to move away (subtract) as many boys with red hats as there are boys with blue hats. Then they should be encouraged to make statements such as "7 boys with red hats minus 3 boys with red hats equal 4 boys with red hats" and, finally, "7 minus 3 equals 4."

The other pictures on the page are taught in the same way. The abler children may not need to use markers to solve each problem, but they should always be ready to show the action with markers. Be sure they understand that in the second picture they subtract 1 white rabbit from 3 white rabbits because there is 1 brown rabbit; in the third picture they subtract 2 baskets from 5 baskets because there are 2 boxes, and so on.

APPLYING THE NEW CONCEPTS AND SKILLS

Continue to have the children make up problems about themselves or about things in the room, as they did for the preceding lesson. Remember that the larger of the two groups must not contain more than seven. Let the children solve the problems by acting them out or by using markers.

Use the small objects mentioned earlier to set up problem situations similar to the ones shown in the pictures on page 64.

65 – 66 Comparing groups by subtraction; symbolism

KNOWING YOUR OBJECTIVE FOR PAGES 65-66

The child learns to read statements that describe the thinking required in comparing two quantities by subtraction.

PREPARING FOR PAGES 65-66

Provide each child with 14 markers, seven of one kind and seven of another kind. Also give each child a set of number markers (one for each number from 1 to 6). See the picture on page 161.

If the work sheet described on page 230 under "Applying the New Concepts and Skills" is to be used, have a copy available for each child.

INTRODUCING PAGES 65-66

Ask the children to open their books to page 65. Let them examine the page and discover that these

pictures are also about the play pictured on the preceding page. Bring out the idea that these pictures also show more objects in one group than in another.

USING PAGES 65-66

These pages require the children to associate a picture with a verbal description of the problem set up by the picture. The children read the problem and supply the missing numbers and words.

Direct the children's attention to the first picture on page 65. They should notice that some of the girls are dressed as white rabbits and some as brown rabbits. Show them the first story at the left and ask them to read it to themselves. Tell them to look at the picture and to use it to answer all the questions and to find the missing numbers. Some children may need individual help with this.

Next ask one child to read the first two sentences aloud. Direct the children to look at the picture and to use a matching procedure to find the answer. [1 white rabbit is matched or paired visually with a brown rabbit.] Direct them to put a marker on each white rabbit. Move the markers from the white rabbits to the brown to show that the brown rabbits are paired with the white rabbits. This action leaves one marker on a white rabbit unmatched.

Let another child read the next sentence aloud. Help the children understand that they can move away 2 white rabbits from the 3 white rabbits to show how many more white rabbits there are than brown rabbits. Emphasize that they move away (subtract) as many white rabbits as there are brown rabbits.

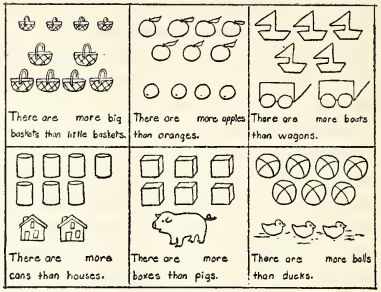
Have another child read the next sentence, saying "1 white rabbit" for the wavy line. Let another child read the last line, saying the number that belongs where the screen is.

Continue in this manner for all of the pictures and stories on pages 65 and 66. For the question "How many do you subtract?" get the children to understand that they subtract (on page 66) as many "little baskets as there are big baskets," "little cars as there are big cars," "wagons as there are sleds," and so on.

Let the children take turns in answering Problems A to L on page 66 (the letters should be called at random). Give each child a set of number markers. Direct one child to read Problem A, for example, and have the other children put on their desks the marker that shows the answer.

APPLYING THE NEW CONCEPTS AND SKILLS

The work sheet illustrated at the right may be used to give the children more practice in reading and solving problems. Divide the page into 6 sections. In each section draw or stamp 2 groups of objects. Under them write in manuscript a statement such as "There are ____ more big baskets than little baskets." Have the children read the problems and supply the missing numbers. Include only the facts for the 3, 5, 6, and 7 groups.



Charting the Course — Additive subtraction

In many problem situations the question to be answered is: How many more are needed? For example, there will be 8 children at the party. There are only 5 chairs around the table now. How many more chairs must be brought in to seat the children? The frequent occurrence of problem situations of this general type and the difficulties encountered by the child in learning how to solve them require that special attention be paid to them.

An analysis of situations of this type shows, first, that there is always something involved which reveals a quantitative need to be met. In the example above, chairs for 8 children are needed. Second, some of the objects required to meet the need are at hand. Thus, 5 chairs are already at the table. Third,

the solution of the problem requires that more objects of the same kind be brought in and combined with those already at hand.

It cannot be emphasized too strongly that *the action involved in solving this kind of problem is of the combining or additive type.* Difficulty arises, however, because the number to be brought in, or added, is unknown. The problem situation, when represented by symbols, cannot be solved directly by addition (see page 150), as is the case when the number in the group at hand and the number being added to the group are both known. When the numbers in the situation are small, as in the example just used, the answer comes to the mind of most adults so easily that the basic difficulty in the general situation may not be fully recognized.

In teaching children how to solve a problem of this type, it has been customary to tell them to "subtract the smaller number from the larger." Through constant drill upon problems of the same general type, some children learn to solve them. This is true in spite of the fact that the action called for is clearly combining or additive, but the process used is subtraction. In the past, few children have been helped to understand why subtraction is used to solve an additive problem.

The key to the solution of this type of problem is the recognition that by additive action the needed additional quantity is brought in. When the problem is solved with the objects themselves, the number of needed additional objects can be determined by a one-by-one procedure until the total needed number is at hand. The additional number can then be added to the original number at hand and its numerousness determined. The objective of the lessons is to enable the child to solve such problems with symbols. To achieve this ability, he must be shown, by separating the original objects from the total group, why he can subtract to find the answer. Next, the child must learn to visualize the total needed quantity, including those at hand, and imagine the separating of the group at hand from the imagined total quantity; only then will he understand the subtraction of the symbols.

Numbers in Action introduces the "how many more are needed" type of problem on page 67, using a picture sequence of four scenes. On page 68 the picture sequence is reduced from four scenes to two scenes, and the pupil must use his imagination to a greater extent to visualize the process of solution. He is not required to meet this type of problem in reading until pages 69 and 70, where he is assisted in his reading and responses by accompanying pictures.

Pages 71 and 72 provide a general review at this midpoint of the book.

67 Using subtraction to find how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 67

The child learns how to solve with objects a "how many more are needed" problem by bringing in (or adding) more objects. He also learns why the problem can be solved by subtracting the number of objects at hand from the total number needed.

PREPARING FOR PAGE 67

Each child will need 7 small markers.

The collections of small objects suggested for use with page 63 will be helpful also in teaching this page.

If Card-Holder No. 3 and the appropriate picture cards are to be used (see page 232 under "Applying the New Concepts and Skills"), have the materials available.

DEVELOPING VOCABULARY FOR PAGE 67

No new words are introduced on this page, but the children should gain experience in phrasing the idea "how many more are needed" in as many ways as possible. Employ such expressions as "How many are missing?" "Are there enough?" etc.

INTRODUCING PAGE 67

Have the children open their books to page 67. Let them talk about the toys shown on the page. Direct their attention to the fact that in each movie more things are needed.

USING PAGE 67

As was pointed out in "Charting the Course," the problem of this lesson is seldom really understood by children. Before going on with the lesson

notes for page 67, a synopsis of the picture sequence will be given.

There are four pictures in each sequence on this page. The first picture shows (1) how many there should be in all and (2) how many there are at hand. It suggests the problem: More dolls (or pennies, or blocks, etc.) are needed.

The second picture shows more objects being brought in to go with those already present, but the number being brought in is *concealed* or *unknown*. Thus, the number in the box or, later, in the closed hand cannot be seen. This both suggests the action which must be carried out when the problem is solved and also emphasizes the real question: How many more are needed? It also suggests the key to the solution: we *imagine* that the problem is being solved.

The third picture shows the completed act, or the situation as it will look after the problem has been solved. In verbal problems it is always necessary to imagine this situation.

The fourth picture shows how the problem can be solved indirectly by the subtraction process. If the group which was originally present is separated or set aside from the completed solution, the remainder is the number which was brought in.

It can hardly be overemphasized that this is basically an additive situation which can be, and usually is, solved by subtraction. This naturally is confusing to children. When the numbers are small, as in the problems on this page, the nature of the difficulty is frequently overlooked by adults. They see at once that 3 more peg dolls are needed; in other words, they do not use subtraction. They simply "know" the missing quantity. If the numbers are large, however, they may not "see" the solution so readily. Suppose the problem is as follows: A man wants to buy a new car which will cost $2357. He has $865 in cash. How much more money does he need? To solve this problem, most adults have been taught to use subtraction. They recognize the goal or solution (as it would appear in the third picture of a sequence), and process the number symbols by subtraction, as would be suggested by the fourth picture of a sequence. The purpose of the picture sequences on page 67 is to lay a foundation for the gradual development of a real understanding of this type of problem.

To help clarify this complex situation for the children, ask them to look at the first picture in the first movie. Say that Nancy wanted to put a peg doll in each hole in the wagon. Continue with questions such as: "How many peg dolls does she need to fill the wagon? Does she have enough dolls? How do you know? What should she do? [Try to get responses such as 'Find some more dolls' or 'Bring in some more dolls.' Lead the children to see that more dolls are needed.] Look at the next picture. What do you suppose is in the box? [More dolls] Let's use markers to find how many more dolls she should bring in. Put down a marker for each doll she has. How many markers did you use? How many dolls does she need altogether? [7] Look at the third picture. Did Nancy bring in the right number of dolls? Show with the markers on your desk that 3 dolls is the right number. [Children should add 3 markers to the 4 markers.] How many dolls does she need in all? How many dolls did she have at first? How many more dolls did she need?"

Now draw attention to the last picture in the movie. Proceed somewhat as follows: "This picture shows why we can subtract 4 dolls from 7 dolls to find how many more dolls Nancy needs. How many dolls does she have in all? How many dolls is she pushing away? Are these the dolls she had at first? How many dolls are left? Are these the dolls she needed to fill the wagon?"

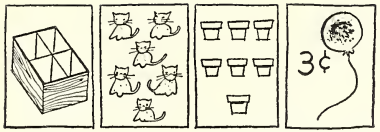
Go over the situation again in a manner like this: "Nancy has only 4 dolls. She needs 7 dolls in all. If you take the 4 dolls she has from 7 dolls, you can find out how many more dolls she needs."

Go through the other movies on the page in a similar way. First have the children use markers to show the action which brings in additional objects to complete the group. Then have them remove the markers that represent the original objects, to clarify the reason for subtracting.

APPLYING THE NEW CONCEPTS AND SKILLS

The collection of small objects mentioned earlier can be used to make up problems requiring the children to find how many more are needed. For example, 4 dolls can be given to a group of 6 girls, and the children can find how many more dolls are needed for the girls by acting out the problem.

Card-Holder No. 3 can be used to advantage with this page. There should be two sets of picture cards. One set of cards (illustrated at the top of the next page) should contain pictures of such objects as boxes divided into sections, boards with



holes in them, a collection of empty flower pots, a toy with a price mark of not more than 7¢, or a group of pets or children. The other set of cards should have single objects drawn or stamped on them—balls to be put in the boxes or given to pets or children, flowers to be put in the pots, pennies to buy the toys, etc. Some of the cards that were used for earlier lessons (see page 173) can probably be used here.

At the top of the chart clip one card from the first set, a box, for example. Below this card, clip cards showing balls to be put into the box. Ask a child to find enough more balls to fill the box and fasten his cards to the chart. Then have him tell how he knew how many more were needed. The abler children can probably carry on this activity by themselves, since the total number of objects required (not to exceed seven) has already been controlled by the teacher on the first set of cards.

68 How many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 68

The activities on this page continue the procedures begun on page 67, but the actions are not shown. The child learns to imagine the actions that are needed to clarify the bringing in (or adding) of a sufficient number of objects and to clarify the reason for subtracting with numbers to find the answer.

PREPARING FOR PAGE 68

Provide 7 small markers for each child. Since markers are used so constantly in this section of the book, try to have as many different kinds as possible to avoid monotony.

Card-Holder No. 3 and the picture cards suggested for page 67 may be used with this page also.

INTRODUCING PAGE 68

Ask the children to open their books to page 68. Let them talk about the toys on the page. Then tell them that the pictures on the page are short movies with two pictures each. The children should discover that some things are always missing or needed in the first picture in the movie.

USING PAGE 68

Call the children's attention to the first picture in the first movie. Ask them what they see in this picture. Have them tell what is missing or needed in the picture. Direct the discussion so they see that the problem is to find how many more balls are needed. Continue somewhat like this: "Can you use markers to find out how many more balls Don needs for the board? How many balls does he need in all? How many does he have? Put a marker on your desk for each ball he has. How many markers have you used? Now put down more markers until you have the number he needs. How many more markers did you use? Can you say that Don needs 4 more balls?

"Look at the last picture in the movie. What does it show? [Children should respond that it shows *all* the balls, including the one Don already had.] What should you do to your markers to show how many more balls Don needs for the board? [Take one away] Why do you take away only one marker?"

By their responses the children should indicate they understand that they subtract the one ball Don already had from the five he needed in all. Conclude with the statements "5 balls minus 1 ball are 4 balls" and "5 minus 1 equals 4."

Use similar procedures for the other movies. The abler children will not need to use markers for every problem, but they should be able to demonstrate their understanding by means of markers.

APPLYING THE NEW CONCEPTS AND SKILLS

The activity using Card-Holder No. 3, which was described in connection with the notes for page 67, is appropriate for this page also. See "Applying the New Concepts and Skills" on pages 232-233.

69 – 70 Symbolism of how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGES 69-70

The child reads statements that express the additive idea involved in finding how many more are needed and statements that express the subtraction process involved in finding the added quantity. He also has experience with the corresponding abstract expressions. He learns to associate the additive form with the subtractive form and to see

why he can subtract to find the unknown added quantity.

PREPARING FOR PAGES 69-70

The 7 markers that were used in connection with preceding lessons may be needed here.

If the work sheet described and illustrated on this page under "Applying the New Concepts and Skills" is to be used, make sure that there is a copy for each child.

INTRODUCING PAGES 69-70

Have the children open their books to page 69. Tell them that there are three movies on this page. Let them decide what they think is missing or needed in the first picture of each movie. On page 70 get the children to see that the pictures are like the first picture in each movie on page 69.

USING PAGES 69-70

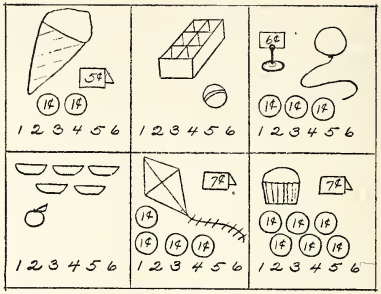
Direct the children's attention to the first movie on page 69. Ask them to find the problem that tells about the movie. Have them read the whole problem to themselves, making sure that they know where the problem begins and ends. Remind them that they are to say the missing numbers to themselves as they read. Then have the separate parts of the problem read aloud and answered. Let the children take turns reading aloud. Show the children how to use the first picture in connection with the first two sentences and the second picture with the third and fourth sentences. They should see that Nancy needs 5 beds because she has 5 dolls. They can easily find the missing number in the third sentence by looking at the pictures. Be sure they understand that if there were no pictures they would subtract the 3 beds Nancy has from the total of 5 beds that she needs in all. Show them that the fourth sentence tells them how to find the missing number in the third sentence. When they get to the last line, show them how the second fact in the line tells them how to get the answer to the first fact in that line. If it seems desirable, have them use markers to show their understanding of the action and the subtraction involved.

The other problems on page 69 may be taught in the same way.

Note that on page 70 the pictures show only the problem situations. The child is to imagine the actions needed to solve the problems as he reads the story. The reading material on this page lessens the child's reliance on the concrete forms and goes more directly to the abstract form. The procedures explained above for page 69 can be used with this page. Be sure the child sees the relation between the two facts in each of the problems A to E. Also be sure he sees that the fact at the right tells how to find the missing number in the fact at the left.

APPLYING THE NEW CONCEPTS AND SKILLS

The work sheet illustrated above at the right will give the children further practice in finding how many more are needed. Divide the sheet into 6 sections. In each section draw a simple problem situation similar to those pictured on pages 68 to 70—for example, a toy with a price mark, along with an insufficient number of pennies; a box divided into sections, along with a few balls; a number of plates, along with a smaller number of cookies; and so on. Remember that the basic facts used should be restricted to the 3, 5, 6, and 7 groups.



Below each picture write the numbers 1 to 6. Also, leave enough space under each picture for the child to write a basic fact. Tell the children that each picture is a problem in finding how many more are needed. They are to draw a ring around the number that tells how many more pennies, etc., are needed. If the children have had practice in writing the basic facts, they should then write in the empty space how they found the answer. That is, for the first problem above they would write "5 — 2 = 3."

71 Pictorial problem situations and practice

KNOWING YOUR OBJECTIVE FOR PAGE 71

The child develops discrimination in associating the action shown in a particular picture with the related problem. He also has experience in describing, in quantitative language, a problem in a picture.

PREPARING FOR PAGE 71

Each child may need 7 small markers. Also have for each child a set of number markers—one for each number from 1 to 7. See page 161.

Have available Card-Holder No. 3 and the picture cards suggested under "Applying the New Concepts and Skills" for this page.

INTRODUCING PAGE 71

Ask the children to open their books to page 71. Let them look at the pictures and then ask them if they like puzzles. Explain to them that the puzzle is to find which of the two pictures shows what the problem tells.

USING PAGE 71

Tell the children to read the first story (the first three lines of text) silently. Let them answer the problem if they can. Then direct their attention to the first two pictures. Ask: "Which picture shows what the story tells? How do you know? What is the answer to the problem? What is happening in the other picture? See if you can make a story about the other picture." Help the children make a story somewhat like the following: "Tom had 5 little toy wagons. Don gave him 2 more toy wagons. How many toy wagons did Tom have then?" Print the story on the blackboard and let the children find the answer. Some children may still need to use markers to help them understand the actions and to discriminate between the actions shown in the pictures.

The other three stories on the page may be handled in much the same way. Be sure that each child in the group has several opportunities to answer questions about the pictures and problems. Let the children take turns in answering the abstract problems at the bottom of the page. The letters should be called at random and identified by color. Give each child a set of number markers. Direct one child to read a designated problem and have the other children hold up the marker that shows the answer.

APPLYING THE NEW CONCEPTS AND SKILLS

Card-Holder No. 3 and the picture cards described on page 173 of these notes may be used to give the children further practice in distinguishing between addition and subtraction situations. You should make up simple addition and subtraction problems dealing with the objects on the picture cards. The problems should be confined to simple combining and separating situations. The children should not be asked here to solve problems that require them to compare or to find how many more are needed. Each child in the group should be allowed to choose a set of 7 picture cards (7 cats, 7 balloons, 7 cookies, etc.). After you have read a problem, the child with the appropriate picture cards should insert them in the card-holder and perform the action suitable to the problem. The other children should decide whether the action is additive or subtractive and supply the basic fact used in finding the answer.

72 Review

KNOWING YOUR OBJECTIVE FOR PAGE 72

The practice on this page gives the child an opportunity to think abstractly in terms of the basic facts and also to test his understanding of the money and measurement relationships taught thus far. He also receives practice on writing the basic facts.

PREPARING FOR PAGE 72

Have enough small markers on hand so that each child who needs them can have seven.

Prepare copies of the work sheet described below if you plan to use it.

USING PAGE 72

Have the children open their books to page 72. Direct their attention to Problem A in the column of problems with blue letters. Ask the group to read Problem A to themselves and supply the missing number as they read (six equals three plus three). Then have a child read the problem aloud. The rest of the column may be used in the same way, taking the problems alphabetically or in random order.

Any child who seems to have difficulty in responding should be encouraged to use markers to find the answers. As the children read the problems, make note of specific difficulties encountered by individual children and plan to give special help to individuals or to small groups so that these deficiencies may be remedied.

The problems lettered in red and gray should be handled in the same way.

APPLYING THE NEW CONCEPTS AND SKILLS

On another day, after the children have responded orally to the problems on the page, give them work sheets on which are printed, in three columns, the letters A to V. Leave enough space after the first and second columns of letters for

the children to write the whole basic fact after each letter. They should copy the facts and put in the missing numbers. It is important for the children to have experience in writing the basic facts. For the last column of problems have the children write just the answers.

Charting the Course — The 8 group

The characteristics of the 8 group are the same as those of the 6 group. Consequently, the sequence of learning experiences followed earlier with the 6 group can again be followed with the 8 group. It is important, however, that the ideas involved in comparison and in solving the "how many are needed" type of problem be reviewed and strengthened before too long a time elapses. Hence it is wise to consider these situations, using the facts of the 8 group, before continuing the special study of the equal subgroups which lead to multiplication and division ideas.

Only two new multiplication facts, combining 4 twos and combining 2 fours, come from the 8 group. There are, of course, also two new division facts, separating 8 into 4 twos and into 2 fours. As part of the preparation for the systematic study of division which will follow in later grades, some attention may now be given to the sharing or distribution type of division, sometimes called "partition." In this type of division the number of equal groups is known and the number in each group is to be found.

This is a convenient point at which to introduce the 4 group. No special difficulties are encountered with the 4 group except, perhaps, those that may arise because of the simplicity of this group. For example, seeing the difference between the addition point of view, as expressed in "2 plus 2 is 4," and the multiplication point of view, as expressed in the phrase "2 twos are 4," calls for making a fine distinction. The pupils may be given experiences with the 4 group without being called upon, at this stage of their development, to make this distinction in any formal way.

Numbers in Action extends addition and subtraction to the 8 group on pages 73 to 77. Problems of the additive-subtraction type using facts of the 8 group are presented on pages 76 and 77. Combining equal groups to make 8 and separating 8 into equal subgroups are treated on pages 78 and 79, respectively. The idea of distributing equally, or sharing, is developed on pages 80 and 81. Following a set of pictorial problem situations and some relatively abstract practice (pages 82 and 83), the 4 group is presented on pages 84 and 85.

73 The 8 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 73

The child learns the basic addition facts for the 8 group, which are illustrated on this page. This introduction to the 8 group contains pictures showing completed action and pictures in which the child is required to imagine that the action has been completed.

PREPARING FOR PAGE 73

If you plan to use the book *Chester* (item 4 in the bibliography) in introducing the page, see that it is available.

Each child will need 8 small markers.

The work sheet described on page 237 under "Applying the New Concepts and Skills" will give further practice in combining two groups to make 8. Each child will need a copy.

INTRODUCING PAGE 73

If the story *Chester* is available, read or tell it to the children. Then tell them that the pictures on page 73 show some of the animals that Carol and Don saw when they went to the pet store. If any of the children have ever visited a pet store, let them talk about their experiences. Have them identify and talk about the animals pictured on page 73. Some of the children may not recognize the guinea pigs in the middle of the page. Encourage the class to notice that in each situation one group is joining another group.

USING PAGE 73

Direct the children's attention to the first picture in the movie at the top of the page. By means of

questions and suggestions establish the facts that 5 puppies are standing at the window; that 3 more puppies are running toward them; and that it is necessary to add the two groups to find how many puppies in all will be at the window. Next have the children look at the second picture and tell what has happened in this picture. [The puppies are all together at the window and there are eight of them.]

Now have the children pretend that their markers are puppies. Direct them to put the markers on their desks in two groups—a group of 5 and a group of 3 as in the first picture. Tell them to move the group of 3 to combine it with the group of 5. Finish by requiring the children to make the statements "5 puppies and 3 puppies are 8 puppies," "5 puppies plus 3 puppies equal 8 puppies," and "5 plus 3 equals 8."

Follow similar procedures for the other picture on the page, having the children show the actions with markers on their desks. Stress the fact that adding takes place in each picture. These pictures show the facts $4 + 4$, $2 + 6$, $7 + 1$, $6 + 2$, $1 + 7$, and $3 + 5$, in that order.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one described and illustrated on page 183 may be adapted for use with this page. A key group of 1, 2, 3, 4, 5, 6, or 7 objects is drawn or stamped in each of the small boxes. The child should complete the 8 group by drawing the correct number of matching objects in the larger boxes. Remember that the objects used should be things that children can draw easily.

74 The 8 group — separating into two groups; comparing

KNOWING YOUR OBJECTIVE FOR PAGE 74

The child learns the basic subtraction facts for the 8 group on this page. Some of the pictures show completed action, and some of them require the child to complete the action in his imagination or with markers. The child learns to discriminate between situations in which he subtracts to find a remainder and situations in which he subtracts to find how many more there are in one group than in another.

PREPARING FOR PAGE 74

Provide 16 small markers for each child, eight of one kind and eight of another.

If you plan to use the work sheet described under "Applying the New Concepts and Skills" (page 238), see that copies are available.

INTRODUCING PAGE 74

Tell the children that the pictures on this page show other pets Don and Carol saw at the pet store. Have them open their books to page 74. Let them identify the animals and talk about the pictures. Get the children to notice that some of the situations clearly show a group leaving a larger group, while other situations show two groups of animals, one group larger than the other.

USING PAGE 74

Direct the children's attention to the first picture in the first movie. Ask them what is happening in this picture. By this time the children have had considerable experience describing the action in a picture. Do not be satisfied with their responses until they say that there are 8 mice in the cage, that 6 mice are running away, and that 2 mice will be left. Then ask them what the second picture in the movie shows. [The 2 mice that are left] Have the children show the action with markers on their desks. Remind them that they are subtracting to find how many are left. Then have them make the statements "8 mice minus 6 mice equal 2 mice" and "8 minus 6 equals 2."

Now ask the children to look at the second movie. By questions and directions get them to respond that the first picture shows two different groups of birds (canaries and parakeets, or yellow birds and blue birds); that there are 8 canaries and 6 parakeets; that one group is not being taken away; and that the problem is to find how many more canaries there are than parakeets.

Direct their attention next to the second picture and ask them what they see. [6 canaries are being taken away; 2 canaries are left. There are 2 more canaries than parakeets.] Ask the children why 6 canaries are taken away, or subtracted. Work for answers that indicate the children understand why it is necessary to take away the same number of canaries as there are parakeets. Have the children work out the problem with markers on their desks, using one kind of marker to represent canaries and the other kind to represent parakeets. See the notes for Lesson 63 (page 228) for a description of the actions with the markers. Be sure the children see that they should subtract to find how many more canaries there are than parakeets. Then require them to make the statements "There are 2 more canaries than para-

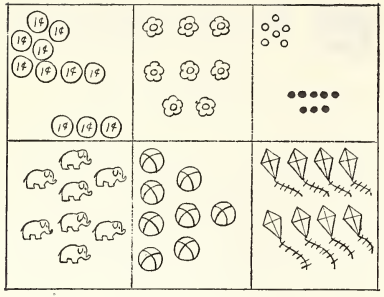
keets," "8 canaries minus 6 canaries are 2 canaries," and "8 minus 6 equals 2."

Notice that the other pictures on the page suggest problems that are to be solved by the children. Follow the procedures just outlined when dealing with these pictures. First have the children describe in detail what they see in a picture. Then have them decide whether they are going to find how many are left or how many more there are in one group than in another. They should use markers on their desks to show how the problem can be solved and should finish by stating the basic fact that is illustrated.

Throughout the work with this page encourage the children to use the words *subtract*, *minus*, *equal*, and *equals* in their responses. The last six pictures show the facts $8 - 5$, $8 - 4$, $8 - 1$, $8 - 2$, $8 - 7$, and $8 - 3$, in that order.

APPLYING THE NEW CONCEPTS AND SKILLS

Divide a sheet of paper into 6 sections. In each section draw or stamp either 2 groups of objects to be compared or a group of 8 objects. Prepare a simple subtraction problem about each picture. Read a problem to the class, have the children look at the appropriate picture, and then ask them to write the number that tells the answer. Suitable problems might be: "Carol has 8 pennies, and Ellen has 3 pennies. [The picture should show a group of 8 pennies and a group of 3 pennies.] Carol has how many more pennies than Ellen?" "Don had 8 cookies. He gave 4 of them to Nancy. How many cookies did he have left?" "Don has 8 black marbles and 6 white marbles. He has how many more black marbles than white marbles?" When the children have finished writing their answers, let them take turns in stating the basic fact for each problem. They should not be expected to write the basic facts for the 8 group in complete form until they have done the work on page 75.



75 The 8 group; symbolism of addition and subtraction facts

KNOWING YOUR OBJECTIVE FOR PAGE 75

The child learns how both the addition and the subtraction basic facts for the 8 group are symbolized. He is given further practice in completing the actions indicated in pictures. He also uses the pictures to answer the questions in the problems.

PREPARING FOR PAGE 75

The book *Lambert's Bargain* (item 15 in the bibliography) may be used to introduce this page.

Each child who needs markers should have 16, eight of one kind and eight of another kind.

If you plan to use the work sheet described under "Applying the New Concepts and Skills" (page 239), prepare a copy for each child.

INTRODUCING PAGE 75

Read or tell *Lambert's Bargain* to the class if it is available. Then tell the children that they are going to read some stories about animals at the pet store. Have them open their books to page 75 and look at the pictures. Let them discuss each picture to decide whether it suggests adding, subtracting, or comparing, and how they can tell.

USING PAGE 75

Direct the children's attention to the first picture and ask them what they see in it. Then have them look at the first story, which belongs with the picture. Tell them that they can find in the picture the answer for every question in the story. Follow the procedures that have been established earlier for this kind of page (see notes for Lessons 27, 48, and 51). That is, have the children read the story to themselves and then ask one child to read each line aloud and give the answer. The slower children should be encouraged to find the answers by moving markers.

Be sure to ask the children to make up questions about each of the three pictures in the right-hand column before they read the one line of text that accompanies the picture.

Pay special attention to the two pictures showing comparison (the mice and the canaries, the large and small cages of canaries). The children should recognize that they are to find how many more animals there are in one group than in the

other. They should also demonstrate that they know they subtract 4 mice because there are 4 canaries, and they subtract 3 canaries because there are 3 canaries in the small cage.

In working with Problems A to L at the bottom of the page, have the children first respond orally. Then have them write the letter A on a sheet of paper and copy the basic fact following A in the book. They should write the correct number in place of the screen. Have them do this for each of the other problems on the page, one at a time.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one described and illustrated on page 238 may be used with this page. In the problems you read to the children, use both addition and subtraction facts from the 8 group.

76 The 8 group — how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 76

The child receives more experience with subtraction in "how many more are needed" situations. The work is confined to the 8 group. The pictures show completed action and illustrate the following basic facts: 8 — 4, 8 — 6, 8 — 3, 8 — 7, 8 — 5, 8 — 2.

PREPARING FOR PAGE 76

Provide 8 small markers for each child.

If you plan to use Card-Holder No. 3 and the appropriate picture cards (see "Applying the New Concepts and Skills"), have the materials ready.

INTRODUCING PAGE 76

Have the children open their books to page 76. Let them look at the pictures and talk about them. Get the children to see that more objects are needed in each movie.

USING PAGE 76

Direct the children's attention to the first picture in the first movie. Explain that Carol's mother is decorating a birthday cake for one of Carol's friends. Proceed with questions and directions such as: "Are there enough candles for the cake? How do you know? [Try to get the children to say that 8 candles are needed, and there are only 4 on the table.] How many more candles are needed for the cake? Look at the next picture. How many candles do you see here? How many candles did Mother have at first? Four candles and how many candles are 8 candles? How many more candles were needed? Did Mother bring in the right number of candles in the second picture?"

Let the children use markers to show the situation. Be sure they understand that Mother needs 8 candles in all. Direct them to put down 4 markers for the 4 candles Mother had to begin with. Then have them put more markers with the four until they have eight. Ask them how many more they brought in, or added, to the four markers they already had. Have them answer the question "4 candles and how many more candles are 8 candles?"

Now have the children look at the last picture in the first movie. Tell them that this picture shows why they can subtract 4 candles from 8 candles to find how many more candles are needed. Get them to understand that they should subtract the number of candles they had at first from the total number of candles needed. To do this, direct their attention to the 8 markers they have that represent the candles. Then have them take away the markers for the candles that Mother had to begin with. Ask: "Do the markers that are left show how many more she needed?" Say: "We can subtract the 4 candles she had from the 8 candles she needs in all." Finally have the children make such statements as "8 candles minus 4 candles are 4 candles" and "8 minus 4 equals 4."

Go through the other movies on the page in the same way, encouraging the children to use markers to show the action for bringing in additional objects and for removing the original objects. Notice that Picture 3 is omitted from the last four movies. Have the children demonstrate the subtraction with markers if they lack understanding.

APPLYING THE NEW CONCEPTS AND SKILLS

The activity using Card-Holder No. 3 described on pages 232 and 233 can be used again here. This time provide several cards on which the total number of objects needed is eight. A few cards from the 6 and 7 groups may also be included.

77 The 8 group — how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 77

The child has further experience with the symbolism of the additive idea begun on pages 69 and 70. He also has further experience in seeing why he can subtract to find how many more are needed.

PREPARING FOR PAGE 77

Provide enough markers so that each child can have eight.

If you plan to use the work sheet described under "Applying the New Concepts and Skills," prepare a copy for each child.

INTRODUCING PAGE 77

Ask the children to open their books to page 77. Let them examine the movies and discover that there are not enough toys to fill the box in the first picture in each movie.

USING PAGE 77

Direct the children's attention to the first movie. Then explain that the first story belongs with this movie. Have the children read the whole story to themselves, putting in the missing numbers as they read, if they can. Remind the children that they can find the answers to the questions in the pictures. Then have the separate parts of the story read aloud and answered. If any children have trouble getting the information from the pictures, have them use their markers to find the answers. Be sure they perform the action of removing from the group representing the total needed group the markers that represent the quantity already on hand in the first picture of the movie.

The other movies on the page may be handled in much the same way.

APPLYING THE NEW CONCEPTS AND SKILLS

On a sheet of paper print simple subtraction problems in both the additive and subtractive forms. These two forms of the same problem should be written side by side. For example, the problem "8 cats equal 5 cats plus ____ cats" should be followed by the problem "8 cats minus 5 cats equal ____ cats." The children should write the missing numbers on the blanks. They should be allowed to use markers to find the answers if they need to. The problems should give practice with the facts in the 8 group.

78 The 8 group — combining equal groups; symbolism

KNOWING YOUR OBJECTIVE FOR PAGE 78

The child has more experience with the concept of multiplication introduced on page 52. He now learns that 4 twos are 8 and that 2 fours are 8. He also begins to learn how the multiplication basic facts for the 8 group are symbolized.

PREPARING FOR PAGE 78

The story "A House for Fido" from *The Hollyberrys* (item 14 in the bibliography) is appropriate for use with this page.

Each child will need 10 or 12 small markers.

Collections of 10 or 12 objects (pennies, small books, blocks, marbles, toy automobiles, etc.) will be useful while teaching this lesson.

INTRODUCING PAGE 78

Read or tell "A House for Fido" to the children and take time to talk about the story in connection with the literature work. Then tell the children that they are going to see pictures of some toys that Don and Carol saw in a toy store. Have the children open their books to page 78 and look at the pictures. Explain that the toys are wind-up toys and can move by themselves. Get the children to notice that in each of the two movies and in the pictures at the bottom of the page, groups of toys are coming together.

USING PAGE 78

Because the concept of multiplication is still new to the children, spend considerable time discussing the action in each situation before you ask the children to read the accompanying problem. Direct the children's attention to the first picture in the first movie. By questions and directions establish the fact that equal groups of dogs are moving toward the bone, that there are 4 groups of dogs, and that there are 2 dogs in each group. Then have the children look at the second picture and tell what has happened. [The dogs are together in one group, and there are eight of them.] Now have the children find the story that belongs with the movie. Follow your usual procedures for reading and answering questions. Finally, have the children repeat the action in the movie with markers on their desks.

The second movie and the two pictures at the bottom of the page may be handled in a way similar to that suggested above. Throughout the work with this page stress the fact that equal groups are coming together. Be sure the children are familiar with the expressions "2 fours equal 8" and "4 twos equal 8."

APPLYING THE NEW CONCEPTS AND SKILLS

Prepare simple multiplication problems about the collections of objects mentioned earlier. Use the facts from both the 6 and 8 groups. Let each child choose a collection of objects. Then read a problem to the group. ("2 groups of 4 pennies each equal how many pennies?") The child who

has chosen the pennies performs the action in the problem and gives the answer. Have other members of the group make the statements "2 groups of 4 pennies equal 8 pennies" and "2 fours equal 8." Include one or two problems using facts from the 6 group to test the children's discrimination between the 6 and 8 groups.

The children, working in pairs, may be able to carry on the following activity with little supervision. Give each pair a collection of 10 objects or markers. Let one child in each pair give directions like "Put 4 groups of 2 sticks [or markers or other objects] on the desk. Now push them together. How many sticks are there altogether?" The second child then gives similar directions to the first child.

79 The 8 group — separating into equal groups; symbolism

KNOWING YOUR OBJECTIVE FOR PAGE 79

The child has additional experience with the concept of division introduced on page 53 (finding how many equal groups there are when the size of the group is known). The child learns that there are 4 twos in 8 and that there are 2 fours in 8. He also learns that the division basic facts for the 8 group are symbolized as $8 = 2$ fours and $8 = 4$ twos.

PREPARING FOR PAGE 79

Provide 8 small markers for each child.

The collections of small objects suggested for use with page 78 may be used in connection with this page also.

DEVELOPING VOCABULARY FOR PAGE 79

Continue informal use of the word *divide* to indicate the separation of a group into smaller equal groups.

INTRODUCING PAGE 79

Ask the children to open their books to page 79 and look at the pictures. Get them to see that the movies and the two pictures at the bottom of the page show groups separating into smaller equal groups.

USING PAGE 79

Because the division concept is still new to the children, spend considerable time discussing the action in each situation before you ask the children to read the accompanying problem. Direct the children's attention to the first picture in the first movie. By questions and directions establish the fact that there are 8 cars in the picture, that the cars are moving away from each other, and that they are moving away (or dividing) in groups of 2 cars each. The children should then look at the second picture and tell what they see. [Four groups of 2 cars each] Direct them to the first story and follow your usual procedures for reading and answering questions. Finish the work on this movie by having the children repeat the action with markers on their desks.

Use similar procedures for the other movie and the two pictures at the bottom of the page. Throughout the work with the page emphasize the fact that a group is being separated, or divided, into smaller groups that are equal in quantity. Be sure the children are familiar with the expressions "$8 = 2$ fours" and "$8 = 4$ twos."

APPLYING THE NEW CONCEPTS AND SKILLS

The activities suggested for page 78 may be adapted for use with this page. The problems, of course, must show the separation of a group of 8 into groups of 2 or 4. The children are to find how many groups of 2 or 4 there are in 8.

80 The 8 group — separating into a given number of equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 80

This lesson introduces the idea of separating a group into a specified number of smaller groups that are equal in quantity. The child now observes the number of smaller groups into which the larger group is being separated or divided. He then determines how many objects there will be in each of the equal groups. The work is confined to finding how many objects there are in each group when the number of groups is known. The movies show completed action for this concept.

PREPARING FOR PAGE 80

Each child will need 8 markers of one kind and 4 markers of another kind.

If you plan to use the work sheet described under "Applying the New Concepts and Skills" (page 242), see that there is a copy for each child.

INTRODUCING PAGE 80

Ask the children to open their books to page 80. Explain that these pictures are also about a toy store. The boys want to buy the toy cars. Let the children discover that the boys are dividing the cars up among themselves and that someone is putting the dolls into the wagons.

USING PAGE 80

Have the children look at the first picture in the first movie. Tell them that the boys want to buy all of the cars and that each boy is going to buy the same number of cars. Proceed somewhat like this: "How many cars are on the table? How many boys are there to buy the cars? Look at the next picture. What are the boys doing? [Each boy is taking one car.] Why is each boy taking a car? [Work for responses that indicate the children understand that the boys are each going to buy the same number of cars and that each boy is taking a car in turn until the cars are used up. Then each boy will have the same number of cars.] Now look at the last picture. What has happened? [Strive for responses such as 'Each boy has taken another car,' 'Each boy has 2 cars,' and 'The boys have divided up the cars.'] When 8 cars are divided equally among 4 boys, how many cars does each boy get?"

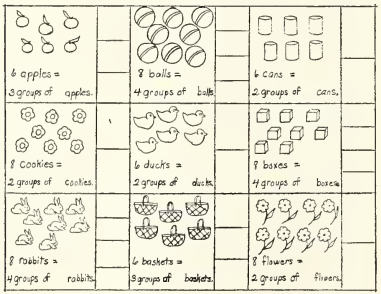
Now let 4 children act out this movie, using 8 books, pencils, or other convenient objects available in the classroom. Encourage the children to make such statements as "8 books are 4 groups of 2 books each," "If you have 8 books and 4 children, and you give the same number to each child, each child will get 2 books," and, finally, "8 equals 4 twos."

Use similar questions and directions for the second movie. Conclude the work on this movie by having the children show the action with markers on their desks. They should use one kind of marker to represent the wagons and the other kind to represent the dolls.

After the work with pictures and markers ask the children to find the story about the boys and the toy cars. Work through the story according to your usual procedures. Before the children read the last line of the story remind them that the wavy line means they are to finish the statement. Allow them to say either "twos" or "groups of 2" for the wavy line. Handle the other story in the same way.

APPLYING THE NEW CONCEPTS AND SKILLS

Divide a sheet of paper into sections as illustrated below. At the right of each section rule off 2, 3, or 4 boxes. At the left of these draw 6 or 8 objects (balls, marbles, boxes, blocks, etc.). Below each picture print a simple problem, such as "8 boxes = 4 groups of _____ boxes." The child should be instructed to draw a line from each object to a box and continue until he has put the same number of objects in each box. He is then to read the problem and write in the missing number.



81 Pictorial problem situations and practice

KNOWING YOUR OBJECTIVE FOR PAGE 81

The child reacts to simple problem situations in which a group of objects is to be divided into a specified number of smaller equal groups. He is to find how many objects there are in each of the equal groups. The child also has further practice in reading problems and in getting information from pictures. The division facts used are from the 6 and 8 groups.

PREPARING FOR PAGE 81

Provide 8 markers for each child.

The collections of small objects used in connection with pages 78 and 79 are useful with this page also.

INTRODUCING PAGE 81

Have the children open their books to page 81. Let them examine the pictures and talk about them. Tell the children that the toys and fruit are going to be put into containers (beds, boxes, bags).

USING PAGE 81

Direct the children's attention to the first picture. Ask them to describe what they see. [3 beds and 6 dolls] Then have them read the first story to themselves and be ready to answer the questions. Encourage them to put markers on the dolls and move the markers from the dolls to the beds to find how many dolls will be in each bed. Then have the children take turns reading the questions aloud and answering them.

Use similar procedures for the other pictures and problems on the page.

APPLYING THE NEW CONCEPTS AND SKILLS

Make up simple division problems about the collections of objects mentioned earlier and let the children act out the problems. For example, give 6 books to 2 children and say, "Divide these books so that each of you will have the same number of books." The other children in the group should supply the statements "6 books equal 2 groups of 3 books each" and "6 equals 2 threes."

82 Pictorial problem situations for the 8 group

KNOWING YOUR OBJECTIVE FOR PAGE 82

The child learns to recognize and distinguish among additive, subtractive, multiplicative, and divisive situations by the actions involved. The facts used are from the 8 group only. The child responds to the pictures by giving the appropriate basic fact in abstract form.

PREPARING FOR PAGE 82

Provide one full-page frame and 8 markers for each child.

If you plan to use the activity suggested under "Applying the New Concepts and Skills," see that the transparent paper is ready.

INTRODUCING PAGE 82

Ask the children to open their books to page 82. Let them examine the pictures and talk about the toys. Ask them to describe the actions shown in several of the pictures. Be sure they see that some of the pictures show combining action, some separating action, some the combining of equal groups, and some the separating of a quantity into equal groups. Some of the children may notice that the total number of objects in each picture is eight.

USING PAGE 82

First tell the children to place the frames on the page with the circle at the top. With the frame in this position only combining actions can be seen, but some of the pictures show addition and some of them can be interpreted as multiplication. Direct the children's attention to the first picture revealed by the frame. Ask a child to describe what is happening in the picture. Try to get him to say something like this: "5 blocks are on the floor. Someone is throwing down 3 more blocks." Then encourage him to make the statements "5 blocks and 3 blocks equal 8 blocks" and "5 plus 3 equals 8."

After several pictures have been used in this way, have the children tell what they see and immediately state the basic fact that applies to the picture. Be sure that all children recognize the actions which can be viewed as the action of multiplication (two or more equal groups moving together at the same time). Let the slower children show the actions with markers.

Now have the children turn their frames so that the star is at the top. With the frame in this position only pictures showing separating actions (both subtraction and division) can be seen. First ask the children how these pictures differ from the pictures they have just been working with. The children should indicate that they recognize the separating actions in all the pictures. Have them look at the pictures one at a time, describe what they see, and give the appropriate basic fact. Help them to recognize the actions that can be interpreted as division.

Next ask the children to place the frames on the page with the circle at the bottom. Pictures showing both combining and separating actions are now visible. Then direct the children's attention to the problems with blue letters at the top of page 83. Be sure they see that Problems A to G are about addition, Problems H to N are about subtraction, and Problems O to R are about combining equal groups and separating into equal groups. Ask them to look at the first picture visible with the frame in this position and find the problem on page 83 that fits the picture [Problem M]. If some of the children have trouble keeping their places, let them put a marker on the picture that is under discussion.

If time permits, the children may next place the frames so that the star is at the bottom and locate the appropriate problems for these pictures also.

If the frame is not available, use a single-view frame or a marker to isolate one picture at a time. Then follow the procedures suggested above for the use of the full-page frame.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a sheet of transparent paper. Help the children fasten the paper to the book with a clamp or paper clips. Instruct them to look at a picture, find the problem on page 83 that fits the picture, and write the letter of the problem on the transparent paper over the center of the picture. For example, the children would write "F" over the first picture.

83 Review

KNOWING YOUR OBJECTIVE FOR PAGE 83

The child practices the basic facts and the money and measurement relationships taught thus far.

PREPARING FOR PAGE 83

Provide enough markers so that any child who needs them can have eight.

Each child will need a copy of each work sheet described below if they are to be used.

USING PAGE 83

Ask the children to open their books to page 83. Direct their attention to Problem A in the columns of problems with red letters. Have the children read the problem to themselves, supplying the missing number as they read. Then ask a child to read the problem aloud. Do this for each problem (red A through R), taking the problems in either alphabetical or random order.

Use a similar procedure for Problems A to V (gray letters). Let the children find the answers with markers if they need to.

Give each child a work sheet with the letters A to R written in one column and the letters A to V written in a second column. Leave enough space after the first column of letters for the children to write the whole basic fact. They should copy the facts and put in the missing numbers. Have them write just the answers for Problems A to V. Remind them that when they come to a wavy line they are to finish the statement. For Problem J they would write "4 nickels," not just "4."

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one described and illustrated on page 178 may be used to test the children's understanding of addition and subtraction. Be sure to include facts from each of the groups studied so far.

84 – 85 The 4 group

KNOWING YOUR OBJECTIVE FOR PAGES 84-85

The child has further experience in combining, separating, and reorganizing groups in working with the 4 group, and thereby learns the basic facts for this group. All the facts are illustrated in the pictures on page 84. These are facts with which many children are already familiar. The treatment of the 4 group is brief, as was the treatment of the 3 group. Page 84 also provides further experience in locating position by use of numbers in two directions. Page 85 symbolizes the facts $2 + 2$, $4 - 2$, 2 twos $= 4$, and $4 = 2$ twos.

PREPARING FOR PAGES 84-85

Page 84 is designed to be used with or without the window device. If the window is to be used, provide one for each child. Single-view frames or markers may be used instead of the windows.

Provide enough markers so that each child who needs them can have four.

The flannel board and cutouts (see page 170 under "Applying the New Concepts and Skills") may be used to advantage with these pages. If you plan to use them, see that the materials are available.

INTRODUCING PAGES 84-85

Tell the children that they are going to see a page with pictures of all kinds of toys. Have them open their books to page 84, and let them talk about the toys. Have them describe the action in several pictures. They should see that some show combining action, some separating action, some the combining of equal groups, and some the separating of a quantity into equal groups.

USING PAGES 84-85

The following suggestions for using page 84 are based on the use of the windows, but single-view frames or markers may be used by adapting the directions. For a complete explanation of the use of the windows, see pages 191-192.

Have the children place the windows over the page. Be sure they have placed the windows in the correct position. Most children will need to have the windows fastened to the page with a clamp or paper clip.

Have the children agree on a starting point for counting rows and windows. You might begin by calling the bottom row Row 1 and the first window at the left Window 1. See that all children can locate Row 1, Window 1. Then give directions such as: "Open Window 1 in Row 1. What do you see? Anne, tell us what is happening in the picture. [There are 4 toy airplanes. One of them has come loose. There are 3 left.]" Then have the child make the statements "4 airplanes minus 1 airplane equal 3 airplanes" and "4 minus 1 equals 3."

After the children have used many of the pictures in this way, let them think of the top row as

Row 1 and the first window at the right as Window 1. They can then start counting from that point. It might be wise to have a plan for using the windows, so that each picture is worked on at least once. Remember that all children should have practice in locating rows from both bottom and top and windows from both right and left.

If the windows are not available, give the children directions such as "Find Row 5, Picture 4. Frame this picture. [The children are to put the single-view frame over the picture.]" Or ask the children to put a marker on Row 5, Picture 4. Then proceed with the picture as suggested above.

The pictures and problems on page 85 may be handled according to the procedures suggested for page 81. The work on page 85 gives the child an opportunity to react to the symbolism of the 4 group in addition, subtraction, multiplication, and division. Note that the second picture is used in two ways by the second and third stories. In the second story the problem is to find how many groups. In the third story the problem is to find how many are in each group.

APPLYING THE NEW CONCEPTS AND SKILLS

The flannel board and cutouts (with sandpaper backs) described and illustrated on page 170 may be used along with cards on which have been printed basic facts in abstract form. Any of the basic facts shown on pages 84 and 85 may be used. Each child should choose a problem card and then select enough cutouts of one kind to act out his problem. He reads the problem to the group and then demonstrates the action by placing the cutouts on the board.

Charting the Course — Foundation for ratio

The idea of one-to-one correspondence, which is a fundamental idea of arithmetic, can be generalized to include correspondences such as two-to-three, one-to-ten, and many others. Suppose, for example, that in a collection of toys 2 balls out of each 3 are red, and 1 out of each 3 is blue. Then there are 2 red balls for each blue ball, and a 2-to-1 correspondence can be made between the group of red balls and the group of blue balls. Similarly, suppose that out of each 5 tops in a collection, 2 are "big" and 3 are "little." Then a 2-to-3 correspondence can be set up between the group composed of all of the big tops and the group composed of all of the little tops. Situations of this kind occur very frequently, and a special word has come into common use to describe them. We say "The *ratio* of red to blue is 2 to 1," or "The *ratio* of big tops to little tops is 2 to 3." The idea of ratio is not difficult—it is simply a correspondence or matching of groups.

It should also be noted that correspondence can be set up between objects which are quite different. Thus, suppose there are only 8 toy airplanes for a group of 12 boys. Then subgroups may be made so that 2 airplanes go with, or correspond to, each 3 boys. In other words, the ratio of airplanes to boys is 2 to 3. The advantage of this way of looking at a situation is that the relationship of two groups (all the boys and all the airplanes) is in its simplest form (2 to 3, not 8 to 12) and is more readily seen.

Numbers in Action introduces the ratio idea on pages 86 to 88. The word *ratio* is not to be used at this level. This fundamental concept will play an increasingly important role with each succeeding year of the child's number experience.

86 Foundation for ratio

KNOWING YOUR OBJECTIVE FOR PAGE 86

The child learns to recognize situations in which there are a number of equal groups of objects each of which contains two subgroups equal in number and possessing similar characteristics throughout. He also learns to discriminate between situations in which a number of equal groups possess similar characteristics and situations in which they do not. He learns the conditions under which he can make such statements as "2 balls out of 3 are red," "1 green ball for every 2 red balls," "3 tops out of 5 are small," etc.

PREPARING FOR PAGE 86

Collections of small objects (marbles of different colors, markers of different shapes, sizes, or

colors, blocks, toy airplanes, pencils, etc.) will be useful in teaching this lesson.

If you plan to use the work sheet described under "Applying the New Concepts and Skills," see that there is a copy for each child.

INTRODUCING PAGE 86

Have the children open their books to page 86. Let them look at the pictures and identify the toys. By questioning get them to see that the toys are arranged in equal groups, and then let them discover the differences and similarities of objects within the groups. Do not emphasize the total number of objects in each picture.

USING PAGE 86

Direct the children's attention to the first picture. Proceed with questions and directions such as: "How are the balls arranged? [In groups of 3] Are the groups of balls alike in any way? [There are 2 red balls in each group.] Can you say that 2 balls out of each group of 3 balls are red? Is there any other way in which the groups of balls are alike? [Work for responses like 'There is 1 green ball in each group,' '1 ball out of each group of 3 balls is green,' '1 out of 3 is green,' 'There is 1 green ball for every 2 red balls.']

"Now look at the picture of the clowns. How are the clowns arranged? [In groups of 3] How are the groups alike? [2 clowns in each group have dotted suits.] What can you say about the groups of clowns? [Try to get responses like '2 clowns out of each group of 3 clowns have dotted suits' and '2 out of each 3 clowns have dotted suits.'] Can you say anything else about the groups of clowns? [1 out of each 3 has a striped suit.] Can you say that 1 out of each 3 clowns is sitting down? Why? [All the clowns in the first group are standing.] Can you say that 2 out of each 3 clowns are dressed in blue? Why? [3 clowns in the last group are dressed in blue.]"

Discuss the other pictures in a similar way. Be sure the children understand clearly that no characteristic can be selected as a common characteristic unless it is true of every group. That is, if they notice that 2 tops in a group of 5 tops are large, they must be sure to check every group of 5 tops to see if it contains just 2 large tops before they can say "2 tops out of each 5 tops are large." The following questions may be considered with the picture of the tops:

Are 3 out of each 5 tops small?

Are 2 out of each 5 tops orange?

Are 2 out of each 5 tops large and blue?

Are 2 out of each 5 tops small and orange?

Is 1 out of each 5 tops green?

Are there 2 big tops for every 3 small tops?

The following questions may be considered in connection with the picture of the chairs:

Is 1 out of each 3 chairs green?

Is 1 out of each 3 chairs red?

Is 1 out of each 3 chairs big?

Are 2 out of each 3 chairs small?

Is 1 out of each 3 chairs small?

Pay special attention to the picture of the wheelbarrows. No quantitative statement of the kind under consideration can be made by the children except that the wheelbarrows are arranged in groups of 5. Some of them are green and some are orange, but the number of each color is not constant in each group. Some children may want to say, "But there are at least 2 orange wheelbarrows in each group." Try to get them to understand that although this is true, it is not the same kind of statement they have been making, because there are 3 or 4 orange wheelbarrows in some of the groups.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a collection of 12 or 15 small objects, one-third of which are different in size, color, or shape from the rest but are similar to one another. Examples of appropriate collections are: 8 green marbles and 4 yellow marbles; 10 round markers and 5 square markers; 8 blue cards and 4 white cards; 10 pieces of white chalk and 5 pieces of yellow chalk. Ask the children to arrange their collections in groups of 3 in such a way that each group is exactly like every other group. Then let each child make statements about another child's arrangement: "1 marble out of each 3 marbles is yellow," "2 marbles out of each 3 are green," "2 markers out of each 3 are round," and so on. If time permits, give the children other collections and have them arrange the objects in groups of 5.

Divide a work sheet into 4 sections. In each section draw or stamp objects arranged in groups of 3 or 5. Instruct the children to color the objects in such a way that 2 objects out of 5 are one color, 1 out of 5 is another color, 1 out of 3 is black, etc. The children should then be required to make statements about their own pictures. This exercise is a good test of their understanding of the work with page 86.

87 Foundation for ratio

KNOWING YOUR OBJECTIVE FOR PAGE 87

The child learns how to determine whether or not he can distribute two series of objects (of unequal number) into the same number of groups so that (1) an equal number of one kind of object is in each group, and (2) an equal number of another kind of object is in each group. He then learns to make comparisons between the quantities by such statements as "There are 2 airplanes for each 3 boys" and "There are 2 for 3."

PREPARING FOR PAGE 87

Provide 15 small markers for each child.

The collections of small objects used in connection with page 86 may be used again with this page.

INTRODUCING PAGE 87

Have the children open their books to page 87 and look at the pictures. Tell them that the children are having a party. Let them identify the objects on the page. Then by questioning get them to notice the different kinds of objects within a picture. They should notice, too, that each kind of object within a picture is arranged in equal groups.

USING PAGE 87

Direct the children's attention to the first picture. Proceed somewhat as follows: "How are the boys arranged? [In groups of 3] How are the airplanes arranged? [In groups of 2] Is there a group of airplanes for each group of boys? What can you say about the groups of airplanes and the groups of boys? Are there 2 airplanes for each 3 boys? What else can you say about the groups of boys and the groups of airplanes? [Try to get the children to say 'There are 3 boys to each 2 airplanes.']

"Now look at the next picture. How are the girls arranged? [In groups of 4] How are the presents arranged? [In groups of 5] What can you say about the groups of presents and the groups of girls?" Work with the children until they can say that there is a group of presents for each group of girls, that there are 5 presents for each 4 girls, 5 for each 4, 4 girls for each 5 presents, and 4 for each 5.

Next explain that the different kinds of cupcakes and cookies belong with the groups of plates and that you will talk about one kind of cake at a time. Start with the cupcakes with cherries on top. By questions and directions establish the facts that the plates are arranged in groups of 5, that the cupcakes are arranged in groups of 4, that there is a group of cupcakes for each group of plates, that there are 4 cupcakes for each 5 plates, and that there are 5 plates for each 4 cupcakes.

Now direct the children to look at the big cupcakes in the next picture (left). Ask them how they could serve these cupcakes on the plates. They will probably suggest that the cupcakes could be cut in pieces. Then ask how many cupcakes there are for each group of plates. The children should answer that there is 1 cupcake for each group of 5 plates. Encourage them to state also that there are 5 plates for 1 cupcake.

Use similar procedures with the picture of cupcakes at the right.

Pay special attention to the two pictures of cookies at the bottom of the page. Here, for the first time, the cookies are not arranged in groups that correspond with the groups of plates. Some of the children may notice immediately that there are only 2 groups of chocolate cookies, and that if the cookies were distributed by groups, only 2 groups of plates would get cookies. Ask the children in what other way the cookies could be arranged. Then suggest that they use markers to find the answer. Have them put a small marker on each cooky and move the markers one by one to the groups of plates until there are no markers left. As an alternative, let them operate markers on their desks. Let them discover that there are 2 markers (cookies) for each group of 5 plates. Use similar procedures for the last picture.

APPLYING THE NEW CONCEPTS AND SKILLS

Ask 6 children to arrange themselves in groups of 2 or groups of 3. When they have done this, give them an appropriate number of objects (books, pencils, toys, etc.) and ask them to arrange these objects so that there is an equal group of objects for each group of children. The children should understand at this point that the groups of objects must be equal in number. Then have one child make the statements "There are 3 books for each 2 children," "There are 2 children for each 3 books," "There are 3 for 2," and "There are 2 for 3." Repeat this activity with different kinds, and numbers, of objects until each child in the group has had a chance to state the comparisons.

88 Pictorial problem situations for ratio

KNOWING YOUR OBJECTIVE FOR PAGE 88

The child meets both types of ratio situations thus far presented and has to distinguish between them. By inspecting the pictures (and sometimes by using markers) he decides whether or not he can make such statements as "There are 4 balls for each 3 bats" and "5 balls out of each 8 balls are footballs."

PREPARING FOR PAGE 88

Each child will need 12 small markers.

Collections of all kinds of small objects (buttons, markers, stones, marbles, chalk of different colors, etc.) will be useful in teaching this lesson.

INTRODUCING PAGE 88

Ask the children to open their books to page 88. Let them identify the toys in the pictures. Encourage them to find the pictures that show the toys arranged in equal groups.

USING PAGE 88

Explain to the children that the pictures of bats, balls, and gloves all belong together. Ask them how the bats are arranged. [In groups of 3] Then ask how the balls are arranged. [In groups of 4] Continue asking questions to bring out the facts that there is a group of bats for each group of balls, that there are 4 balls for each 3 bats, and that there are 3 bats for each 4 balls. Then ask if the gloves can be arranged in groups to go with the bats. Have the children use markers for the gloves and move them from the gloves to the groups of bats. They should discover that they cannot arrange the gloves in equal groups to correspond to the groups of bats. Consequently, it is impossible to say that there are a certain number of gloves for each 3 bats.

Help the children to see that the next series of pictures presents the same kind of problem as the first series. Then ask such questions as: "What can you say about the green brushes and the jars of paint? [There are 3 green brushes for each 5 jars of paint. There are 5 jars of paint for each 3 green brushes.] What can you say about the red brushes and the jars of paint? [The children may indicate that they do not know, because the red brushes are not arranged in groups.] Do you think that there are 2 red brushes for each 5 jars? How can you find out?" The children should discover that here, too, they cannot make statements comparing groups of brushes and groups of jars. Such a statement as "There is 1 red brush for each group of jars, and 2 red brushes are left over," although correct, should not be encouraged.

In dealing with the picture of the dolls the following questions should be raised:

Are 2 out of each 3 dolls baby dolls?

Is 1 out of each 3 dolls wearing a hat?

Are 2 out of each 3 dolls wrapped in blankets?

Are 2 out of each 3 dolls smiling?

Are there 2 baby dolls for each other kind of doll?

Notice that the toy cars are arranged in groups of 5 each but that the groups do not contain an equal number of objects with similar characteristics. Let the children discover this for themselves by considering the following questions.

Are 2 out of each 5 cars passenger cars?

Are 3 out of each 5 cars trucks?

Is 1 out of each 5 cars blue?

Is 1 out of each 5 cars green?

Let the children formulate as many of the statements as possible about the last two pictures, since they do not offer any special difficulties.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child different quantities of two kinds of objects. For example, give one child 9 pieces of yellow chalk and 12 pieces of white chalk, and give another child 10 small sticks and 15 buttons. If enough objects are not available, use small pieces of different-colored paper. Other possible combinations of objects are 6 (of one kind) and 9 (of another kind), 8 and 12, 6 and 15, 15 and 20, 12 and 15, 12 and 16, and 10 and 25. In this exercise it is best to avoid combinations which can be reduced to a ratio of 1 to any other number (2 and 12, 4 and 8, etc.). Tell the children that they are to arrange each kind of object in equal groups in such a way that they have a group of one kind for a group of the other kind. Explain that they should be able to say of their arrangements, "I have 2 sticks for 3 buttons," or "There are 3 black marbles for 5 green marbles." This activity is difficult but challenging.

89 Pictorial problem situations and practice

KNOWING YOUR OBJECTIVE FOR PAGE 89

The child has another opportunity to exercise discrimination in associating the correct actions

(pictured) with problems he reads. He also has experience in describing a problem (pictured) in quantitative language.

PREPARING FOR PAGE 89

Provide 8 small markers for each child.

If the work sheet described under "Applying the New Concepts and Skills" is to be used, prepare a copy for each child.

INTRODUCING PAGE 89

When the children have opened their books to page 89 and looked at the pictures, explain that there are two pictures to look at for each story.

USING PAGE 89

Ask the children to read the first story and be prepared to give the answer to the problem. Ask them to say the basic fact for the story ($6+2=8$). Then call their attention to the first two pictures. Have them tell which picture shows what is happening in the story. Be sure they can explain why the second picture is the correct choice. Now ask them what Don is doing in the other picture. Have them make a story somewhat like this: "There were 6 blocks on the table. Don took 2 of them away to give to Nancy. How many blocks were left on the table?" The children should then give the answer to the problem and supply the appropriate basic fact.

The other three stories on the page may be taught in the same way. Be sure that each child in the group has several opportunities to answer questions about the pictures and the problems.

Follow your usual procedures with the abstract problems at the bottom of the page. Let the children use markers to find the answers if necessary.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet like that described and illustrated on page 178 will give the children further practice in discriminating between addition and subtraction. Use addition and subtraction facts from any of the groups taught so far.

Charting the Course — The number system to 999

Any number, no matter how large, can be written using only the 10 numerals and the principles of the number system. When 10 tens is reached in the counting process, an entirely new word is used, namely, *hundred*. By using this new number word along with those already in use and the principles of the number system, it is easy to read numbers to 999. Thus the number 437, which could be read as "forty-three tens, seven" is usually read "four hundred thirty-seven." The reading or oral description of the larger numbers becomes lengthy or awkward if new number words are not introduced.

Children must learn to use the number word *hundred* in order to deal with larger numbers. They should know its meaning not only as the next number word after *ninety-nine*, but also as the name of a very special group—the group of 10 tens. They should learn how hundreds are indicated by place value in written number symbols. In short, their knowledge of the number system must be extended to cover the range from 99 to 999. The objective is not to have the children learn 900 numbers as more or less isolated numbers, but to learn the *principles of the system*. When 999 is reached, another new word is introduced *(thousand)*, and the system is again extended.

In *Numbers in Action* the extension of the number system to 999 is taught on pages 90 to 96. The learning experiences are organized by a plan similar to that used in the earlier work on the number system (pages 35-42). The child learns to think of 10 groups of 10 as a single group of 100 in connection with pages 90 to 92. He also learns how numbers in the hundreds are written using place value. On page 93 he learns to count by hundreds, and how the hundreds (100, 200, 300, etc.) are written. On page 94 the emphasis is upon counting by tens within the hundreds. The principles are further developed on page 95 by special attention to the effects of increasing a number by 1, then by 10, and finally by 100. Special attention is also given to decreasing a number by 1, by 10, and by 100 (page 96). These experiences enrich the child's understanding of the number system.

90 Grouping by tens and ones beyond 100

KNOWING YOUR OBJECTIVE FOR PAGE 90

The child has many experiences with groups of 10 as preparation for thinking of 10 groups of 10 as a single group of 100. By grouping objects, his counting experiences are now extended beyond 99; that is, he now works more than 9 groups of ten.

PREPARING FOR PAGE 90

Have available many sticks or other objects that can be tied into bundles of 10 each. It is desirable to have between 100 and 200 of these objects and enough rubber bands to fasten them in bundles. Good use can be made of boxes that are alike in size and shape and large enough so that each will hold 10 objects.

Provide a work sheet for each child. Each side of the work sheet should be divided into eight or more sections. In each section there should be a vertical line to provide a space for tens and a space for ones.

Arithmetic Readiness Cards Set 2: Number System[1] may be used in connection with this page. Use the pictures specified in "Applying the New Concepts and Skills."

INTRODUCING PAGE 90

Have the children look at this page and discover that the girl is counting the pencils and other objects. She is arranging the pencils in bundles of 10. Have them observe that the sticks also are in bundles of 10. Explain carefully that each package in the last picture holds 10 little candies.

USING PAGE 90

Call attention to the girl in the picture again and point out that she has some pencils left over after making as many bundles of 10 as she can. When the children have examined the picture and observed the work sheet in the picture, ask questions somewhat as follows: "What does each tally mark at the left of the line mean? [1 ten or one bundle of 10 pencils] How many tally marks has the girl made at the left of the line? Why? Why did she write 21 at the left of the line? [To tell that there are 21 tally marks] What do the 21 tally marks stand for?" Make sure the children understand that the girl has made one tally mark for each bundle of 10 pencils and try to get them to say "21 bundles of 10," or "21 tens." "Why has the girl made six tally marks at the right of the line? What does each tally mark mean? [1 pencil]"

Let two or three children arrange whatever objects are at hand into groups of 10. Then direct each child to make tally marks in one section of a work sheet to show how many tens and ones there are. He should also write numbers on his work sheet to show how many tallies he has for tens and for ones. Instead of bundles, boxes containing 10 objects each can be used for this activity.

Proceed in the same manner with the other two pictures on this page.

APPLYING THE NEW CONCEPTS AND SKILLS

The *Arithmetic Readiness Cards Set 2: Number System* (Pictures 16, 17, 18, 34, 35, 36, 52, 53, 54, 70, 71, 72, 88, 89, 90, 106, 107, 108) may be used at this time. The children can continue to use the work sheets referred to above. The cards may be set up against the blackboard or on a table or held up before the children. Have the children make tally marks on their work sheets for each card, indicating the groups of 10 and the ones. Be sure they notice that some of the bundles or boxes of 10 are in piles and that they make a tally mark for each 10. Finally, instruct them to write numbers to show how many tens and how many ones there are.

[1] *Arithmetic Readiness Cards Set 2: Number System*, by Maurice L. Hartung, Henry Van Engen, and Helen Palmer. Scott, Foresman and Co.

91 Grouping by hundreds, tens, and ones

KNOWING YOUR OBJECTIVE FOR PAGE 91

The child learns that 10 groups of 10 can be thought of as one group of 100. He also begins to learn how place value is used to indicate hundreds.

PREPARING FOR PAGE 91

Have available, if possible, a large quantity of objects that can be tied into bundles, as was done in the work for page 90. Use can also be made of the boxes of objects.

The same pictures from the *Arithmetic Readiness Cards Set 2: Number System* that were used in connection with page 90 can be used with this page.

Provide each child with a work sheet similar to the one used with page 90, but have two vertical lines in each section to provide spaces for hundreds, tens, and ones.

DEVELOPING VOCABULARY FOR PAGE 91

The words *hundred* and *hundreds* will be developed orally in connection with the work on this page.

INTRODUCING PAGE 91

Let the children look at this page and discover that the pictures show the same objects that were shown on page 90. Help them discover that the girl is putting 10 bundles of pencils in each pile, and (in the other pictures) has already put 10 bundles of sticks in each pile and 10 packages (each containing 10 objects) in each pile.

USING PAGE 91

Ask the children to look at the first picture and to explain how they know there are 10 bundles in each pile. They should know this because of their familiarity with the pyramid formation that has 4 on the bottom row. To help the children discover that the girl has 21 bundles of 10, have them count the bundles in each pile by tens. They should count "10, 20, 30, 40," etc. When they have said "90," tell them that the next number to say will be "one hundred." Tell them that 10 tens are called one hundred.

Have the children look at the work sheet at the lower right of the picture. Explain that the space at the left is for the hundreds and that the girl has made a tally mark there for each pile of 100. Be sure they understand that each of these 2 tally marks stands for 100 pencils or for 10 bundles of 10 pencils. Explain that the next space is still for tens. Have the children point out the bundle of pencils for which the tally mark stands. Ask them what this tally mark stands for and work for the answer "1 bundle of 10 pencils" or "10 pencils." Finally, explain that the space at the right is still for ones. Question them to bring out the idea that the girl has made 6 tallies in that space because she has 6 pencils that are not in bundles. Be sure they know that each tally mark stands for 1 pencil.

When the children have a clear understanding of the use of the three spaces and the tally marks in them, draw attention to the figures that the girl has written on her work sheet. Be sure they can explain why she has written the 2 (the 2 tally marks that mean 100), the 1, and the 6. They should be led to say that the 2 means 2 piles of 100 pencils each, the 1 means 1 bundle of 10 pencils (or 10 pencils), the 6 means 6 pencils.

Follow the same procedures with the other two pictures on the page. If possible, let two or three children arrange objects into bundles (or boxes) of 10 each and put these bundles into piles of 10 each (100 objects). Of course there should be some bundles (fewer than 10) left over from the piles of 100 and some objects (fewer than 10) not in bundles. Then give each child a work sheet. Tell the children to make tally marks in the space at the left for the hundreds, in the next space at the right for the tens, and in the next space at the right for the ones. Finally, direct them to write a number in each space to show how many tally marks they have made and to tell what each number means.

APPLYING THE NEW CONCEPTS AND SKILLS

Use the pictures from *Arithmetic Readiness Cards Set 2: Number System* that were listed for the work with page 90, together with the work sheets described previously and already used with this page. Put 10 or 12 cards up against the blackboard or on the table. For each card direct the children to make tally marks for the hundreds in the column at the left in one section of the work sheet, for the tens in the next column, and for the ones in the next column. Then direct them to write the numbers in the proper spaces to tell how many hundreds, tens, and ones are shown.

92 Grouping by hundreds, tens, and ones

KNOWING YOUR OBJECTIVE FOR PAGE 92

The child has additional experiences with groups of tens and hundreds. He also has experiences that lead to an understanding of a 3-digit number.

PREPARING FOR PAGE 92

The objects prepared for use with page 91 may be used in connection with this page.

The cards from the *Arithmetic Readiness Cards Set 2: Number System* specified for the work on pages 90 and 91 may also be used here.

Provide for each child a work sheet like the one described for use with page 91. (See page 250 under "Preparing for Page 91.")

INTRODUCING PAGE 92

Let the children look at the various pictures and talk about the objects shown—sticks, candleholders, clothespins, stick candy, packages of 10 pieces of candy. Help them to discover that there are groups or piles of 10 bundles (or packages) of 10 things each. Let them count the candle-

holders in the pile of boxes in the second picture as "10 (holders), 20, 30, 40," etc., to 100.

For the remainder of the number system sequence (ending on page 96), the section on "Introducing the Page" will be omitted, since, of necessity, the method of introduction will not vary greatly. However, always give the children a chance to talk about the pictures and decide what objects are being shown and what is being done with them.

USING PAGE 92

Ask the children to look at the first picture. Remember that the child should not be asked to count the bundled objects singly. He is to accept each bundle or package as 10. The objects in one bundle may be counted if the children insist.

Proceed somewhat as follows: "What do you see in this picture? [Sticks] What has been done with the sticks? [They have been put into bundles and piles.] How many sticks are in each bundle? How many sticks are in each pile? [Work for the answers '10 bundles of 10 sticks each' and '100 sticks'] John, count the sticks in the first pile by tens." Have the child count "10, 20, 30, 40," etc. This counting should not be necessary hereafter, since the children should accept each pile as 100.

Next direct the children's attention to the work sheet shown at the lower right in the picture. Ask such questions as: "Why are there 4 tally marks in the space at the left? What does each of these tally marks stand for? [100 sticks; 10 bundles of 10 sticks] Which sticks do they stand for? Why are there 5 tally marks in the next space? What does each tally mark stand for? [10 sticks; 1 bundle of 10 sticks] Which sticks do they stand for? How many tally marks are there in the space at the right? What does each tally mark stand for? [1 stick] Which sticks do these tally marks stand for? [Children should point to or refer to the 5 single sticks.]"

Now draw attention to the number in each space. Ask: "Why is 4 written in the space at the left? What does the 4 stand for? [400 sticks; 4 piles of 100 sticks each] Which sticks does it stand for? Why is 5 written in the next space? What does the 5 stand for? [5 bundles of 10 sticks; 50 sticks] Why is 5 written at the right? What does the 5 stand for?"

Finally draw attention to the number 455. Tell the children to read it "four hundred fifty-five." Let them talk about each figure in the number and show which sticks in the picture it stands for. Try to get such responses as "The 4 means 4 hundreds," "4 piles of 100 each."

Let the children make tally marks on their work sheets for the objects shown in the first three pictures on the page. Then proceed in the same manner with each of the other six pictures. When they have counted the tally marks and written the number in each column, have them write the entire number below and read it.

APPLYING THE NEW CONCEPTS AND SKILLS

The work begun on page 91 may be continued at this time with the cards from *Arithmetic Readiness Cards Set 2: Number System* that were specified for pages 90 and 91 (see pages 250 and 251 under "Applying the New Concepts and Skills"). Use the cards and work sheets as suggested for those pages.

93 Symbolism of the hundreds

KNOWING YOUR OBJECTIVE FOR PAGE 93

The child learns the symbolism of the hundreds (100, 200, 300, 400, etc.) and learns to say the hundreds in their proper order. He gains an understanding of the quantities these numbers represent and of the use of zero in both the ones' and the tens' columns.

PREPARING FOR PAGE 93

Provide at least 2 markers for each child.

A work sheet like the one described in "Preparing for Page 91," page 250, should be provided for each child.

If the activity mentioned in "Applying the New Concepts and Skills," page 253, is to be used, prepare these work sheets as described.

USING PAGE 93

Have the children open their books to page 93. Tell them that bundles and boxes of 10 objects each have been stacked in piles of 100 objects as on the preceding page. Help the children to discover that each picture on this page shows piles of 10 bundles (or boxes) and that there are no single bundles or single objects. Let them tell how many piles of 10 bundles appear in each picture. Be sure they understand that each pile contains 100 objects and that each box or bundle contains 10 objects. They should then be able to observe that the pictures are arranged in order —1 hundred, 2 hundreds, 3 hundreds, etc.

Give each child a work sheet divided into nine sections, each section of which is divided into three

spaces by two vertical lines. Call attention to Picture 1 and have them make 1 tally mark in the first column at the left. Explain to the children that no tally marks are written in the second column because there are no tens, and no tally marks are written in the third column because there are no ones. Then have them write the number 1 for the tally mark in the hundreds' column and zeros in the other two columns. Tell them that zero in the middle space means there are no tens, and zero in the space at the right means there are no ones. They should next write the number as 100.

Use the same procedure with the next picture. Before going on, have the children count the piles as "100, 200."

Treat the other pictures in the same way. Have the children count the piles in each picture as "100, 200, 300," "100, 200, 300, 400," and so on.

When the work with tally marks and numbers has been completed for the nine pictures, have the children match each number at the right of the page with the correct picture. They can do this by putting a marker on the picture and another marker on the number. Then let them practice saying the hundreds in order.

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a work sheet showing the numbers 100, 200, 300, etc., in rows in random order. Several sets of these numbers in irregular order can be included on the work sheet. Instruct the child to show by arrows the correct places for the numbers. In some of the rows of numbers omit a few and tell the children to write in the missing numbers.

94 Symbolism of the decades within any hundred

KNOWING YOUR OBJECTIVE FOR PAGE 94

The child combines his knowledge of the decade numbers (10 to 90) with what he has learned about the hundred numbers (100 to 900).

PREPARING FOR PAGE 94

Have enough markers available so that each child can have 2.

Provide for each child a work sheet with nine sections like the one used for pages 91, 92, and 93.

If the activity described in "Applying the New Concepts and Skills" is to be used, provide sufficient work sheets for all of the children.

USING PAGE 94

Have the children look at page 94 and ask questions to help them observe that in these pictures all the objects are included in packages or bundles of 10. Get them to discover that there are three large piles of 10 bundles (or 100 objects) in each picture. Also help them to see that each picture shows a different number of extra bundles of 10. They should understand that each package in Picture 7 contains 10 small packages. They should observe that the pictures are arranged consecutively by tens and that each picture shows one more group of 10 than the preceding picture.

Give each child a work sheet divided into nine sections with each section divided into three spaces for three-digit numbers. Call attention to Picture 1 and have the children make 3 tally marks in the first space at the left. Then, continuing with Picture 1, have them make 1 tally mark in the second column for the single bundle of 10. Next explain to the children that no tally marks are written in the third column because there are no ones. Then have them write the number 3 for the tally marks in the hundreds' column, the number 1 for the tally mark in the tens' column, and zero in the ones' column. Tell them that the zero in the space at the right shows there are no ones. Then ask the children to write the number 310.

Use the same procedure with each of the other eight pictures on the page.

When the work with tally marks and numbers has been completed for the nine pictures, have the children match the numbers at the left of the page with the correct pictures. This can be done with markers. Then have the children say these numbers in order.

Now tell the children to cover up two piles of 100 in each picture and say the number that tells how many objects there are (110, 120, 130, etc.). Next have them cover up one pile of 100 in each picture and say the number (210, 220, 230, etc.). Finally, have the children count by tens within each hundred without using the pictures. Be sure to give them experience in counting from a hundred to the next hundred by tens (270, 280, 290, 300, 310, etc.).

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a work sheet on which rows of the decade numbers are written in random order. For example, one row might contain 350, 370, 380, 360, 390, 400, 420, 410, 430. Tell the children to show the correct places for the numbers by using arrows. In some of the rows a few numbers may

be omitted. In these cases the children should write in the missing numbers.

95 Increasing groups by 1, 10, and 100

KNOWING YOUR OBJECTIVE FOR PAGE 95

The child learns the effects of adding a single object, a bundle of 10 objects, or a pile of 100 objects to a collection of objects. He continues to learn how the number symbol which represents a certain quantity is changed when the quantity is increased by 1, 10, or 100.

PREPARING FOR PAGE 95

Provide for each child a work sheet divided into 8 sections.

If the activity suggested in "Applying the New Concepts and Skills" is to be used, prepare the work sheets described on this page.

USING PAGE 95

Give each child a work sheet ruled off into 8 sections. Begin by calling attention to Picture 1 (the pictures can be referred to by color) and asking such questions as: "How many piles of 100 sticks are there? In the first section on your work sheet write the number that tells how many hundreds there are. How many separate bundles of 10 are there? There are how many tens? Write this number beside the 2. How many ones are there? Write this number beside the second 2. Be ready to read the number."

When the work sheets have been examined to find out if the children have written the number correctly, ask them to look at the single stick at the upper right of the page. Ask questions to help the children imagine that this stick has been placed with those in Picture 1. Continue asking questions to lead them to observe that while there are still 2 hundreds and 2 tens, there are now 6 ones. The new number is 226. Have the children write this new number under the 225 in the first section of their work sheets. Tell them to imagine that the 1 stick has now been put back in its place in the box at the upper right.

Next ask questions to help the children imagine that the bundle of 10 objects at the upper right of the page has been placed with those in Picture 1. See if they can discover that there are now 2 hundreds, 3 tens, and 5 ones. Have them write the new number (235) under the 226. Then tell them to imagine that the bundle of 10 sticks has been put back in its place.

Now ask questions to help the children imagine that the pile of 100 objects at the upper right of the page has been combined with those in Picture 1. Help them to see that there now are 3 piles of 100 objects, and that the number changes to 325. Have them write this number under 235. Tell them to "put back" the 100 sticks.

Use the objects in the three "orange" boxes in the same sequence with each of the other pictures on the page. In the section in the upper-right corner of the work sheet have the children write the number that tells how many sticks there are in all in the orange boxes of the book.

One more exercise can be used with the children in some groups. Tell them to imagine that the sticks in all three pictures at the upper right have been added to the sticks in each of the other pictures and to write the new numbers.

Let the children take turns reading the numbers as they write them on their work sheets.

Also have the children take turns counting the objects in the pictures by hundreds, tens, and ones. In the first picture, for example, they should count the objects by saying "100, 200, 210, 220, 221, 222, 223, 224, 225."

Give the children occasional exercises in writing numbers from dictation. They should be able to write any 3-digit number as it is dictated.

APPLYING THE NEW CONCEPTS AND SKILLS

Use work sheets on which numbers selected from 99 to 899 have been written in a column in a mixed sequence. At the right of these numbers provide three columns in which the children are to write new numbers. Instruct them to write in the first column the number that will result if 1 object is added to the objects represented by the number shown on the paper, in the next column the number that will result if a group of 10 things is added, and in the last column the number that will result if a group of 100 objects is added.

96 Decreasing groups by 1, 10, and 100

KNOWING YOUR OBJECTIVE FOR PAGE 96

The child imagines the removal of a single object or a group of 10 objects or a group of 100 objects from a collection of objects. He learns how the number symbol changes when a quantity is decreased by 1, 10, or 100.

PREPARING FOR PAGE 96

Have ready for each child a work sheet divided into 8 sections.

If the activity described on this page in "Applying the New Concepts and Skills" is to be used, provide the work sheets described there.

USING PAGE 96

Give the children work sheets that have been marked off into 8 sections. Tell them to open their books to page 96 and draw their attention to the first picture. Direct them to write (in the first section of the work sheet) the number that tells how many candleholders there are. Next tell them to imagine that one of the candleholders that is not in a box has been taken away. If necessary, let the children cover one of the candleholders in the picture with a piece of paper or their fingers. Have them write the number that tells how many candleholders there are now. They should write this number under the first one.

Then tell the children to imagine that a box of candleholders has been taken away. Direct them to write (under the other two numbers) the number that tells how many are left. Finally, have the children write a fourth number to indicate how many candleholders are left when they imagine that a pile of 100 has been taken away.

Treat each of the other pictures in the same way.

Continue to dictate numbers for the children to write. Also have them count by tens and hundreds, beginning at various points (90, 400, 750, etc.).

APPLYING THE NEW CONCEPTS AND SKILLS

Give each child a work sheet on which a column of 10 to 15 numbers (use a sequence within 101 through 999) is written in a haphazard order. Provide 3 columns at the right of these numbers in which the children are to write new numbers. Instruct them to write in the first column the number that will result if 1 object is removed from the objects represented by the number shown on the paper, in the next column the number that will result if a group of 10 objects is removed, and in the last column the number that will result if a group of 100 objects is removed.

Charting the Course — Money; counting by fives; the quarter

Learning to count by fives is usually considered one of the objectives of primary arithmetic. The reason for this is that the ability is useful when money is to be counted. The existence of the nickel and the quarter gives rise to situations that require counting by fives. There is no point to rote counting by fives. The ability should be learned in connection with counting the value of collections of coins.

The sequence of learning experiences should be as follows. Collections of pennies in groups of five should be counted so that the child will be aware that he is shortening the counting process. Then collections of coins including pennies (in groups of five) and nickels should be counted by fives. Next, extra pennies to be counted by ones should be included with the groups of five.

The quarter should be introduced and various ways of making up twenty-five cents using coins of smaller value should be considered. Finally, collections of coins which include pennies, nickels, dimes, and one quarter may be counted. The coins should be arranged so that they can be counted by tens, fives, and ones.

The sequence outlined above is followed on pages 97 to 103 of *Numbers in Action*. It should be noted, however, that the first and last pages of this section are devoted to more general types of problem situations in which the number facts and relations arise in connection with money.

97 Problems involving money

KNOWING YOUR OBJECTIVE FOR PAGE 97

The child learns to use money in problem situations involving addition, subtraction, multiplication, and division.

PREPARING FOR PAGE 97

Have on hand enough coins so that the children can make the combinations required in the problems. A few dimes and about fifty pennies should be sufficient.

Provide 6 markers for each child.

INTRODUCING PAGE 97

Ask the children to examine page 97. Have them discover that money is shown in each picture.

USING PAGE 97

When the children have examined the page, tell them to look at the story about the first picture and to read it to themselves. Be sure they understand that the first story includes the first three lines of reading material. After they have read the story and before they try to answer the questions, have them look carefully at the picture. Then proceed in this manner: "Look carefully at the picture and be ready to tell us the answer to the first line of the story. John, what is the answer? Now look at the next line. Be ready to tell us what belongs where the screen is in that line. Susan, what number belongs there? Now read the third line of the story. Be ready to tell us the answer and how you get it. What is the answer?" If necessary, have some pennies at hand and let the children act out this problem. Some of the children will get the answer at once by thinking additively. Help any who need it to "see" 6 pennies in all and to separate from the 6 pennies the 4 pennies Don has already put down.

Now direct the children's attention to the next story (the next four lines) and have them read it to themselves. Then, after they have looked at the picture, continue: "Be ready to answer the questions and give the missing number in the story. Look at the second line. What number belongs where the screen is? Look at the third line of the story. The picture tells you the answer to it. What is the answer? Read the last line of the story. Let's imagine that Carol has put her money in one group. How many pennies will be in the group?"

Next have the children read the third story and find the picture that goes with it. It may be necessary for them to use actual money and markers to represent the cookies before they can answer the question. Let the children discover that Billy will have 4 groups of pennies with 2 pennies in each group. They should be able to say that 8 equals 4 twos and to decide that Billy can buy 4 cookies with the money that he has.

Call the attention of the children to the fourth story and the corresponding picture. By this time they should understand that they can subtract from the 8 pennies as many pennies as there are dimes to find how many more pennies than dimes there are. That is, they subtract 3 pennies from 8 pennies to find the answer. If this is not clear to the children, give them coins. Have them match pennies to dimes and then move away a group of 3 pennies. The pictures and notes for page 63 make this procedure clear.

Continue in this way with the remaining two pictures and stories. End up with the abstract facts $8 - 5$ and $3 + 2$.

When all of the problems have been worked, ask the children to be ready to give the "number story" (that is, the basic fact) that belongs with each picture. For example, for the first picture, they should give $6 - 4 = 2$.

APPLYING THE NEW CONCEPTS AND SKILLS

Set up some situations similar to those in the pictures on page 97 and have the children react to each one by giving the abstract basic fact that corresponds to the situation. Coins should be used with this activity, if possible.

98 Counting money by fives

KNOWING YOUR OBJECTIVE FOR PAGE 98

The child learns how pennies and nickels can be arranged in groups for counting by fives and how to count by fives in a meaningful way.

PREPARING FOR PAGE 98

Provide 10 markers for each child.

If the activities suggested in "Applying the New Concepts and Skills" (page 257) are to be used, have on hand 10 nickels and 50 pennies and enough small objects to make 10 piles of 5.

INTRODUCING PAGE 98

Call the children's attention to the pictures of money and to the numbers at the top of the page. Let them discover that all the numbers up to 50 are there, that they are arranged in order, and that some of the numbers are red.

USING PAGE 98

Begin the lesson by asking the children to look at the first picture and to notice that the pennies are arranged in groups of 5. Then tell them that they are going to count this money by fives. Distribute markers and tell the children to put a marker on each group of pennies. Ask them to move the marker from the first pile of pennies to the red number 5 in the list of numbers. Make sure the children understand that they can put the marker on 5 because there are 5 pennies in the

group—one for each number up to and including 5. Now tell them to move the marker from the second pile of pennies to the list of numbers. Again be sure they understand that they can place the marker 5 numbers to the right (ahead) of the other marker (on 10) because there are 5 pennies in the pile. Proceed in this manner with the markers on each of the 10 groups of pennies. Be sure the children understand that the 5, 10, 15, etc., mean 5¢, 10¢, 15¢, etc.

When all of the markers have been placed on the red numbers, have the children remove them and, as they do so, read the red numbers consecutively (5, 10, 15, etc.). Next ask the children to say these numbers in counting as they point to, or look at, the piles of pennies—to say 5 for the first pile, 10 when they point to the next pile, 15 when they look at the next pile, etc.

Now call the attention of the children to the second picture in the first row. Have them put a marker on each nickel and be sure they understand that each nickel is equal to 5 cents. Now tell them to move the markers from the nickels to the red numbers, just as they did with the markers on the pennies. It must be made clear to the children that they can place the markers 5 numbers ahead each time because each nickel is equal to 5¢. When all of the markers have been placed on the red numbers, the children should remove them and read the red numbers consecutively (5, 10, 15, etc.). Then have them count the nickels as they point to them—5, 10, 15, etc.

Proceed in this way with each of the other pictures on the page, taking the markers from the coins and placing them on the red numbers and then reading the red numbers and counting the coins by fives.

APPLYING THE NEW CONCEPTS AND SKILLS

Let one child arrange the nickels and pennies on hand in piles of 5¢ for counting. See that this arrangement does not include a total of more than 50¢. Then let him count the money orally by fives for the group. Each child should have an opportunity to do this.

Then have a child arrange some small objects in not more than 10 piles of 5 each. He should next count the objects by 5 just as he has been counting the money. Each child should have one or more turns at doing this kind of counting.

99 Counting money by fives and ones

KNOWING YOUR OBJECTIVE FOR PAGE 99

The child learns how pennies and nickels can be arranged for counting by fives and ones and how to count money by fives and ones.

PREPARING FOR PAGE 99

Have on hand 11 markers for each child.

If the activity in "Applying the New Concepts and Skills" (page 258) is to be used, provide about 10 nickels and 50 pennies. The small objects suggested for page 98 may also be used.

INTRODUCING PAGE 99

Tell the children to open their books to page 99 and to look at the first picture. Get them to notice that nickels and pennies are shown. Tell the children that they are going to count this money.

USING PAGE 99

Distribute a set of markers to each child. Then tell the children to put a marker on each coin in the first picture. Have them move the marker from the first nickel to the number 5. Be sure they understand that the marker can be put on the red 5 because the nickel is equal to 5 pennies. Then have them move the marker from the second nickel to the red 10. Let them see that the 10 is 5 numbers ahead of the 5 and that the marker can be moved to the 10 because it represents a nickel or 5¢. They should next move the marker from the third nickel to the red 15.

Now by means of questions help the children to understand that the marker on the first penny is to be placed on the number 16. They should be made to see that this marker is put on the next number beyond 15 because the marker stands for a penny or 1¢. Then have them move the marker from the second penny to the number 17.

When all of the markers in the first picture have been moved to the list of numbers, ask the children to count the money, pointing to the nickels and pennies as they count. Be sure they count "5, 10, 15, 16, 17. There are 17 cents."

Next direct the attention of the children to the second picture. Have them put markers on each of the nickels and pennies, again making sure they know the value of the coins. The markers should then be moved from the nickels and pennies to the proper numbers in the list in the same manner as was done with the nickels and pennies in the first picture. When all of the markers have been moved to the list of numbers, have the children count the

nickels and pennies, saying "5, 10, 15, 20, 25, 26, 27, 28. There are 28 cents."

The children should proceed in this way with the next three pictures, moving the markers from the nickels and pennies, placing them on the proper numbers, and then counting the coins by fives and ones. When they come to the last picture, point out that there are no numbers in the list for the last 4 pennies in this picture. Have them count this money without the help of the numbers and markers.

APPLYING THE NEW CONCEPTS AND SKILLS

Have one child arrange coins so that they can be counted by fives and ones. The money arranged should not total more than 54¢. Then tell the child to count the money orally by fives and ones. The children should take turns at this kind of arranging and counting.

In the same manner let one child arrange small objects so they can be counted by fives and ones. The number of objects arranged should not exceed a total of 54. Have him count the objects by fives and ones. Each child should have one or more opportunities to arrange and count objects in this way.

100 – 101 Money; the quarter

KNOWING YOUR OBJECTIVE FOR PAGES 100-101

The child learns the value of the quarter and its relationship to the dime, nickel, and penny. He practices counting money by fives and also by tens and fives.

PREPARING FOR PAGES 100-101

If you plan to use the activity described in "Applying the New Concepts and Skills" (page 259), provide 9 dimes, 10 nickels, and 25 pennies.

DEVELOPING VOCABULARY FOR PAGES 100-101

Introduce the word *quarter* orally in connection with the work on this page. See that it is used in as many meaningful situations as possible.

INTRODUCING PAGES 100-101

Have the children examine the pictures on pages 100 and 101 carefully. Let them discover that Carol, Don, Billy, and Ellen are buying tops and books at the store. Let them identify the coins in the four pictures. Give help with the quarter if the children seem to need it.

USING PAGES 100-101

Call attention to the first picture on page 100. Get the children to observe that each top costs 25¢, that Don is going to buy a top, and that he is using a quarter to pay for it. Ask the children to look at Carol's money. They should count her piles of pennies by fives and observe that she, too, has 25¢ and that she is going to buy a top with the 25 pennies. This should make clear to them that a quarter and 25 pennies are equal in value.

Now have the children look at the next picture. Ellen and Billy are buying tops. Billy has a quarter. Let the children discover that Ellen has 5 nickels. Have them count the nickels by fives and in this way bring out the fact that 5 nickels and a quarter are equal in value.

Next call attention to the pictures of coins on page 100. Have the children count the pennies in the first picture by fives. They should count 5, 10, 15, 20 and say "20 cents." Then ask if this picture shows more or less money than a quarter and if there is enough money to buy a top.

Go on to the next picture of coins on page 100 and deal with it in the same manner—counting the money by fives, deciding whether there is more or less money than a quarter, and whether or not there is enough to buy a top. Use the same procedure for all the pictures of money on page 100. If two days are to be used for these pages, this is a good point at which to break the lesson.

Now tell the children to look at the first picture on page 101, in which Don and Carol are buying books. Be sure the children notice that the books are being sold for 25¢ each. They should observe that Don has a quarter to pay for his book. Let them find out that Carol has 2 dimes and a nickel. Show them how to count her money. See that they count the dimes first by tens and then count the nickel as 5 more. They should learn to say "10, 20, 25. She has 25 cents." Emphasize the fact that Carol's money is equal to Don's quarter.

Next tell the children to look at the second picture on page 101, in which Billy and Ellen are buying books. By questions help the children to see that Billy is buying his book with a quarter and that Ellen has a dime and 3 nickels. Show the children how to count Ellen's money by pointing to the coins and saying "10, 15, 20, 25. She has 25 cents." Emphasize the equivalence of Ellen's money and Billy's quarter. In the work with this page it is important that the children learn to count all the tens first and then continue by counting the fives.

Focus the children's attention in turn on each picture of coins on page 101. Have them count the money by tens and fives and then decide whether or not there is just enough, more than enough, or less than enough money to buy a book.

APPLYING THE NEW CONCEPTS AND SKILLS

Have the children arrange coins so they can be counted by tens and fives. The situations may be restricted so that the child does not need to count by fives beyond 50¢. In other words, by this time he should be able to count by tens to 90, by fives to 50, and by tens and fives to 50. Do not include the quarter among the coins to be counted.

102 Counting money by tens, fives, and ones

KNOWING YOUR OBJECTIVE FOR PAGE 102

The child learns to organize money in piles of 10¢ and 5¢ for counting. He learns to count money by tens, fives, and ones and also by tens and ones. He also counts money by starting with a quarter and saying "25 cents."

PREPARING FOR PAGE 102

The full-page frame can be used to good advantage with this page. If possible, provide one for each child. (See page 157 for information about procuring or making such a frame.) If the full-page frame is not available, use a single-view frame (described on page 157) or a marker.

If the activity suggested in "Applying the New Concepts and Skills" is to be used, provide coins amounting to about 2 dollars and a quarter—1 quarter, 10 dimes, 10 nickels, and 50 pennies.

INTRODUCING PAGE 102

Ask the children to look at the page and tell what coins are shown in the pictures. By this time they should be able to identify the quarter, dime, nickel, and penny without difficulty.

USING PAGE 102

Have the children place the frames on the page so that the circle is at the top. Let them observe that when the frame is in this position all the pictures except three show only nickels or pennies. Help the children discover that a quarter appears in each of the other three pictures.

Direct the children to count the money in the first picture at the upper left. Be sure that they count by fives and ones. If any of the children have difficulty in doing this, write the numbers from 1 through 50 on the blackboard. Use a different colored chalk for the numbers 5, 10, 15, etc., and show the children how to count this way, as was described in connection with the work for pages 98 and 99. Now direct the children to look at the picture at the upper right and to count the money in this picture. See that they begin to count with 25 (25, 30, 31, etc.). Make sure the children understand that they begin with 25 because the quarter is equal to 25¢. Ask them which of the two pictures shows more money.

Proceed in a similar manner with each of the other pictures. In each case have the children count the money and then compare the amount with the other amounts they have already counted. Give special attention to each picture that shows a quarter. The children should now be able to count by saying 25, 30, 35, etc. Before having the frames removed, ask which picture shows the most money and which one shows the least money.

Next have the children place the frames on the page with the star at the top. Get them to observe that these pictures show dimes, nickels, and pennies. Help them to decide that they should count this money by tens, fives, and ones. With the frame in this position treat each picture as described above for the first position of the frame.

The frames also may be placed on the page with the circle at the bottom and then with the star at the bottom, to vary the practice. Finally, the frames may be removed entirely and the children permitted to count the money in the pictures in the order in which they appear.

APPLYING THE NEW CONCEPTS AND SKILLS

Have the children arrange coins so they can be counted by tens, fives, and ones. The money arranged should occasionally include 1 quarter, but the arrangements should not require the child to count by fives beyond 50¢. Be sure that each child has an opportunity to count in this way.

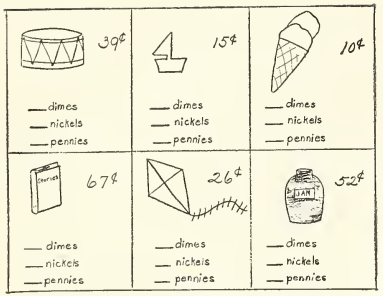
103 Problems involving money

KNOWING YOUR OBJECTIVE FOR PAGE 103

The child learns to solve problems that involve money.

PREPARING FOR PAGE 103

Provide enough coins so that the children who need extra help can dramatize the problems presented in the text and pictures—1 quarter, 2 dimes, 7 nickels, and 7 pennies.



If the work sheet suggested in "Applying the New Concepts and Skills" is to be used, prepare a copy for each child.

INTRODUCING PAGE 103

Ask the children to examine page 103 carefully. Let them talk about the toys that the children in the pictures are buying.

USING PAGE 103

Have the children look at Problem A, read it to themselves, and find the picture that belongs with it. When they have decided that the problem is about the animal cookies, tell them to be ready to answer the question. Then call on one child to give the answer. If the children are not sure of their answers, have them use coins.

Direct the children to look at Problem B and to use the appropriate picture to find the answer, just as they did for Problem A. Continue in this manner with the other problems on the page.

APPLYING THE NEW CONCEPTS AND SKILLS

To give the children further practice with money, the work sheet illustrated at the left is helpful. Prepare it as follows: Divide a sheet of paper into 6 or 8 sections and in each section draw or stamp a familiar object, such as a book, a ball, a kite, etc. Indicate also the amount of money needed to buy each object. In a column under each picture put the words *dimes, nickels, pennies*, preceded by a short line, on which the children write the number of each coin they would use if they were buying the article. Any combination of coins should be considered correct—for example, if the amount needed were 12¢, 1 dime and 2 pennies, 2 nickels and 2 pennies, or 12 pennies should be counted as correct.

Charting the Course — Fractions (one-half, one-fourth)

Many young children use the terms *one-half* and *one-fourth* without having clear ideas of what these terms really mean. Even older children and adults will often use the phrase "the bigger half." A beginning may be made in Grade Two toward helping the children develop a more precise meaning of these fractions.

The essential ideas are, first, a whole is in view or can be visualized; second, this whole is separated into a certain number of parts that are all equal; third, attention becomes focused on one or more of these equal parts. Children should have experience with these three ideas to enable them to have the concept of a fraction as a certain part of a whole. It is not desirable to introduce the symbols $\frac{1}{2}$ and $\frac{1}{4}$ in Grade Two, and certainly no attempt to compute with fractions should be made.

Page 104 of *Numbers in Action* introduces the fractions one-half and one-fourth. Page 105 is designed to develop the ability to discriminate between two parts that are halves of an object and two parts that are not halves, and similarly for the fourths.

104 Fractions; one-half and one-fourth of an object

KNOWING YOUR OBJECTIVE FOR PAGE 104

The child learns what is meant by one-half of an object and one-fourth of an object. He learns that when something is cut into halves one part is equal to the other part, and that when something is cut into fourths all parts are equal.

PREPARING FOR PAGE 104

Prepare a sufficient number of strips of paper so that all the children can have materials to divide into halves and fourths. Have on hand also some apples, dowel sticks, or other objects suitable for this purpose.

If the activity in "Applying the New Concepts and Skills" is to be used, provide the materials.

DEVELOPING VOCABULARY FOR PAGE 104

The new words that the children should learn to use orally with this page are *half, fourth, one-half,* and *one-fourth.*

INTRODUCING PAGE 104

Before referring to page 104 distribute among the children pieces of paper, dowel sticks, and any other materials you have that are suitable for cutting and dividing with scissors or coping saws. Set up situations that require "sharing" each of these objects between two, or among four, children.

USING PAGE 104

Call the children's attention to the first movie. In connection with the first picture let the children discover that Don is sawing a dowel stick into two parts. Have the children work in pairs or groups and let them cut their pieces of paper, dowel sticks, etc., into two parts. Try to get them to be critical about having the parts equal in size, and encourage discussion about it.

Then have the children look at the second picture in the movie and observe that the boys are finding out whether or not the parts of the dowel stick are equal in length. Bring out the fact that if the pieces are equal each piece is one-half of the stick. Have the pairs or groups of children put the two parts of their objects together to see whether or not they are equal. Then they should decide whether or not each part is one-half of the object.

Direct attention to the last picture. Be sure the children understand that the dowel stick is now in two pieces, that the pieces are equal in length, and that each piece is one-half of the original stick.

Proceed in the same manner with the second movie. Let the children observe the activity in the first picture and then perform this activity with dowel sticks or cardboard strips. Be sure they talk about fourths and discover that all fourths of the same thing are equal. Note that the fourths in the last movie result from cutting each half of the board into two equal parts.

APPLYING THE NEW CONCEPTS AND SKILLS

The flannel board, described on page 170, can be used to advantage in connection with this lesson. Prepare a quantity of cards showing cutouts of circles, squares, apples, pies, etc., and on the back of each paste a small piece of sandpaper to make it adhere to the flannel board. Some of the cards should show a whole object, some should show halves of objects, and some should show fourths of objects. These cards can then be put in piles on a table or desk—all the apples and their parts in one pile, the circles and their parts in one pile, and so on. Give the children such directions as the following: "John, make a circle on the flannel board using halves of circles. [John should select from the cards two pieces that can be put together on the flannel board to make a complete circle.] Helen, put a card on the flannel board that shows a whole pie. Mary, find a card that shows just one-half of this pie. Put it on the flannel board. Joe, find the other half of this pie and put it on the flannel board." Use similar procedures when dealing with fourths of the various objects you have prepared.

105 Practice with halves and fourths

KNOWING YOUR OBJECTIVE FOR PAGE 105

The child recognizes two parts of a thing that are halves and two parts that are not halves. Similarly, he recognizes four parts of a thing that are fourths and four parts that are not fourths.

PREPARING FOR PAGE 105

Provide a full-page frame for each child. (See page 157 for information about procuring or making such a frame.) If it is not feasible to supply this frame, either a single-view frame (see page 157) or a marker may be used. If the single-view frame or the marker is used, follow the same lesson procedure suggested for the full-page frame.

If the activity suggested in "Applying the New Concepts and Skills" (page 262) is to be used, prepare the work sheet described.

INTRODUCING PAGE 105

Let the children examine the pictures on page 105. Tell them that Don and his friends have been working with some objects they are going to use to make things.

USING PAGE 105

Place the full-page frame in position with the circle at the top. By questions get the children to observe that each object shown with the frame in this position has been marked off or cut into two parts. Note that in two cases the object is shown both before and after it has been cut. Tell the children that for each object they are to decide whether or not it has been marked or cut into halves. Call attention to the first picture and let

the children decide if the spool has been cut into halves. Encourage the children to give reasons for their decisions. Continue with a discussion of each picture shown with the frame in this position. In each case ask the children whether or not the object has been cut into halves and get them to explain why they think as they do.

Now place the frame on the page with the star at the top. Point out to the children that each object they see now has been marked or cut into four parts. They are to decide whether or not each object has been marked or cut into fourths. Urge the children to justify their decisions.

The frame also may be used in two other positions—with the star at the bottom and with the circle at the bottom. As the children look at the pictures, get them to make such statements as "The circle is not marked into halves," "The stick has been cut into fourths," "Each part of the board is one-half," etc.

If the single-view frame is used, direct the children to frame each picture you wish to have discussed. If neither type of frame is available, let each child use a marker to isolate the picture.

APPLYING THE NEW CONCEPTS AND SKILLS

On work sheets draw or stamp pictures of objects with lines indicating how they are divided. Some should be divided into halves, some into fourths, some into two parts that are not halves, and some into four parts that are not fourths. Direct the children to put a distinctive mark on each picture that shows the object divided into halves and another distinctive mark on each picture that shows the object divided into fourths.

Charting the Course — The 9 group

The 9 group is noteworthy because it is the only group represented by an odd number smaller than 10 which can be separated into equal subgroups. The 9 group can be separated into 3 groups of 3 each, and hence this group has one division fact. There is, of course, one corresponding multiplication fact, 3 threes equal 9.

Apart from these special features and its larger size, the 9 group is no different from the 3, 5, and 7 groups introduced earlier. Consequently, the same sequence of learning experiences may be followed. The ideas of combining action and separating action should by now be so familiar that the presentation of the 9 group can be condensed somewhat. There are new basic facts to be learned, but no new fundamental ideas need to be introduced along with these facts.

Numbers in Action presents the 9 group on pages 106 to 114. Combining action, both actual and imagined, is shown on page 106, followed immediately by separating action and comparisons on page 107. Addition and subtraction facts are both symbolized on page 108. Problem situations of the "how many more are needed" type using facts from the 9 group are given pictorially on page 109, followed by the corresponding symbolization on page 110. The single multiplication fact and the division fact are taught on page 111. Pages 112 to 115 provide both pictorial problems and problems requiring reading. Abstract practice with facts of the 9 group and other facts selected for review are also given on these pages.

106 The 9 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 106

The child practices combining actions for addition while learning the basic addition facts in the 9 group. The movie which illustrates $6 + 3$ shows completed action, but each of the other six pictures on the page requires the child to complete, in his imagination, the action that is indicated in the picture.

PREPARING FOR PAGE 106

The book *The Circus Baby* (item 6 in the bibliography) may be used to introduce page 106.

Have at least 9 small markers on hand for each child.

The activity described under "Applying the New Concepts and Skills" (page 263) will give practice in combining two groups to make 9. If this exercise is to be used, prepare enough work sheets so each child can have one.

INTRODUCING PAGE 106

If you have read or told *The Circus Baby* to the children, give them time to discuss the story. Then have them open their books to page 106 and tell them that the pictures show some toy circus animals that Carol and Don like to play with. Let the children talk about what they have seen at circuses, and then have them identify the animals in the pictures. Help the children to see that in each picture two groups are being combined to form a larger group.

USING PAGE 106

Direct attention to the first picture in the movie at the top of the page. Ask the children what they see in this picture and get them to discover that there are 6 toy horses in the first group and that Don is going to move 3 more horses over to the first group. By means of questions get the children to say that one must add the two groups to find how many toy horses there are in all. Next have the children look at the second picture and tell what has happened. [The toy horses are all together in one group, and there are 9 of them.]

Now tell the children to put markers on the toy horses in the first picture or on their desks to represent the situation shown in the picture. The markers should be moved together to show the completed action in the second picture. Encourage the children to make such statements as "6 horses and 3 horses are 9 horses," "6 horses plus 3 horses equal 9 horses," and "6 plus 3 equals 9."

Proceed with the other six pictures on the page in a similar manner, having the children show the action with markers on their books or desks. Make sure the children understand that they are adding the groups of objects shown in each picture. The pictures on page 106 show the facts $6 + 3$, $3 + 6$, $7 + 2$, $5 + 4$, $8 + 1$, $4 + 5$, and $2 + 7$, in that order.

APPLYING THE NEW CONCEPTS AND SKILLS

The work sheet described on page 183 may be adapted for use with this page. A key group of 1, 2, 3, 4, 5, 6, 7, or 8 objects is drawn or stamped in each small box. The child is to complete the 9 group by drawing the correct number of matching objects in the larger box. Be sure to use objects that children can easily draw.

107 The 9 group — separating into two groups; comparing groups

KNOWING YOUR OBJECTIVE FOR PAGE 107

The child learns to discriminate between situations in which he subtracts to find a remainder and situations in which he subtracts to find how many more there are in one group than in another. He also learns the basic subtraction facts for the 9 group. Both completed and imagined actions are shown.

PREPARING FOR PAGE 107

If you plan to use a story to introduce this page, the book *Circus Time* (item 7 in the bibliography) is suitable.

Provide 18 small markers for each child, 9 of one kind and 9 of another.

If the activity suggested under "Applying the New Concepts and Skills" (page 264) is to be used, have the necessary materials available.

INTRODUCING PAGE 107

If *Circus Time* has been read to the children, take time to talk about it. Then tell the children to open their books to page 107. Let them identify the various toy circus animals and objects shown in the pictures. Try to bring out the fact that in some of the pictures part of a group is being taken away from the whole group and that in other pictures two groups are being compared.

USING PAGE 107

Call attention to the first picture in the first movie at the top of the page. Ask the children what they see in this picture. Tell them that Don wanted to know how many more seals there were than clowns. Call attention to the second picture, where Don has arranged the clowns and seals in rows, with the clowns under the seals. Now he can see if there is a clown for every seal. Then ask the children if they can tell how many more seals there are than clowns. If necessary, let them put a marker on each seal and move the markers to the clowns until there is a marker on each one. They should then count the markers that have not been moved.

Next ask the children to look at the last picture in the first movie. Tell them that this picture shows why Don could subtract 5 seals from 9 seals to find how many more seals than clowns there are. Ask them what Don is doing. [He is taking 5 seals away; 4 seals are left. There are 4 more seals than clowns.] Make clear to the children that Don subtracted 5 seals because that is the number of seals equal to the number of clowns. Again the children may work out the problem with markers, using

one kind of marker to represent seals and the other kind to represent clowns. Then require them to make the statements "9 seals minus 5 seals are 4 seals" and "9 minus 5 equals 4."

Now have the children look at the second movie. Ask them what is happening in the first picture. They should be able to say that there are 9 elephants in all and that 3 elephants are being taken away. Then ask what the second picture shows. [6 elephants are left.] Have the children show the action with markers on their desks. Be sure they realize that they are subtracting to find how many are left. Urge them to make statements such as "9 elephants minus 3 elephants equal 6 elephants" and "9 minus 3 equals 6."

The other pictures on the page suggest similar problems and may be handled in much the same way. For each picture have the children describe in detail what they see and then decide whether they should find how many are left or how many more there are in one group than in another. [The questions are: How many more seals are balancing balls than are not? How many lions are left? How many dogs are left? How many more barrels are there than stands?] The children should use markers on their desks to show how each problem can be solved and orally give the basic facts represented.

APPLYING THE NEW CONCEPTS AND SKILLS

If the flannel board described on page 170 is available, it can be used again here. Have on hand a collection of paper cutouts, such as dogs and cats. Paste a strip of sandpaper to the back of each cutout so it will adhere to the flannel. Have the children make up stories about the cutouts. For example, John might choose to tell a story about how many dogs and cats he saw at the pet store. He would then put 9 dogs on the flannel board. Underneath them he would put 7 cats. He would then say "How many more dogs are there than cats?" and give the answer. John would then be asked, "Now what is the number story?" He would say "$9 - 7 = 2$." Control the activity so that the 9 group is emphasized, but do not confine the work exclusively to this group.

108 The 9 group — symbolism of addition and subtraction facts

KNOWING YOUR OBJECTIVE FOR PAGE 108

The child learns to use the symbolism of the addition and subtraction basic facts for the 9 group. He imagines the completion of the actions indicated in the pictures and uses the pictures to answer the questions in the problems. The work includes both "remainder" and "how many more than" situations.

PREPARING FOR PAGE 108

The book *Little Circus Dog* (item 17 in the bibliography) may be used to introduce the page.

Provide 18 markers for each child, 9 of one kind and 9 of another kind.

If the work sheet referred to on this page under "Applying the New Concepts and Skills" is to be used, provide a copy for each child.

INTRODUCING PAGE 108

Read or tell *Little Circus Dog* to the children. Then let them look at the toy animals and balls in the pictures on page 108. They may want to talk further about experiences they have had at the circus. Have the children examine each picture, and then tell whether they think it shows adding or subtracting and why they think so.

USING PAGE 108

Call attention to the first picture and ask the children what they see. Have them read to themselves the story which describes the picture and help them find in the picture the missing numbers and words. With each of the following stories have the children read it first to themselves. Then have each story read aloud, line by line. The reader should give the answer or supply the missing words and numbers after examination of the appropriate picture. The children should illustrate each situation with markers on their desks, as they did in previous lessons.

Pay special attention to the two pictures showing comparison (the picture of balls at the top; the toy dogs and toy stand at the bottom). The children should realize that they are to find how many more blue balls there are than red balls. They should understand why 7 blue balls are subtracted from 9 blue balls. They should know that they subtract 7 blue balls because there are 7 red balls.

APPLYING THE NEW CONCEPTS AND SKILLS

For further practice with the basic facts for the 9 group, rule sheets of paper into 8 or 9 sections. In each section draw or stamp groups of objects, some of which are to be crossed out if subtraction is indicated by the basic fact written below the pictures, and more of which are to be

drawn if the basic fact indicates addition. A complete description of a similar activity is given on page 178.

109 The 9 group — how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 109

The child has more experience with subtraction to find "how many more are needed." The work is confined to the 9 group. The pictures show completed action and illustrate the following basic facts: $9 - 6$, $9 - 4$, $9 - 7$, $9 - 3$.

PREPARING FOR PAGE 109

Provide 9 small markers for each child.

If the activity described in "Applying the New Concepts and Skills" is to be used, prepare the work sheets.

INTRODUCING PAGE 109

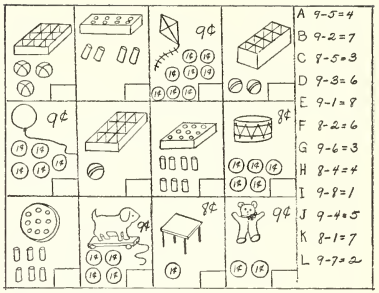
Direct the children to open their books and look at page 109. Let them talk about the pictures. Help them to discover that in the first picture of each movie more objects are needed to fill the boxes.

USING PAGE 109

Call attention to the first picture in the first movie. By questions bring out the fact that there are not enough toy barrels to fill all the spaces in the box. Try to get the children to make statements like "There are 9 spaces and only 6 barrels." Proceed somewhat as follows: "How many more barrels are needed to fill the box? Look at the next picture. How many barrels do you see? How many barrels were there at first? 9 barrels equal 6 barrels and how many more barrels? How many more barrels were needed? Is Don bringing in the correct number of barrels in the second picture?" Let the children use markers to show the situation. Be sure they understand that Don needs 9 barrels in all. Direct them to put down markers for the 6 barrels Don had to begin with. Then have them put more markers with the 6 until they have 9. Ask them how many more Don brought in, or added, to the 6 he already had. Get them to answer the question "6 barrels and how many more barrels are 9 barrels?"

Now have the children look at the last picture in the first movie. Tell the children that this picture shows why they can subtract 6 barrels from 9 barrels to find how many more barrels are needed. Get them to understand that they should subtract the number of barrels they have from the total number of barrels needed to fill the box. To do this, direct their attention to the 9 markers they have that represent the barrels. Then have the children cover up with one hand the 3 markers that represent the barrels that were brought in, leaving the markers for the 6 original barrels in view. Ask the children if they can "see" or imagine all the barrels. Then have them move the 6 exposed markers (barrels) away, saying "9 minus 6 is how many?" Finally they uncover the 3 hidden markers (barrels) to show the answer.

Continue with the other movies in the same manner. Encourage the children to use markers to show the imagined action of bringing in additional objects (Picture 2) and the removal of the original objects (Picture 3). Notice that the picture corresponding to Picture 2 in the first two movies is omitted from the last two movies.



APPLYING THE NEW CONCEPTS AND SKILLS

For further practice on "how many more are needed" situations, the work sheet illustrated above may be used. Each of the 12 sections shows a situation that illustrates one of the basic facts at the right. For example, 9 spaces and 3 balls illustrate the basic fact $9 - 3 = 6$. The child is first to find the basic fact that each situation illustrates. He then writes in that section the letter that identifies the basic fact. Note that subtraction facts from the 8 group may be included.

110 The 9 group — how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 110

The work on this page provides the child with more practice with the additive idea involved in finding how many more are needed and further

experience in seeing why he can subtract to find the needed quantity. The subtraction facts from the 9 group are used.

PREPARING FOR PAGE 110

Provide enough markers so that each child may have 9.

The book *Chirp, a Little Clown in a Big Circus* (item 5 in the bibliography) may be used to introduce this page.

INTRODUCING PAGE 110

If you have read *Chirp, a Little Clown in a Big Circus* to the children, let them talk about the story. Then have them open their books to page 110 and identify and talk about the toys in the pictures.

USING PAGE 110

Ask the children to look at the first picture and tell what they see. Direct them to read the first story to themselves and tell them that they can find the missing numbers by studying the picture. Then have the story read aloud and the missing numbers and words supplied.

If necessary, permit the children to illustrate the situation in the picture with markers on their desks. Make sure the children understand that Don needs 9 dogs to fill the box. Let them put down 6 markers to represent the number of dogs Don has and then add more markers until they have 9. Then ask them how many more were added to the 6 to make 9.

Have the children cover the 3 brought in and still think of the 9. In other words, get them to visualize the total needed number even when the 3 that were brought in are covered. Then have them move away the 6 markers representing the original dogs and think, "9 minus 6 is 3." Finally, as a check on the answer, have them uncover the 3 brought in.

The other three pictures and stories on the page may be handled in a similar way.

The children should respond orally to Problems A to R below the stories. For further practice they may copy the problems and write the correct numbers in place of the screens, or they may write the letters A to R in a column on their papers and write the answer for each problem opposite its letter.

APPLYING THE NEW CONCEPTS AND SKILLS

Any of the activities suggested for similar preceding pages (see the lesson notes for pages 76 and 77 on page 239, for example) may be used in connection with this page.

111 The 9 group — equal groups; combining and separating

KNOWING YOUR OBJECTIVE FOR PAGE 111

The child has further experiences with the concepts of multiplicative and divisive actions. He learns that 3 threes are 9 and that 9 can be separated into 3 threes. He also learns the symbolism for the multiplication and division basic facts of the 9 group (3 threes = 9 and 9 = 3 threes).

PREPARING FOR PAGE 111

The book *Barney's Adventure* (item 2 in the bibliography) may be used to introduce this page.

Provide 9 small markers for each child.

INTRODUCING PAGE 111

If the children have heard *Barney's Adventure*, let them talk about the story. Then have them open their books to page 111 and look at the pictures. Get them to discover that the first movie (the toy dogs) and the first picture at the bottom of the page show groups coming together and that the second movie and the last picture at the bottom show groups being separated into smaller groups.

USING PAGE 111

Ask the children to look at Picture 1 in the first movie. They should discover that there are 3 groups of dogs, with 3 dogs in each group. Then ask the children to look at the second picture and tell what has happened. [The dogs are together in one group, and there are 9 of them.] Now have the children read the story silently and be prepared to answer the questions and supply the missing number and word. Then have the children take turns reading a line at a time aloud and giving the answers. Let them use markers on their desks to repeat the action in the movie, if necessary.

Next direct their attention to the first picture in the second movie. Establish the fact that there are 9 clowns. Tell the children that the clowns are just ready to separate into groups of 3 clowns each. Then have the children look at the second picture and tell what they see. Direct their attention to the second story, which they should read, first silently and then aloud. If necessary, have them repeat the action with markers as they answer the questions in the story.

Note that in the first picture at the bottom of the page equal groups of clowns are coming together and that in the last picture the balls are

already separated into equal groups. Be sure the children understand and use the statements "3 threes = 9" and "9 = 3 groups of three." Have the last two stories read and the questions answered in the usual way.

Complete the lesson by having the children respond orally to Problems A to H below the stories. Note that facts from the 4, 6, and 8 groups are included.

APPLYING THE NEW CONCEPTS AND SKILLS

Any activities suggested for pages 78, 79, and 80 are suitable for use with page 111. See "Applying the New Concepts and Skills," on pages 240, 241, and 242.

112 The 9 group — pictorial problem situations

KNOWING YOUR OBJECTIVE FOR PAGE 112

The child has further practice with additive and subtractive situations involving the 9 group.

PREPARING FOR PAGE 112

The book *Little Moo and the Circus* (item 20 in the bibliography) may be used to introduce this page.

Provide a full-page frame and at least 9 markers for each child. If the full-page frame is not available, use a single-view frame or a marker.

If the exercise in "Applying the New Concepts and Skills" is to be used, see that sheets of transparent paper are available.

INTRODUCING PAGE 112

If you have read or told *Little Moo and the Circus* to the class, let the children talk about it. Then have them open their books to page 112. Let them examine the pictures and talk about the objects shown. Be sure they realize that some of the pictures show combining action and some of them show separating action.

USING PAGE 112

Tell the children to place the frames on the page with the circle at the top. Get them to observe that all the pictures they see with the frame in this position show the combining of groups. Call attention to the first picture and encourage them to make the statements "7 elephants and 2 elephants equal 9 elephants" and "7 plus 2 equals 9." Proceed in the same manner with the other seven pictures visible with the frame in this position. Have the children tell what they see in each picture and state the basic fact that applies to it.

Then have the children place the frames on the page with the star at the top. Be sure they see that these pictures are different from the ones just studied because groups of objects are now being separated into subgroups. Have them look at the pictures one at a time, describe what they see, and give the correct basic fact (for example, 9 balls minus 7 balls equal 2 balls, and 9 minus 7 equals 2). Let the children show the actions with markers, if necessary.

Next ask the children to place the frames so that the circle is at the bottom. Now pictures showing both combining and separating actions are visible. Direct attention to the problems with blue letters at the top of page 113. Get the children to notice that Problems A to H are about addition, Problems I to P are about subtraction, and Problems Q and R are about combining equal groups and separating into equal groups. Ask the children to look at the first visible picture and find the problem at the top of page 113 that fits the picture (Problem J). Then have them find the problems that fit the other seven pictures shown with the frame in this position.

The frames may also be placed so that the star is at the bottom and the appropriate problems located on page 113 for the pictures shown with the frames in this position.

If a single-view frame or a marker is used to isolate the pictures, follow the same procedures.

APPLYING THE NEW CONCEPTS AND SKILLS

The problems at the top of page 113 may be used in another way for further practice with the facts for the 9 group. Help the children fasten sheets of transparent paper to page 112 in their books with paper clips or spring clamps. Tell them to look at each picture, find the problem on page 113 that fits the picture, and then write the letter of the problem on the transparent paper over the picture.

113 Review

KNOWING YOUR OBJECTIVE FOR PAGE 113

The child practices (1) the basic facts and (2) the money and measurement relationships taught thus far.

PREPARING FOR PAGE 113

Provide 9 small markers for each child.

Provide for each child a copy of the work sheet described in "Using Page 113."

If the work sheet suggested in "Applying the New Concepts and Skills" is to be used, have copies on hand for all of the children.

USING PAGE 113

Tell the children to open their books to page 113. Call attention to Problem A in the columns of problems with red letters. Ask the children to read the problem to themselves and supply any missing number or number word. Then ask one child to read the problem aloud. Proceed with each of the problems in the same way in either alphabetical or random order.

Problems A to V (gray letters) in the next column may be handled in the same manner. If necessary, let the children use markers to find the answers.

Now distribute to the children work sheets with the letters A to T written in one column and the letters A to V written in another column. Leave enough space after the column A to T for the children to write a basic fact. They should copy each fact and put in the missing number or number word. For Problems A to V the children should write the answers only. Remind them that when they come to a wavy line they are to complete the statement. For Problem J they should write "7 toy houses," not just "7."

APPLYING THE NEW CONCEPTS AND SKILLS

For further practice with the basic facts a work sheet similar to the one described and illustrated on page 178 may be used. Include addition and subtraction facts from each of the groups studied so far.

114 Pictorial problem situations and practice

KNOWING YOUR OBJECTIVE FOR PAGE 114

The child reacts to additive, subtractive, and comparative situations using all the groups taught thus far. He also has more experience in the symbolism of the above situations.

PREPARING FOR PAGE 114

Provide 18 markers for each child, 9 of one kind and 9 of another.

Prepare copies of the work sheet described in "Applying the New Concepts and Skills" if the activity described there is to be used.

INTRODUCING PAGE 114

Let the children look at the toy animals and objects in the pictures on page 114. Have them examine each picture and tell whether they think it shows adding or subtracting.

USING PAGE 114

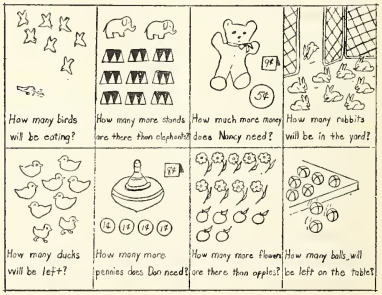
Call attention to the first picture and ask the children what they see. Have them read to themselves the story that describes the picture and tell them to be ready to give the answer. Then ask one child to read the story aloud, line by line, giving the answer and supplying the missing words and numbers as well as the reason for adding. Let the children use markers to illustrate the situation if they wish.

Proceed with each of the other pictures in the same manner.

Be sure the children realize that they are comparing dogs and elephants in Picture 3 (Problem C), and that, to do so, they should subtract as many dogs as there are elephants. The situation is similar in Picture 8 (Problem H). In Picture 4 (Problem D) the children should understand that they subtract from the total of 9 dogs needed the number of dogs there are to begin with. The stands in the picture are used only to determine the total number of dogs needed.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet similar to the one illustrated below will test the children's recognition of the problem situations encountered in this lesson. Divide the sheet into 6 or 8 sections. In some of the sections draw or stamp pictures indicating action in which one group is being separated from a larger group. In other sections show two groups of objects that are to be compared. In still another section or two show pictures of objects with signs saying that the objects cost 9¢ or 8¢ and by means of circles labeled 5¢ and 1¢ (to represent nickels and pennies) show the amount of money on hand. In any remaining sections show pictures indicating action by which one group of objects



is joining another group. In each section print or write a question such as "How many cats will be left?" "How much more money does John need?" "How many more balls are there than bats?" The children will then write each answer in a space provided in each section.

115 Review

KNOWING YOUR OBJECTIVE FOR PAGE 115

The child practices his knowledge of the basic facts learned thus far in connection with situations involving money and measurement.

PREPARING FOR PAGE 115

If the work sheet described in "Applying the New Concepts and Skills" is to be used, provide a copy for each child.

INTRODUCING PAGE 115

Let the children examine the page and talk about the various objects shown in the pictures.

USING PAGE 115

When the children have had an opportunity to discuss the pictures in general, call attention to the first picture. Have them read Problem A to themselves and tell them to be ready to give the answer. Then ask one child to read the problem aloud and give the answer.

Direct the children to look at Problem B and let them discover that the first picture applies to this problem also. Ask them to read it to themselves and then call on one child to read it aloud and give the answer. Continue in this manner with each problem on the page.

When the children come to Problems E, F, G, and H, encourage them to think in terms of twos. Try to get them to see the relationship between the statements "3 quarts equal 6 pints" and "3 twos equal 6," and also between "8 pints equal 4 quarts" and "8 equals 4 twos." For Problem L ask the children which of the rabbit hops in the picture represents 2 feet and which represents 3 feet. For Problem M let them mark off a space on a piece of paper or cut a piece of paper equal in length to the large box and then mark off the length of the small box on it as many times as possible. Some children may cut 3 or 4 pieces of paper equal in length to the small box and then place the pieces on the big box.

APPLYING THE NEW CONCEPTS AND SKILLS

Make a work sheet similar to the one described for page 114. This one, however, should be limited to pictures dealing with money and measurement. For example, in some of the sections have objects marked with signs showing their cost and coins to indicate how much money Don has. In other sections show a comparison of pint and quart containers, and in others show lines or objects for the children to measure and compare. Then write a suitable question in each section.

Charting the Course — The 10 group

The 10 group plays a central role in the number system. From the standpoint of the basic facts which belong to it, however, there is little to distinguish it from the 8 group. The same sequence of learning experiences used earlier should be followed in learning the basic facts for the 10 group. These steps should by now be familiar, and they will not be outlined again here.

There is one issue which must be discussed. In the first 127 pages of *Numbers in Action* the basic facts are not written in the vertical arrangement. Actually, there is no need to write basic facts vertically. The vertical arrangement of larger numbers for computation is a convenient device, but vertical arrangement of the *basic facts* has no special advantages. In Grade Two the emphasis should be upon the meaning of addition and subtraction in terms of the actions they represent. These actions are symbolized by special marks (+, −) between the numbers which represent the groups. The various possible arrangements of number symbols for computational purposes can best be presented to the children at the time when they are being taught how to compute. Nevertheless, in view of the fact that children may see the vertical arrangement of basic facts in published tests or in other materials, they should know how to deal with it. For this reason the vertical arrangement is shown on page 128.

116 The 10 group — combining two groups

KNOWING YOUR OBJECTIVE FOR PAGE 116

The child recognizes the additive actions involving the basic addition facts for the 10 group. He is required to respond when both completed action and imagined action are shown.

PREPARING FOR PAGE 116

The story "The Hollyberrys' Garden" in *The Hollyberrys* or the story "Seeds for Sale" in *Happy Days in the Garden* (items 14 and 10 in the bibliography) may be used to introduce page 116.

Provide 10 small markers for each child.

Prepare the work sheet described in "Applying the New Concepts and Skills" if you wish to use this exercise, and have on hand enough copies for all the children.

INTRODUCING PAGE 116

Read or tell either "The Hollyberrys' Garden" or "Seeds for Sale" to the children if possible. Let the children talk about their own gardening experiences if they wish. Then have them look at the pictures on page 116 and tell them that Don and his father are working in their flower garden. They are arranging some packages of flower seeds and getting some plants ready to set out. Let the children identify, if they can, the kinds of plants in the pictures and help them to see that in all the pictures one group is being combined with another group.

USING PAGE 116

Call attention to the first picture in the movie at the top of the page. Let the children discover that there are 6 packages of seeds on the ground and that Don is dropping 4 more packages. Then have them look at the second picture and tell what has happened. [The packages of seeds are all together in one group and there are 10 of them.]

Next have the children put markers on the packages of seeds in the first picture and move them together to show the completed action in the second picture. Help them to make such statements as "6 packages and 4 packages are 10 packages," "6 packages plus 4 packages equal 10 packages," and "6 plus 4 equals 10."

Follow similar procedures with the other six pictures on the page, having the children show the action with markers on their books. Stress the fact that adding is taking place in each picture. The facts for $6 + 4$, $3 + 7$, $5 + 5$, $8 + 2$, $7 + 3$, $1 + 9$, and $4 + 6$ are illustrated. The other addition facts for the 10 group ($9 + 1$ and $2 + 8$) are illustrated on page 118.

APPLYING THE NEW CONCEPTS AND SKILLS

Make a work sheet divided into 6 or 8 sections. In each section put drawings of two or more groups of from 1 to 9 objects. The child is to encircle pairs of groups in each section that make a total of 10. For example, in the first section of the work sheet there might be the following groups of balls: 3, 5, 6, 7, 4, 1. Arrange them so the child can encircle the pairs that make 10. In this arrangement he can encircle the groups of 6 and 4 and the groups of 7 and 3. He should be told to expect that some will be left over. Be sure the children understand that they must encircle only *pairs* of groups.

117 The 10 group — separating into two groups; comparing

KNOWING YOUR OBJECTIVE FOR PAGE 117

The child learns to discriminate between (1) situations in which he subtracts to find a remainder and (2) situations in which he subtracts to find how many more there are in one group than in another. At the same time he learns some of the subtraction basic facts for the 10 group. Both completed and imagined action are shown.

PREPARING FOR PAGE 117

The poem "Growing" from *Living Together at Home and at School* (item 21 in the bibliography) may be used to introduce this page.

Provide 20 small markers for each child, 10 of one kind and 10 of another.

If you wish to use the activity described in "Applying the New Concepts and Skills" (page 271), have the flannel board and a quantity of paper cutouts on hand.

INTRODUCING PAGE 117

Read the poem "Growing" to the children. Then tell them that page 117 shows some of the early vegetables and flowers that Don and his father picked in their garden. Let the children try to identify the radishes, onions, tulips, and irises in the pictures. Help the children to discover that in some pictures a group is being separated from a larger group, while in other pictures two groups are being compared.

USING PAGE 117

Direct attention to the first picture in the first movie at the top of the page. Tell the children that Don wanted to know how many more onions

there were than radishes. In the second picture he has arranged the radishes in a row under the onions to make it easier to compare them. Then ask the children if they can tell how many more onions there are than radishes.

Next ask the children to look at the last picture in the first movie. Tell them that this picture shows why Don could subtract 3 onions from 10 onions to find how many more onions than radishes there were. Ask them what Don is doing. [He is taking 3 onions away; 7 onions are left. There are 7 more onions than radishes.] Help the children to see that Don subtracted 3 onions because that is the number of onions equal to the number of radishes. If necessary, let the children put a marker on each onion, move the markers to the radishes until there is a marker on each radish, and count the markers that are not moved. Then have the children make such statements as "10 onions minus 3 onions equal 7 onions" and "10 minus 3 equals 7."

Now have the children look at the second movie. Ask them what is happening. They should be able to say that there are 10 radishes in all; that 5 radishes are being taken away; and that 5 radishes are left. If necessary, have the children show the action with markers. Be sure they realize that they are subtracting to find how many are left. Encourage them to make the statements "10 radishes minus 5 radishes equal 5 radishes" and "10 minus 5 equals 5."

The other pictures on the page suggest similar problems and are to be taught in the same manner. Have the children describe in detail what they see in each picture and then decide whether they are going to find how many are left or how many more there are in one group than in another. [Typical questions are: How many tulips are left in the last picture in the second row? How many more purple irises are there than red tulips? How many tulips are left in the second picture in the last row? How many more yellow irises are there than purple irises?] The children should use markers on their desks to show how each problem can be solved and should also give the basic fact represented.

The pictures on this page illustrate the subtraction facts for 10 — 3, 10 — 5, 10 — 1, 10 — 7, 10 — 2, and 10 — 6. The other subtraction facts for the 10 group are shown on pages 118 and 119.

APPLYING THE NEW CONCEPTS AND SKILLS

The flannel board, described on page 170, may be used here if it is available. Have on hand a collection of paper cutouts—perhaps flowers or vegetables, or whatever the stories require—with strips of sandpaper pasted on the back. Have the children take turns telling stories about plants in a garden. For example, Helen might say that she picked 10 tulips and 7 irises. She would then put these flowers on the flannel board and say "How many more tulips did I pick than irises?" and give the answer. She would then be asked "Now what is the 'number story'?" and she would say "10 minus 7 equals 3." Supplement the activity with stories of your own to make sure the children practice all the subtraction facts illustrated on page 117.

118 The 10 group — symbolism of addition and subtraction facts

KNOWING YOUR OBJECTIVE FOR PAGE 118

The child uses the symbolism for the addition and subtraction basic facts for the 10 group. He visualizes the action indicated in the pictures as completed and uses the pictures to help answer the questions in the problems.

PREPARING FOR PAGE 118

If possible, have on hand the book *The Little Gardeners* (item 18 in the bibliography) to read or tell to the children.

Provide 20 markers for each child, 10 of one kind and 10 of another kind.

Prepare copies of the work sheet described in "Applying the New Concepts and Skills" (page 272) if you wish to use this exercise.

INTRODUCING PAGE 118

The Little Gardeners can be used to advantage to introduce the lesson.

Let the children look at the plants and flowers in the pictures on page 118 and permit them to talk about gardens if they wish. Have them examine each picture carefully and tell whether it shows an additive, subtractive, or comparison situation. Let them explain how they distinguish among these situations.

USING PAGE 118

Call attention to the first picture. Then ask the children to read to themselves the story that describes the picture and be ready to give the answer. Have one child reread the story aloud, line by line, supplying the missing numbers. Continue in this manner with each picture on the page.

Let the children illustrate the situations and show the actions by using markers on their desks if they wish.

Be sure they realize that they are comparing the blue flowers and the white flowers in the second picture and that they should subtract as many white flowers as there are blue flowers. The same situation occurs in Picture 6 (as many red peonies are subtracted as there are white peonies).

APPLYING THE NEW CONCEPTS AND SKILLS

Make a work sheet divided into 6 or 8 sections. In half of the sections draw or stamp pictures indicating action in which one group is being separated from a larger group. In the other sections show two groups of objects that are to be compared. Use the basic facts of the 10 group. In each section print or write a question such as "How many flowers will be left?" and "How many more big flowers are there than little flowers?" Then provide a space below in which the children may write the answer.

119 The 10 group — how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 119

The child reviews the thinking involved in "how many more are needed" situations. The work is confined to the 10 group. The pictures show completed action and illustrate the following basic facts: 10 — 4, 10 — 9, 10 — 5, 10 — 8.

PREPARING FOR PAGE 119

Have on hand at least 10 small markers for each child.

If you wish to use the work sheet described in "Applying the New Concepts and Skills," prepare a copy for each child.

INTRODUCING PAGE 119

Tell the children to open their books to page 119. Again let them talk about the plants in Don's garden and help them identify the petunias, cabbage plants, pansies, and tulip bulbs. Help them to discover that in the first picture of each movie more plants are needed to fill the pots or holes.

USING PAGE 119

Direct attention to Picture 1 in the first movie. Get the children to notice that there are not enough plants for all of the pots. Try to get them to make statements like "Don has 10 pots and only 4 flowers." Proceed somewhat as follows: "We want to find how many more flowers Don needs to fill the pots. Now look at the next picture. We can see the 4 flowers that Don already has and more being brought in." Let the children use markers to show the situation. Be sure they understand that 10 flowers are needed in all. Have each child put down 4 markers for the 4 flowers Don had to begin with and then put down more markers until there are 10. Ask how many more flowers Don brought in or added to the 4 he already had. Then ask the question "4 flowers and how many more flowers are 10 flowers?"

Now have the children look at the last picture in the first movie. Tell them that it shows all of the flowers Don will have, and why they can subtract 4 flowers from 10 flowers to find how many more flowers Don needs. Explain that they can subtract the number of flowers Don had at first from the total number of flowers needed to fill the pots. Finally have the children make such statements as "10 flowers minus 4 flowers equal 6 flowers" and "10 minus 4 equals 6."

Go through the other movies in the same way. Encourage the children to use markers to show the actions of bringing in additional objects (Picture 2) and of removing the original objects (Picture 3). Notice that the picture corresponding to Picture 2 in the first movie is omitted from the last two movies.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet may be used for further practice on "how many more are needed" situations. Divide a sheet of paper into 12 sections, leaving a column at the right of the sheet for 12 basic subtraction facts labeled A, B, C, etc. In each section show a situation that illustrates one of the basic facts at the right. For example, show 10 stick-figure boys and 5 stick-figure horses and write below the question "How many more horses are needed for the boys?" The child is to find the basic fact that answers the question and write in that section the letter labeling the basic fact. Subtraction facts from previously taught groups may be included with the 10 group.

120 The 10 group — symbolism of how many more are needed

KNOWING YOUR OBJECTIVE FOR PAGE 120

The child receives further experience with the additive idea involved in finding how many more are needed and in seeing why he can subtract

to find the needed additional quantity. He also reacts to the symbolism of the ideas involved. Subtraction facts from the 10 group are used.

PREPARING FOR PAGE 120

The story "In the Garden" from *Happy Days on the Farm* (item 11 in the bibliography) may be used to introduce this page. Have the book available if you plan to use it.

Provide at least 10 markers for each child.

If you plan to use the activity mentioned in "Applying the New Concepts and Skills," prepare the necessary materials.

INTRODUCING PAGE 120

Read or tell "In the Garden" to the children. Have them open their books to page 120 and let them talk about the gardens shown there. They should observe that Don, Carol, Nancy, and Tom have gardens. The children may be able to identify the cabbage plants, petunias, pansies, and rosebushes.

USING PAGE 120

Call attention to the first picture. Have the children read the first story to themselves. Tell them that they can find the missing numbers by studying the picture. Then have a child read the story aloud and supply the missing numbers. Permit the children to illustrate the situation in the picture with markers on their desks. Make sure they understand that Don needs 10 plants to fill the holes. They should put on their desks 2 markers to represent the number of plants Don has and then add more markers until there are 10. Ask them how many more were added to the 2 to make 10. Get the children to show, by removing the original 2 markers, why they can get the answer by subtracting 2 from 10.

The other three pictures and accompanying stories may be handled in the same way.

Have the children respond orally to Problems A to X below the stories. Each child should have several opportunities to respond. For further practice they may write the letters A to X in a column on their papers and write the answers for the problems opposite these letters.

APPLYING THE NEW CONCEPTS AND SKILLS

On a sheet of paper write subtraction problems in both the additive and the subtractive form. These two forms of the same problem should be written side by side. For example, the problem "10 plants equal 2 plants and _____ plants" should be followed by the problem "10 plants minus 2 plants equal _____ plants." The children then write the missing numbers on the blanks. Permit them to use markers to find the answers if they need to. The problems should include the facts in the 10 group and also some facts from previously taught groups.

121 The 10 group — combining equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 121

In this lesson the child continues his experiences with the concept of multiplication. He learns that 5 twos are 10 and that 2 fives are 10. The child also learns the symbolism for the multiplication basic facts for the 10 group (5 twos = 10 and 2 fives = 10).

PREPARING FOR PAGE 121

Provide 10 small markers for each child.

Have available as many sets of 10 objects each (blocks, marbles, etc.) as possible for the activity described in "Applying the New Concepts and Skills."

INTRODUCING PAGE 121

Have the children look at the pictures on page 121. See if they can identify the flowers (lilac and peony), the birds (robins and blackbirds), and the bees. Get them to notice that the two movies and the pictures at the bottom of the page all show equal groups coming together.

USING PAGE 121

When the children have examined the pictures, ask them to read the first story to themselves. Then have them look at the first movie. They should discover in the first picture that there are 5 groups of bees and that there are 2 in each group. Ask what has happened in the second picture. [The bees are together in one group and there are 10 of them.] Now have one child read the story aloud and answer the questions in the usual way. Let the children use markers on their desks to repeat the action, if necessary.

The second movie and the two pictures at the bottom of the page may be handled in the way just suggested. In the work with this page stress the fact that equal groups are coming together. Make sure the children are familiar with the expressions "2 fives = 10" and "5 twos = 10."

APPLYING THE NEW CONCEPTS AND SKILLS

Distribute collections of 10 objects among as many children as your supply permits. Then make

simple multiplication problems about the objects. For example, you may give this problem to a child who has blocks: "2 groups of 5 blocks each equal how many blocks?" The child arranges his blocks in 2 groups of 5 each, moves them together, and gives the answer. Keep the emphasis on facts from the 10 group, but include also problems from groups previously studied.

122 The 10 group — separating into equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 122

The child continues his experience with one of the concepts of division—finding how many equal groups there are when the size of the subgroup is known. He learns that there are 2 fives in 10 and that there are 5 twos in 10. He also learns to use symbolism with the division basic facts for the 10 group (10 = 2 fives and 10 = 5 twos).

PREPARING FOR PAGE 122

Provide 10 small markers for each child.

The collections of small objects suggested for use with page 121 may be used in connection with this page also.

INTRODUCING PAGE 122

Have the children open their books to page 122 and look at the pictures. Get them to see that each of the three movies shows a group separating into smaller groups.

USING PAGE 122

Direct attention to the first picture in the first movie. Establish the facts that there are 10 bees in the picture, that they are about to fly away, and that they are about to fly away (or are dividing up) in groups of 5 bees each. Then have the children look at the second picture and tell what they see [2 groups of 5 bees each]. Now direct attention to the first story and follow the usual procedures for reading and supplying the answers. Complete the work on this movie by having the children illustrate the action with markers.

Use similar procedures for the other two movies. Throughout the work with this page stress the fact that a group is being separated, or divided, into smaller groups that are equal. See that the children become familiar with the expressions "10 = 2 fives" and "10 = 5 twos."

Have the children respond orally to Problems A to J. For further practice they may write the letters A to J in a column on their papers and write the answer for each problem opposite its letter.

APPLYING THE NEW CONCEPTS AND SKILLS

The activity suggested for page 121 may be adapted for use with this page. Using facts from the 10 group, make simple problems showing the separation of a group of 10 into groups of 2 or 5. The children then find how many groups of 2 or 5 there are in 10. If you wish, facts from the 6 and 8 groups may be included.

123 The 10 group—separating into a given number of equal groups

KNOWING YOUR OBJECTIVE FOR PAGE 123

The child receives further practice with the idea of separating a group into a specified number of smaller groups that are equal. He determines how many objects there will be in each of the equal groups. Completed and imagined actions are shown.

PREPARING FOR PAGE 123

Each child will need 10 markers of one kind and 5 markers of another kind.

If the work sheet described in "Applying the New Concepts and Skills" (page 275) is to be used, prepare a copy for each child.

INTRODUCING PAGE 123

Have the children repeat the Mother Goose rhyme "Mary, Mary, Quite Contrary" (item 22 in the bibliography) and then open their books to page 123. Tell them that the pictures again show some of the plants and flowers the children have in their gardens.

USING PAGE 123

Ask the children to look at the first picture in the first movie. Tell them that Don is going to put the same number of flowers in each box. Proceed somewhat like this: "How many boxes are there? How many flowers are there? Look at the next picture. What has happened?" Get the children to make responses such as "Don has divided up the flowers among the five boxes. He has put the same number in each box." Then ask "When 10 flowers are divided equally among 5 boxes, how many flowers are there for each box?" Encourage the children to make such statements as "10 flowers equal 5 groups of 2 flowers each" and "10 equals 5 twos." Let the children repeat the action with markers on their desks. They can use 5 of one kind of marker to represent the boxes and 10 of another kind to represent the flowers.

Now have the children find the story about these flowers and have it read in the usual way.

Remind the children that the wavy line in the last line of the story means they are to finish the statement. They should say either "twos" or "groups of 2" for the wavy line.

When the work with the first movie has been completed, proceed with the second movie and the two pictures at the bottom in a similar manner. Stress the fact that groups are being separated into equal smaller groups.

Have the children orally give the answers to Problems A to L. Then have them copy the problems on their papers and supply the missing numbers and words.

APPLYING THE NEW CONCEPTS AND SKILLS

Make a work sheet similar to the one described in "Applying the New Concepts and Skills" for page 80. This work sheet, however, should have 10 objects drawn in each section and should have either 2 or 5 boxes ruled off at the right of each section. See page 242 for a full description.

124 – 125 The 10 group — pictorial problems

KNOWING YOUR OBJECTIVE FOR PAGES 124-125

The child has practice with additive and subtractive situations for the 10 group. He responds to the pictures by giving the appropriate addition or subtraction facts.

PREPARING FOR PAGES 124-125

The story "Making Gardens" in the book *Happy Days on the Farm* (item 11 in the bibliography) may be used to introduce this page. Have the book available if you plan to use it.

Provide a full-page frame and 10 markers for each child. If the full-page frame is not available, use a single-view frame or a marker.

Prepare the work sheets described in "Using Pages 124-125."

If the activity mentioned in "Applying the New Concepts and Skills" (page 276) is to be used, have sheets of transparent paper on hand.

INTRODUCING PAGES 124-125

Read or tell "Making Gardens" to the children. Tell the children to open their books to page 124. Let them identify and talk about the objects shown. Be sure they notice that some of the pictures show combining action and some of them show separating action.

USING PAGES 124-125

First have the children place the frames on the page with the circle at the top and observe that all the pictures visible with the frame in this position show the combining of groups. Call their attention to the first picture and encourage them to make the statements "9 plants and 1 plant equal 10 plants" and "9 plus 1 equals 10." Proceed in the same manner with the other seven pictures that are visible with the frame in this position. For each picture require the children to state the basic fact that applies.

Now have the children place the frames on the page with the star at the top. Be sure they see that these pictures are different from those just studied because now groups of objects are being separated instead of combined. Have them look at the pictures one at a time, describe what they see, and give the correct basic fact [10 packages minus 4 packages equal 6 packages, 10 minus 4 equals 6]. Let the children show the action with markers only if they need to.

Next ask the children to place the frames so that the circle is at the bottom. Now pictures showing both combining and separating actions are visible. Direct attention to the problems with blue letters at the top of page 125. Direct attention to the fact that Problems A to I are about addition, Problems J to R are about subtraction, and Problems S to V are about combining equal groups and separating into equal groups. Ask the children to look at the first picture and find the problem at the top of page 125 that fits the picture (Problem M). Then have them find the problems that fit the other seven pictures shown with the frame in this position.

The frames may also be placed so that the star is at the bottom and the appropriate problems located on page 125 for the pictures shown with the frames in this position.

Now direct attention to Problem A in the columns of problems with red letters on page 125. Ask the children to read the problem to themselves and to supply the missing number. Then have one child read the problem aloud. Proceed with each of the problems in the same way.

Problems A to V (gray letters) in the next column may be handled in the same manner. Let the children find the answers with markers if necessary.

Distribute work sheets with the letters A to N written in one column and the letters A to V

written in other columns. Leave enough space after the letters A to N for the children to write the basic facts. They should copy the facts (Problems A to N, red), putting in the missing numbers. For Problems A to V the children should write the answers only. Remind them that when they come to a wavy line they are to complete the statement. For Problem L, for example, they should write "1 clown," not just "1."

APPLYING THE NEW CONCEPTS AND SKILLS

The problems with blue letters on page 125 may be used in another way for further practice with the facts for the 10 group. Help the children fasten sheets of transparent paper to page 124 in their books with paper clips or spring clamps. Have the children look at a picture and find a problem that fits the picture. They should then write the letter of the problem on the transparent paper over the picture.

126 – 127 Pictorial problem situations; practice

KNOWING YOUR OBJECTIVE FOR PAGES 126-127

The child reacts to problem situations involving addition and subtraction with all groups taught thus far and has more experience with the related symbolism.

PREPARING FOR PAGES 126-127

Have on hand 10 markers of one kind and 5 of another kind for each child.

If the work sheet referred to in "Applying the New Concepts and Skills" is to be used, provide a copy for each child.

INTRODUCING PAGES 126-127

Let the children identify the plants and flowers on these pages if they can. For each picture have them tell whether adding or subtracting is shown.

USING PAGES 126-127

Call attention to the first picture on page 126. Have the children read the story that describes the picture to themselves. Tell them to be ready to give the answer. Then ask one child to read the story aloud, line by line, supplying the missing numbers. Let the children use markers only if they need to. Handle each picture on pages 126 and 127 in a similar manner.

Be sure the children realize that in Picture 1 (Problem A) on page 126 they are comparing plants and flowers and that they subtract as many plants as there are flowers. The same situation occurs in Picture 8 (Problem H) on the same page and in Picture 4 (Problem D) on page 127. Also be sure that the children realize they are finding how many more are needed in Picture 5 (Problem E) on page 126 and in Picture 2 (Problem B) and Picture 7 (Problem G) on page 127.

APPLYING THE NEW CONCEPTS AND SKILLS

A work sheet may be used for further practice with the addition and subtraction basic facts for all the groups through 10. Divide each sheet into 8 or 9 sections. In each section draw or stamp pictures showing objects, some of which are to be crossed out if subtraction is indicated by the basic fact (written below the picture) and more of which are to be added if the basic fact indicates addition. A full description of a similar work sheet is given on page 178.

128 Vertical form for the addition and subtraction basic facts

KNOWING YOUR OBJECTIVE FOR PAGE 128

The child learns how to use the basic facts when written in vertical form. While there is no need for the vertical form for the basic facts, the child sometimes meets them in tests and other printed materials. For this reason he is made familiar with the form here. (See the discussion of this point in "Charting the Course," page 269.)

INTRODUCING PAGE 128

Get the children to notice the new form and explain to them that it is another way of writing number problems. Call attention to Problem A (blue) and have them notice that $7 + 3 = 10$ is written below in the new way. Try to get the children to observe that the plus sign is used only in the first two problems (A and B) and is not used thereafter. Then ask them to look at the problems below the heavy black line—the ones labeled with red letters—and tell them that problems like $7 - 3 = 4$ are also written in the new way. Help them to make the same observations about the use of the minus sign in these problems that they made about the use of the plus sign.

USING PAGE 128

Direct attention again to Problem A at the top of the page. First have the children look at the form to which they are accustomed ($7 + 3 = 10$) and observe that the answer is given. Then let them look at this problem written in the new way immediately below and get them to notice where the answer is placed. Show them how to read the problem in this form by beginning at the top and

saying "plus" after the first number and "equals" after the second number.

Now go on to Problem B. Have the children read the problem at the top of the box and give the answer. Then have them read the vertical form as " 2 plus 6 equals 8," supplying the answer as they read the problem. Proceed in this manner with each addition problem, letting the children take turns reading problems and giving answers.

Follow similar procedures with the subtraction examples.

Additional use may be made of the practice examples on this page in the following ways: (1) Call on the children to read specified problems (take them in random order) and give the answers. For example, say: "Problem L, blue. John, read the problem and tell us the answer. Problem T, red. Helen, read the problem and give the answer." (2) Have the children write the letters A to U in columns on paper and write the answer for each example opposite its letter. This can be done for both the addition and the subtraction examples. (3) The children may be shown how to place a folded sheet of paper under the examples in the first row and write the answers; then to fold the sheet again and place it under the examples in the next row and write the answers. Not all of the children will be able to handle this technique, and it should not be required of those who have difficulty. (4) For experience in writing examples in vertical form have the children copy designated addition basic facts and subtraction basic facts and write the answers where they belong.

Charting the Course

Regrouping larger groups (11 to 18)

Up to this point the child has been learning the basic facts which arise from groups of 10 or fewer. Eventually he must also learn the "higher decade" basic facts which arise in connection with larger groups. Thus he will learn that 8 plus 7 is 15 and that $17 - 9 = 8$. All of the addition facts with sums up to 18, and the corresponding subtraction facts, must sooner or later be learned and retained for successful work in arithmetic. As preparation for this work some special attention to groups of 11 to 18 may now be given.

In the past, children have often memorized these facts with little or no experience which related the facts to real objects. Even if real objects or pictures were used, the experience was quite commonly confined to counting. For example, if groups of 8 and 5 were to be combined, the child was told to start with the 8 group and continue the counting with the members of the 5 group, saying "nine, ten, eleven, twelve, thirteen." No direct use was made of the idea of reorganizing the groups and of the principles of the number system. To provide greater continuity and sequence in the organization of the learning experiences, these ideas and principles should be explicitly used.

If a group of 8 and a group of 5 are to be combined, the total group may be reorganized into a group of 10 and a group of 3. To the adult, who knows that $8 + 5 = 13$, this statement may appear to be obvious and trivial. To the child who is learning the fact for the first time, it is not so simple. He can be helped to see and understand it by taking two objects from the 5 group and putting them with the 8 group to make 10. The group of 10 and the group of 3 which remains may then be seen as 13 by use of the principles of the number system discussed earlier. A child should have many regrouping experiences of this kind before he is expected to learn and remember the higher decade addition facts. He should also have experience in determining by means of regrouping (forming one group of 10) the number of objects in the larger groups (11 to 18). He can later use this ability to determine without counting the size of the minuend group in situations used to introduce and teach the subtraction basic facts for these larger groups.

As preparation for learning the addition facts with sums from 11 to 18, and the subtraction facts with these numbers as minuends, *Numbers in Action* devotes pages 129 to 135 to experiences in regrouping involving these numbers.

129 – 131 Regrouping to form totals of 11 to 18

KNOWING YOUR OBJECTIVE FOR PAGES 129-131

The child learns that when he sees two groups that will total more than 10, he should put with one of the groups enough objects from the other group to make a group of 10. He can then recognize, without counting, the numerousness of both the group of 10 and the other group. He knows immediately that the total is 11, 12, 13, etc., because he sees the total as 10 and 1 more, 10 and 2 more, etc. Throughout the work with these pages the child uses his ability to recognize the numerousness of groups of objects up to 10 and also uses the skills he acquired in his previous work with the number system. The work on these pages is a preparation for the higher decade basic facts that will be taught in the next grade.

PREPARING FOR PAGES 129-131

Provide 18 small objects or markers for each child.

The work sheet described under "Applying the New Concepts and Skills" on this page may be used to give the children further practice in regrouping. Have a copy for each child if you wish to use this activity.

INTRODUCING PAGES 129-131

Tell the children that Don, Carol, Nancy, and their parents took an automobile trip through the country and stopped at several roadside stands to buy fruit and vegetables. Then let the children talk about roadside stands they have seen and what was sold at them. Have the children open their books to page 129 and tell them that the whole page is one movie.

USING PAGES 129-131

Direct attention to the first picture on page 129. Because of the children's previous experience with regrouping, they will be able to recognize at once that there are more than 10 boxes of berries. By questions and suggestions get them to say that the boxes of berries are in two groups, that there are 9 boxes in the larger group and 5 boxes in the smaller group. Continue with questions such as: "How can we find out how many boxes of berries there are in all without counting? The farmer is showing Don how to find out. Look at the next picture. What is the farmer doing? [Work for the response 'He is making a group of 10 boxes.'] How do you know? [He is putting 1 box with the 9 boxes in the larger group.] Now look at the last picture. How many boxes are there besides the group of 10 boxes? How many boxes are there in all?" Develop the idea that we know there are 14 boxes because there is a group of 10 and 4 ones.

Have the children repeat the action in this movie with markers on their desks, starting with a group of 9 and a group of 5. Then continue with directions such as these: "Let's pretend that your markers are boxes of berries. Make a group of 7 boxes and a group of 6 boxes. Using just these two groups of boxes, make a group of 10. What do you have now? [A group of 10 and a group of 3] How many markers do you have in all? [13, because there are 10 and 3 more]" Repeat this activity, using groups of 6 and 5, 7 and 9, etc.

Pages 130 and 131 may be handled in the same way as page 129, but do not attempt to teach all three pages on the same day. Notice that the third step shown on page 129 has been omitted from the movies on pages 130 and 131.

The children should have much practice with markers or other small objects in regrouping pairs of groups whose sums are 11, 12, 13, 14, 15, 16, 17, or 18. Their responses should always be similar to the following: "I have 10 and 5 more, or 15 markers."

APPLYING THE NEW CONCEPTS AND SKILLS

Divide a sheet of paper into four or six sections. In each section draw or stamp two groups of objects whose total is any number from 11 to 18. Instruct the children to draw a ring around one group and enough of the other group to make 10. They should then write the total number of objects in the section.

132 Regrouping two groups totaling 11 to 18

KNOWING YOUR OBJECTIVE FOR PAGE 132

The child has practice in regrouping two groups whose total is a number from 11 to 18 and finding the total by inspection. He performs the action in his imagination or with markers.

PREPARING FOR PAGE 132

Each child will need 18 markers small enough to use on his book.

If you wish to use the work sheet suggested in "Applying the New Concepts and Skills" (page 279), have copies available.

INTRODUCING PAGE 132

Ask the children to open their books to page 132. Tell them that the pictures show other fruits for sale at the roadstand.

USING PAGE 132

Direct attention to the four small pictures of apples. Explain that the group of apples with the colored background is to be used with each of the other groups of apples. Proceed somewhat as follows: "How many apples are in the first picture (the one with the colored background)? How many apples are in the picture at the right? Put markers on the apples you would take from the group at the right to make 10 apples in the first group. How many apples are left? Now you have 10 apples and how many more? There are how many apples in all in the two pictures?"

If the children have difficulty, it may be necessary to use markers somewhat as follows: "Put markers on your desk for the apples in the picture with the yellow background. In another place on your desk put markers for the apples at the right. Now move enough markers from the second group to make 10 in the first group. How many markers are left in the second group? How many markers are there in all? How many apples are there in all?"

Now ask the children to find the group of apples under the first picture. Proceed as follows: "How many are in this second group? Put markers on as many apples in the second picture as you need to make 10 apples in the first group. You have 10 apples and how many more? There are how many apples in all in these two pictures?"

The fourth picture of apples and the remaining pictures on the page should be handled in the same way. Notice that in each section of four pictures the picture with the colored background is the key picture and is to be combined with each of the other pictures in turn. Be sure the children understand that an easy way to find the total number of objects in two groups is to make a group of 10 and see how many more than 10 there are. Watch to see that they are not counting the total number. The slower children, especially, should have much practice in manipulating two groups of markers and finding the totals.

APPLYING THE NEW CONCEPTS AND SKILLS

The work sheet suggested on page 278 may be adapted for use with this page. Be sure to use groups that differ from those used in the pictures on page 132.

133 – 134 Regrouping to determine numerousness

KNOWING YOUR OBJECTIVE FOR PAGES 133-134

The child has experiences that will enable him to regroup quantities of 11 to 18 objects so that he can tell the total without counting. He regroups the objects to form a group of 10 so that he can use the group of 10 and the smaller group to determine how many objects there are.

PREPARING FOR PAGES 133-134

Provide 18 small markers for each child.

The collections of small objects mentioned in connection with pages 129-131 also may be used with pages 133-134.

INTRODUCING PAGES 133-134

Tell the children that pages 133-134 show more pictures of fruit for sale at the stand. Let them look at the pictures and identify the different kinds of fruit. Explain that on these pages, too, they are going to find how many boxes, bags, or pieces of fruit there are.

USING PAGES 133-134

Direct attention to the first movie on page 133. Ask the children to look at the first picture and then at the second picture and be ready to tell what the farmer is doing with the boxes of berries. [He is making a group of 10 boxes.] Then ask how many more than 10 boxes there are. The children should immediately see that the farmer has 13 boxes of berries. Now ask the children to put on their desks a marker for each box of berries in the first picture. Stress the fact that it does not matter how they arrange their markers. Then have them make a group of 10 markers, observe the number in the other group, and give the total number of markers.

Use similar questions and instructions for the other movie on page 133 and the four movies on page 134. Have the children repeat the action in each movie with markers on their desks, always emphasizing an unorganized arrangement of objects to start. If some children count to determine the total number of objects, give them special help in regrouping by tens and ones.

APPLYING THE NEW CONCEPTS AND SKILLS

Put before each child in the class a different number of small objects—that is, give one child 13 jacks, another child 17 toothpicks, a third child

15 buttons, and so on. Have each child show how he would make a group of 10 and how he would then determine how many objects he has.

135 Regrouping to determine numerousness without counting

KNOWING YOUR OBJECTIVE FOR PAGE 135

The child has practice in regrouping an unknown number of objects into two groups, one of which is a ten, so that he can find the total number of objects by inspection. The totals are restricted to 11 to 18.

PREPARING FOR PAGE 135

Each child will need 18 small markers.

Provide each child with a small stick about 2 inches long—a toothpick or paste stick will do.

If you plan to use the work sheet described under "Applying the New Concepts and Skills" on this page, prepare a copy for each child.

The collections of small objects used with pages 133-134 may be used again with this page.

INTRODUCING PAGE 135

Ask the children to open their books to page 135. Let them examine the pictures and identify the fruits and vegetables. Tell them that they are going to find out without counting how many objects there are in each picture.

USING PAGE 135

Direct attention to the picture of the tomatoes. Ask the children how they would go about finding how many tomatoes there are. By this time they should suggest making a group of 10 and seeing how many more than 10 tomatoes there are. Let those children who can do so find "by eye" a group of 10 and be ready to tell how many are left and how many there are altogether. A small stick may be used to separate a group of 10 from the other tomatoes. They are so grouped that there is space to put a small stick between the groups.

Instruct the children who cannot use the above procedure to use their markers to find the answer. Discourage counting and encourage grouping.

The other pictures on the page may be handled in the same way. The abler children should regroup the objects without using markers, but allow the others to demonstrate the regrouping with markers. Note that in these pictures there is usually a choice of positions for the stick to be used to separate the group of 10 from the smaller group.

APPLYING THE NEW CONCEPTS AND SKILLS

The activity using small objects that was suggested in connection with pages 133-134 may be repeated with this lesson.

A work sheet similar to the one described on page 278 may be used as a test of the children's understanding of regrouping. For page 135, however, the objects in each section should be in one unorganized group instead of in two groups. The children are to circle a group of 10 and write the total number of objects in a corner of the section.

Charting the Course — Review and evaluation

Earlier discussions have made clear that the emphasis in the early stages of arithmetic should be upon concept building rather than upon the memorization of number facts. The concepts of addition and subtraction, of combining equal groups and separating into equal groups, of ratio, the number system, measurement, and money have all been introduced and developed. It is important, however, to remember that concepts, like facts and skills, can be forgotten unless they are used and reviewed. Pages 136 to 140 of *Numbers in Action* provide a general review of the concepts and skills taught on the earlier pages. This material can also be used to secure information for the final evaluation of each pupil's learning.

136 – 137 Review of addition and subtraction

KNOWING YOUR OBJECTIVE FOR PAGES 136-137

For the child these pages provide a review of addition and subtraction, and for the teacher they furnish a means of evaluating the learning related to addition and subtraction.

PREPARING FOR PAGES 136-137

Provide copies of the two work sheets described in "Using Pages 136-137."

INTRODUCING PAGES 136-137

Have the children open their books to page 136. Let them describe briefly what is happening in each picture.

USING PAGES 136-137

Direct attention to the problems with blue letters. Ask the children to look at Problem A and find the picture that belongs with the problem. Then tell them to be ready to read Problem A, saying the missing numbers. Have one child read the problem to the group. Continue in this manner with the other problems with blue letters.

Next direct attention to Problems A to P (red letters). Tell the children to look at a problem and then call on a child to give the answer. The problems may be taken alphabetically or in random order. Problems A to F (gray letters) may be handled in the same way.

Give each child a work sheet on which are written the letters A to P. The children may write just the answers for the problems with red letters, or, if you prefer, they may copy the examples and then supply the answers. Finally, have the children copy Problems A to F at the bottom of the page and write the answers, to give them additional experience with the basic facts in vertical form.

Use the same procedures for the work on page 137, which deals entirely with subtraction. Pay special attention to Problems B, E, F, and J (red letters). Be sure the children understand that they can subtract to find the answers.

A work sheet with the letters A to L and A to F written on it may be given to each child and the same procedures followed as were suggested above for page 136.

138 Review of equal groups, ratio, and the number system

KNOWING YOUR OBJECTIVE FOR PAGE 138

The child has an opportunity on this page to review his understanding of combining equal groups, separating into equal groups, ratio, and the number system. The page provides a way of evaluating the work in these areas.

PREPARING FOR PAGE 138

Provide enough small markers so that any child who needs them can have 15 to find the answers for Problem E (blue letter).

Prepare for each child a copy of the work sheet described under "Using Page 138."

INTRODUCING PAGE 138

Ask the children to open their books to page 138 and look at the pictures. Let them tell briefly what they see in each picture (equal groups coming together, equal groups going apart, groups of umbrellas, bundles of sticks, etc.).

USING PAGE 138

Ask the children to look at Problem A (blue letter) and find the picture that belongs with it. Then have them read the problem to themselves, supplying the missing numbers as they read. Ask one child to read the problem aloud. The other problems with blue letters may be handled in the same manner. Pay special attention to Problem E. Most children will need to use markers to answer the questions in this problem. The markers, representing the sticks, can be moved one by one to the groups of whirlers in the book.

Next have the children look at Problems A to P (red letters) one at a time and give the answers. The problems may be taken in alphabetical or random order. Be sure that each child in the group has several opportunities to answer a problem.

Finally, provide each child with a work sheet on which the letters A to P have been printed. Have the children write just the answers to Problems A to P.

139 Review of measurement and money

KNOWING YOUR OBJECTIVE FOR PAGE 139

The child reviews the money and measurement relationships taught during the year. The work on the page provides an opportunity for observing the degree to which children have acquired competence in using a ruler and in counting money.

PREPARING FOR PAGE 139

Each child will need a foot ruler with the inches numbered.

Provide enough small markers so that each child who needs them can have 8 or 10.

INTRODUCING PAGE 139

Ask the children to open their books to page 139. Let them look at the pictures and talk about them. They should recognize the pint and quart jars in the pictures. Give each child a ruler and review its use by having the children measure a number of objects in the room in both feet and inches.

USING PAGE 139

Direct the children's attention to Problem A (blue) at the top of the page. Ask them to read the problem silently, find the right picture, and be ready to answer the question in the problem. Then call on one child to give the answer and show how he measured the red sticks to find the one that is just an inch long. While the children are measuring the sticks, watch to see that they are using their rulers properly.

Use a similar procedure for Problem B. If the children wish to measure the other sticks in the picture and tell how long they are, do not discourage them from doing so.

If necessary, let the children use markers, representing the pints, to find the answers for Problems C and D.

When the children have found the answers for Problems I to L, let each child count aloud the money in one of the pictures, to see whether he can count by tens and fives with ease.

Now proceed to the problems with red letters. Ask the children to read a problem silently and be prepared to supply the missing number and word. Then call on a child for the answer.

140 Review of basic facts; practice with the vertical arrangement

KNOWING YOUR OBJECTIVE FOR PAGE 140

The child has another opportunity to react to the addition and subtraction basic facts in vertical form. (See the notes for page 128 for a discussion of the vertical form.)

PREPARING FOR PAGE 140

If you plan to have the children give written responses to the basic facts, prepare copies of the work sheets described under "Using Page 140."

INTRODUCING PAGE 140

Let the children examine page 140 and discover that they are to add in all the problems at the left of the gray line and that they are to subtract in all the problems at the right of the gray line. Call their attention to the words *Add* and *Subtract* above the first problem in each section if they do not discover the words by themselves.

USING PAGE 140

The work on this page may be handled in any or all of several ways. You may want the children to respond orally. If you do, take the problems in random order—red A, blue K, blue B, red J, red D, etc.

If you prefer to have the children give their responses in writing, give each child a work sheet that has been folded lengthwise in four sections. Show him how to place the sheet lengthwise under a row of problems and instruct him to write just the answers under the problems. Explain how to refold the paper and use a new section for each row. Or give the children work sheets which have been divided in half by a vertical line and on which the letters A to Y have been printed on each half. The children may write just the answers to the problems, or they may copy the whole basic fact and write the answer.

The children can be directed to write the examples in horizontal form and to supply the answers. Have them label each example with its letter.

Bibliography

The items listed below are referred to in the Lesson Notes and will be found useful in introducing the pages.

1 **Animals of the Farm,** Encyclopaedia Britannica Picture Stories. Encyclopaedia Britannica Press, 1946

2 **Barney's Adventure,** written and illustrated by Margot Austin. E. P. Dutton and Company, 1941

3 **Billy's Picture,** by Margaret and H. A. Rey. Harper and Brothers, 1948

4 **Chester,** by Charles E. Bracker. Julian Messner, Inc., 1939

5 **Chirp, A Little Clown in a Big Circus,** by Ruth Wittner, illustrated by Ottilie Foy. American Book Company, 1942

6 **Circus Baby, The,** A Picture Book, by Maud and Miska Petersham. The Macmillan Company, 1950

7 **Circus Time,** A Little Golden Book, by Marion Conger, pictures by Tibor Gergely. Simon and Schuster, 1948

8 **Come to the Farm,** by Ruth M. Tensen. The Reilly and Lee Company, 1949

9 **Grandpa's Farm,** by Helen and Melvin Martinson, illustrated by Chauncey Maltman. Childrens Press, Inc., 1949

10 **Happy Days in the Garden,** by Ella H. Hay, pictures by L. Raymond Jones. Beckley-Cardy Company, 1944

11 **Happy Days on the Farm,** by Ella H. Hay, pictures by Jack Merryweather. Beckley-Cardy Company, 1941

12 **Here, There and Everywhere,** by Dorothy Aldis, drawings by Marjorie Flack. Minton, Balch and Company, 1928

13 **Hodie,** by Katharine and Bernard Garbutt. Aladdin Books, 1949

14 **Hollyberrys, The,** by Alice Dalgliesh and Cleo Bennett, illustrated by Pru Herric. Charles Scribner's Sons, 1939

15 **Lambert's Bargain,** by Clare Turlay Newberry. Harper and Brothers, 1941

16 **Let's Go Shopping with Peter and Penny,** by Lenora Combes. Simon and Schuster, 1948

17 **Little Circus Dog,** by Jene Barr, pictures by Kurt Wiese. Albert Whitman and Company, 1949

18 **Little Gardeners, The,** by Louise F. Encking, pictures by Marigard Bantzer. Junior Press Books, Albert Whitman and Company, 1935

19 **Little Golden Book of Poetry, The,** illustrated by Corinne Malvern. Simon and Schuster, 1947

20 **Little Moo and the Circus,** by Helen Sterling, pictures by Harry Lees. Franklin Watts, Inc., 1945

21 **Living Together at Home and at School,** by Prudence Cutright, W. W. Charters, Mae Knight Clark, and Zoe A. Thralls, illustrated by Kate Seredy. The Macmillan Company, 1944

22 **Mother Goose,** Seventy-seven verses with pictures by Tasha Tudor. Oxford University Press, 1944

23 **Nappy Chooses a Pet,** by Inez Hogan. E. P. Dutton and Company, Inc., 1946

24 **On the Farm,** by Marian Duncan. David McKay Company, 1940

25 **Peter Rabbit,** An Operetta, words and music by Ola H. Meredith. Boston Music Company, 1942

26 **Picnic Woods,** written and illustrated by Lilian Robertson. Harcourt, Brace and Company, 1949

27 **Poppy Seed Cakes, The,** by Margery Clark, illustrated by Maud and Miska Petersham. Doubleday, Doran and Company, Inc., 1924

28 **Size of It, The,** by Ethel S. Berkley, illustrated by Kathleen Elgin. William R. Scott, Inc., 1950

29 **Smokey's Big Discovery,** by Hall Preston and Cathrine Barr. Oxford University Press, 1950

30 **Snow House, The,** by Marian Johnston, pictures by Marion Downer. E. P. Dutton and Company, Inc., 1940

31 **Susan's Surprise,** by Freya Mills, illustrated by Marian Sheldon. Oxford University Press, 1946

32 **Tall-Enough Tommy,** A Silver Star Book, by Becky. Childrens Press, Inc., 1948

33 **Ted and Nina Go to the Grocery Store,** by Marguerite de Angeli. Doubleday and Company, Inc., 1935

34 **White Snow Bright Snow,** by Alvin Tresselt, illustrated by Roger Duvoisin. Lothrop, Lee and Shepard Company, Inc., 1947

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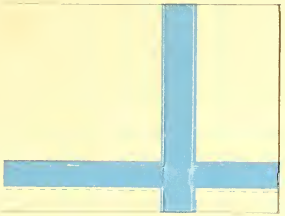
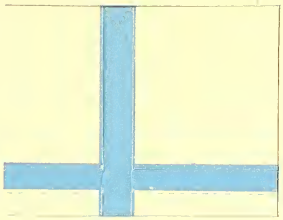
1 frames
1 windows in pocket





Frame

Use with **Numbers We See,** pages 11, 23, 39, 46, 54, 55, and 66.
Use with **Numbers in Action,** pages 6, 7, 11, 18, 28, 44, 82, 102, 105, 112, and 124.
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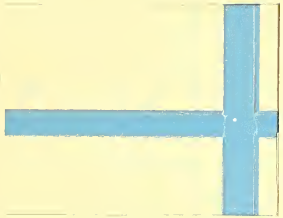

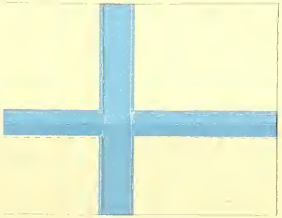

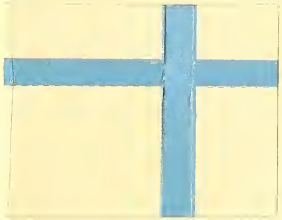

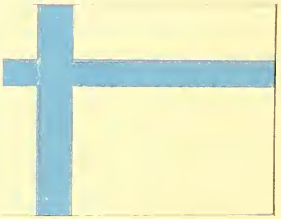

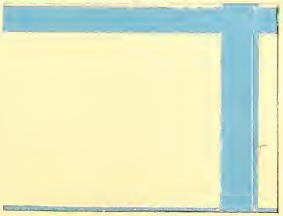

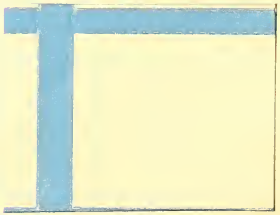

Windows

Use with **Numbers We See,** pages 19, 27, 68, and 69.
Use with **Numbers in Action,** pages 32, 56, and 84.

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1+4=5