PRIMARY ARITHMETIC

CHANCELLOR

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ELEMENTARY SCHOOL MATHEMATICS

GLOBE SERIES IN THREE BOOKS

PRIMARY

RATIO AND NUMBER

BY

WILLIAM E. CHANCELLOR, M.A.

SUPERINTENDENT OF SCHOOLS, BLOOMFIELD, N.J.

GLOBE SCHOOL BOOK COMPANY

NEW YORK BOSTON CHICAGO

"The proper use of the book in the elementary school requires that the teacher and class should read and study the text-book together. The preparation for each lesson should require that teacher and class take it up jointly, with the book open before them. . . . The text-book then fills the proper place, and enables the child to review and master in detail, and more thoroughly, the lesson with which he has become acquainted by joint study with the teacher. It enables the slow child to keep step with the brighter."

F. Louis Soldan, LL.D.,
Superintendent of Public Instruction, St. Louis, Mo.

In *Educational Review*, February, 1903.

"The proper use of the printed page is the greatest of all arts taught in the school."

W. T. Harris, LL.D.,
United States Commissioner of Educat'

From Address before the National Educational Association, 1896.

"The elementary arithmetic stands next to the reader as a means of training children in thought reading, and especially is this true when it contains numerous simple problems for study, grasp, and solution. There is no more effective training for a child in thought reading than the grasp of the simple relation between concrete numbers expressed in language. The printed manual has several important advantages over number exercises written on the board. . . . The use of a book by the pupils relieves the teacher from much unnecessary labor in preparing blackboard work, this being especially true in problems; and it also relieves the pupils from the necessity of copying so many exercises from the board, often a severe tax on the eyes and nerves.

Emerson E. White, LL.D.

"*The Art of Teaching.*"

M. P. 2

MANHATTAN PRESS
474 WEST BROADWAY
NEW YORK

PREFACE

The purpose of this book is twofold: to supply the teacher with material for class instruction; and to provide a text-book for children to study as soon as they know how to read. The course herein begins with the number ten and proceeds by hundreds and thousands to one million, teaches the elementary facts of fractions and parts of numbers, thoroughly develops the fundamental operations, — addition, subtraction, multiplication, division, and comparison, — and begins the subject of denominate numbers, using the fundamental facts in many problems.

The breadth of the course is suggested by a review of the table of contents. The modern demand in schools is for books that give the teacher and the pupils freedom of choice by offering a variety of profitable exercises. A narrow course confining a class to a routine must nowadays be avoided by all text-books, so various are the conditions of the communities, the schools, and the classes in which school books are used.

Progress in education is largely a matter of progress in power to understand books. Oral instruction may be continued too long as the sole medium for imparting knowledge. This book is both to be read and to be studied. It calls for oral recitation and for written work. Print enables the child quietly and studiously to work out for himself the processes taught by the teacher.

Author and publishers desire to acknowledge the valuable suggestions of Superintendent George I. Aldrich, Brookline, Mass., of Principal W. B. Gunnison, Ph.D., of Erasmus Hall High School, Brooklyn, N. Y., and of Principal Ida E. Robinson, School No, 7. Bloomfield, in reviewing these pages.

W. E. C.

Bloomfield, N.J.,
Sept. 1, 1903.

SUGGESTIONS TO TEACHERS

1. The preface explains the general purpose of the book.

2. Read the book itself. The purposes of certain special features appear only when considered in relation to other features. See also the author's "Elementary School Mathematics: Theory of Method."

3. Do not hesitate to use in advance of the order in the book facts which appear later in these pages, whenever doing so adds interest and aids understanding.

4. Develop the number-story features of primary work as much as time permits. The reading and the speaking of English sentences where numbers are involved do not interfere with, but rather tend to promote, that rational understanding of number-processes which is the end of Arithmetic as a science.

5. Do not ask the children to study quietly over twenty minutes at any one time. Children tire quickly and recover even more quickly.

6. Drill for the sake of instant accuracy; but do not follow any drill to the point of over-fatigue.

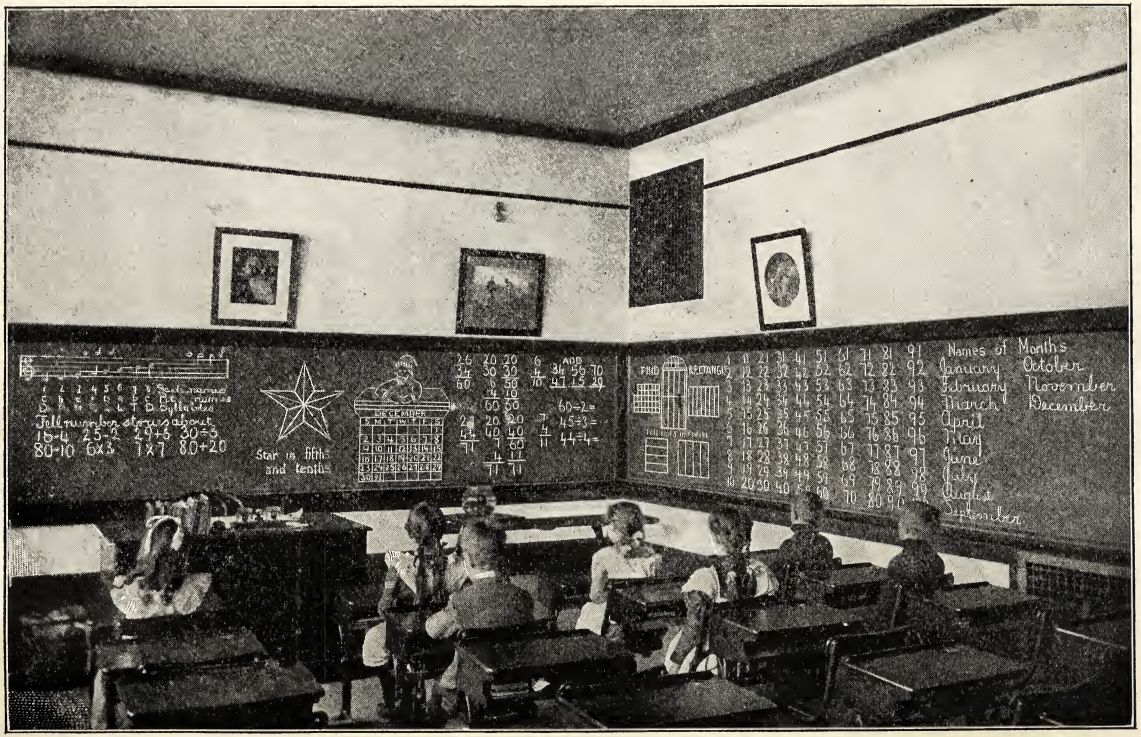
7. Seek great variety in methods and devices. There are children who will not learn things in our ways. Try to find their ways of understanding number-facts and number-principles.

8. Let us not expect all children to be interested in the same things. And let us not expect children always to be at their best. This is physically impossible. But when children are at their best let us take advantage of their strength and enthusiasm. Then they learn rapidly new and difficult topics.

9. A boy or girl may be ready to undertake harder work than this book offers before knowing this book from cover to cover. Yet doing easy things over and over begets confidence, which supports us in our attacks upon new and harder problems.

10. Neatness in writing tends to accuracy in all number-operations. Encourage fine work by commending it. The sizes suggested on pages 14, 15, and 88 for figures on blackboard and on paper represent the limits that are best for the child's arm, wrist, and fingers, and for his eyesight. Children develop earliest the larger muscles. In lower grades children of defective eyesight do not yet wear glasses, and unrecognized eye troubles are common. Freedom of movement, legibility, and facility in writing, together with the demonstrated facts of child physiology, conspire to enforce the requirement of large letters and figures from children under ten years of age.

TABLE OF CONTENTS


Star is fifth and tenth
Names of Months
January
February
March
April
May
June
July
August
September
October
November
December

TELLING NUMBERS AT SIGHT

How many ones?

How many ones?

How many twos?

Find twos and threes.

How many ones? Find five and one.
How many threes? Look across.
How many twos? Look up and down.

How many twos? Find threes and two.
How many fours? Find five and three.

How many threes? Find two fours and one.
Find six and three. Find seven and two.
Find five and four. Find eight and one.

How many twos?
How many fives?

How many?

Numbers tell how many.

COUNTING AND MEASURING

Count these dots ● ● ● ● ● and crosses X X X. We cannot add dots and crosses together because they are not the same kind of things.

Count these circles ○ ○ ○ ○ and squares □ □ □ □ □. Can we add circles and squares together? Why not?

Numbers tell how many things of the same kind.

This picture shows one inch square. Draw one square inch on paper.

EACH SIDE IS ONE INCH LONG

And this picture shows two inches square.

How many square inches do you find in this two-inch square picture?

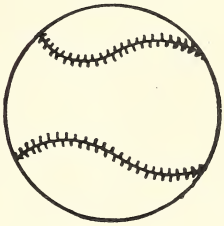
Telling the size or amount or weight is called *measuring*.

We answer "How many?" by counting; and "How much?" by measuring.

sloop

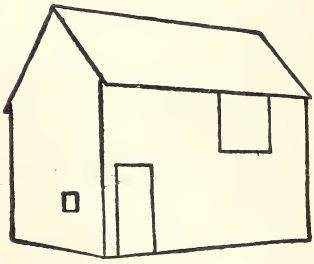
tent

cup



ball

paper-doll



barn

Draw, or cut out of paper, various numbers of these objects.

REVIEW QUESTIONS, 1 TO 10

1. Mother had two tarts for each of three little boys. How many tarts had she in all?

2. A hen had nine little chicks. Three were black, and the rest were white. How many were white?

3. There were nine apples in a basket. Mary divided them equally between Susan, Kate, and herself. How many apples were there for each?

4. Tom caught two trout in a brook. Each weighed half a pound. How much did the fish weigh together?

5. How many letters are there in each of these names: Louise, Katherine, William, Charles, Thomas?

6. Alice had ten cents and John had seven. How many more did Alice have than John?

7. There were six chairs in the dining room. Father bought four more. Then how many were there in all?

8. Nine children were playing hide-and-seek. Four were boys. How many were girls?

9. Ralph counted three robins on the lawn, two in a tree, and one flying in the air. How many did he count in all?

10. Which is more, eight cents or five cents? By how much?

11. On a Christmas tree were nine glass balls. Five were gold in color, one was silver, and the others were bronze. How many were bronze?

12. A farmer put ten tons of hay in a barn. The cattle ate two tons a week. In four weeks how many tons of hay were eaten? How many were left?

FACTS OF 1 TO 10, IN REVIEW

Additions:

1+1=2	1+6= 7	2+3=5	2+8=10	3+7=10
1+2=3	1+7= 8	2+4=6	3+3= 6	4+4= 8
1+3=4	1+8= 9	2+5=7	3+4= 7	4+5= 9
1+4=5	1+9=10	2+6=8	3+5= 8	4+6=10
1+5=6	2+2= 4	2+7=9	3+6= 9	5+5=10

Subtractions:

10−9=1	9−8=1	8−6=2	7−4=3	5−3=2
10−8=2	9−7=2	8−5=3	6−5=1	4−3=1
10−7=3	9−6=3	8−4=4	6−4=2	4−2=2
10−6=4	9−5=4	7−6=1	6−3=3	3−2=1
10−5=5	8−7=1	7−5=2	5−4=1	2−1=1

Multiplications:

2×2=4	2×3=6	2×4=8	2×5=10	3×3=9

Divisions:

10÷5=2	8÷4=2	9÷3=3	6÷3=2	4÷2=2
10÷2=5	8÷2=4	6÷2=3	2÷1=1	

1. Three little birds in one nest and three more birds in another nest make —— birds.

2. Six little birds and four big birds make —— birds.

3. Ten leaves on a branch, and the wind blew three away. —— were left.

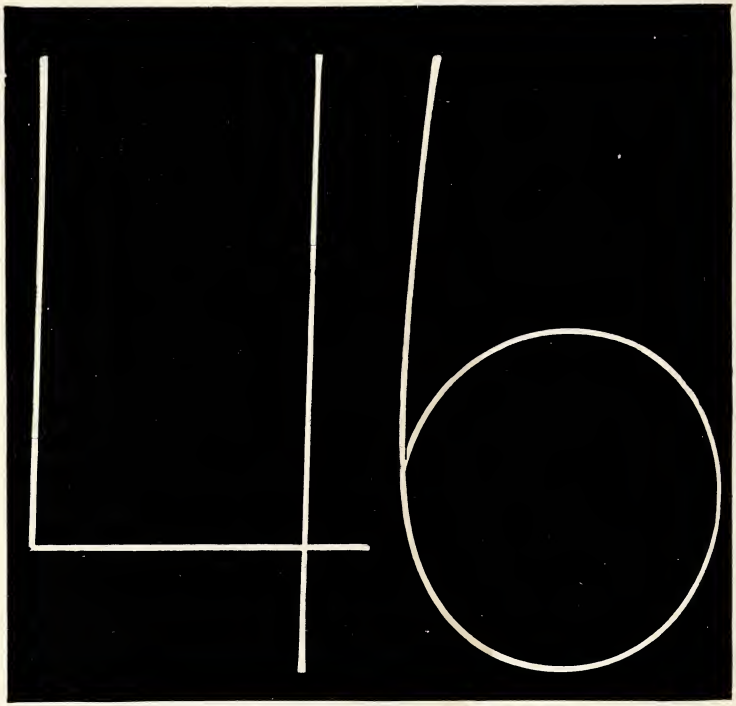
EXERCISES

1. Fold a piece of paper two inches square into four square inches.

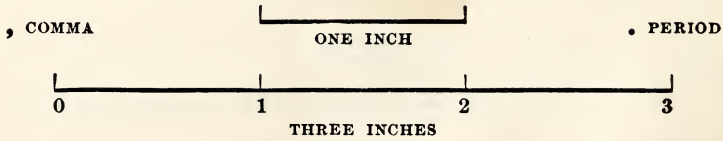
2. Fold a piece of paper three inches square into nine square inches.

BLACKBOARD

With thumb and fingers, hold the chalk crayon under the palm of the hand, and use free arm movements only.



These figures are three inches high.



Write on the blackboard five times with commas and period: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

PAPER WITH PENCIL

2 4 6 3 5 7 1 8 9 0

These figures are one half inch high.

Each side of this square measures one half inch. We call this a half inch square.

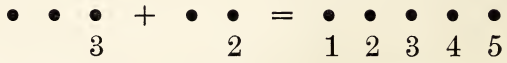
1. Write 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.
2. Write 0, 9, 8, 7, 6, 5, 4, 3, 2, 1.
3. Write 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.
4. Write 20, 21, 22, 23, 24, 25, 26, 27, 28, 29.
5. Write 30, 31, 32, 33, 34, 35, 36, 37, 38, 39.
6. Write 40, 41, 42, 43, 44, 45, 46, 47, 48, 49

SPELLING OF THE NUMBER-NAMES

1, one	0, cipher, or zero	20, twenty
2, two	11, eleven	30, thirty
3, three	12, twelve	40, forty
4, four	13, thirteen	50, fifty
5, five	14, fourteen	60, sixty
6, six	15, fifteen	70, seventy
7, seven	16, sixteen	80, eighty
8, eight	17, seventeen	90, ninety
9, nine	18, eighteen	99, ninety-nine
10, ten	19, nineteen	100, one hundred

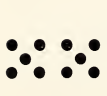
TEN, 10

We count by ones. One and one are two, two and one are three, ten and one are eleven, twenty and one are twenty-one.



Until we reach the number **ten**, each number has one figure as its sign. The sign of one is 1, of five is 5, of nine is 9. But when we reach the number ten, we find a number that has two figures as its sign. The sign of ten is 10. In this sign 10 are the figure 1 and the figure 0, called **zero**. This 0, or **zero**, with a figure before it at the left as we look at it, shows that the figure means ten times the number of ones for which the figure stands when it has no 0, or zero, after it.

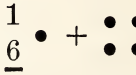
10 means 1 ten, 20 means 2 tens, 50 means 5 tens.

 are 1 ten, or 10, ten.

 are 2 tens, or 20, twenty.

All these dots together are 3 tens, or 30, thirty.

When a number has two figures, the left-hand figure tells how many tens are meant.

Add 1
6  =

Add 10
6  =
sixteen 16

NUMBER-NAMES ABOVE TEN

We call ten and one, eleven, 11; ten and two, twelve, 12. Ten and three are thirteen, 13. Ten and four are fourteen, 14. Ten and five are fifteen, 15. Ten and six are sixteen, 16. Ten and seven are seventeen, 17. Ten and eight are eighteen, 18. Ten and nine are nineteen, 19.

1. Read these numbers: 11, 12, 13, 14, 15, 16, 17, 18, 19.

 are ten.  are two tens.

Two fives we call ten. Two tens we call twenty.

Twenty and one we call twenty-one, 21; twenty and two, twenty-two, 22; twenty and three, twenty-three, 23; then we have twenty-four, 24; twenty-five, 25; twenty-six, 26; twenty-seven, 27; twenty-eight, 28; and twenty-nine, 29.

2. Give the names for these numbers: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29.

3. Read these numbers: 25, 24, 26, 28, 22, 27, 21, 29.

Three tens we call thirty, 30. Three tens and one we call thirty-one, 31. Four tens we call forty, 40. Fifty means five tens, 50. Sixty, six tens, 60. Seventy, seven tens, 70. Eighty, eight tens, 80. Ninety, nine tens, 90.

We call ten tens, one hundred, 100.

4. Read these numbers: 30, 40, 35, 46, 50, 32, 47, 58, 60.

5. Write the figures for these numbers: Twenty-nine, thirty-six, forty-four, fifty-seven, sixty-eight, seventy-one.

6. Read these numbers: 52, 67, 94, 83, 99, 76, 62, 95.

7. Write all the numbers from one to one hundred in figures and in words.

COUNTING

Count by twos, beginning at 2.

2	4	6	8	10	12	14	16	18	20
22	24	26	28	30	32	34	36	38	40
42	44	46	48	50	52	54	56	58	60
62	64	66	68	70	72	74	76	78	80
82	84	86	88	90	92	94	96	98	100

These are called the **even** numbers. 2 divides each of these numbers without remainder.

Count by twos, beginning at 1.

1	3	5	7	9	11	13	15	17	19
21	23	25	27	29	31	33	35	37	39
41	43	45	47	49	51	53	55	57	59
61	63	65	67	69	71	73	75	77	79
81	83	85	87	89	91	93	95	97	99

These are called the **odd** numbers. 2 divides none of these numbers without remainder. One is always left over.

Count by threes, beginning at 3.

3	6	9	12	15	18	21	24	27	30	33
36	39	42	45	48	51	54	57	60	63	66
69	72	75	78	81	84	87	90	93	96	99

Count by fives, beginning at 5.

5	10	15	20	25	30	35	40	45	50
55	60	65	70	75	80	85	90	95	100

Count by sevens, beginning at 7.

7	14	21	28	35	42	49
56	63	70	77	84	91	98

Count by twos, threes, fives, sevens, beginning at various numbers.

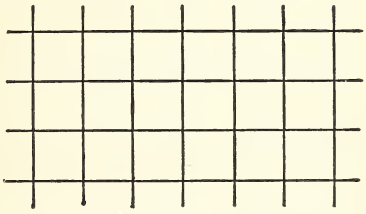
THINGS TO DO

1. Count all the boys in the room, giving them *odd* numbers, and all the girls, giving them *even* numbers. How many children are there in all? Can each boy and girl remember the number given to him or to her?

2. Cut out thirty squares of paper. Write the numbers to thirty, one number on each square.

3. Cut each square into two pieces, and using the other side of the paper, number each of the pieces.

4. Draw lines like these, but longer, so as to make more squares, and number each of the squares. Cut the squares apart.



5. Count the number of panes of glass in all the window sashes of the classroom.

6. Count the number of desks in the room, and then the number of chairs. Write the number for each desk upon a piece of paper, and place it on the desk to which it belongs.

7. Count such objects as marbles, hats, caps, pencils, splints, blocks.

8. Read the numbers of the pages of this book as far as one hundred.

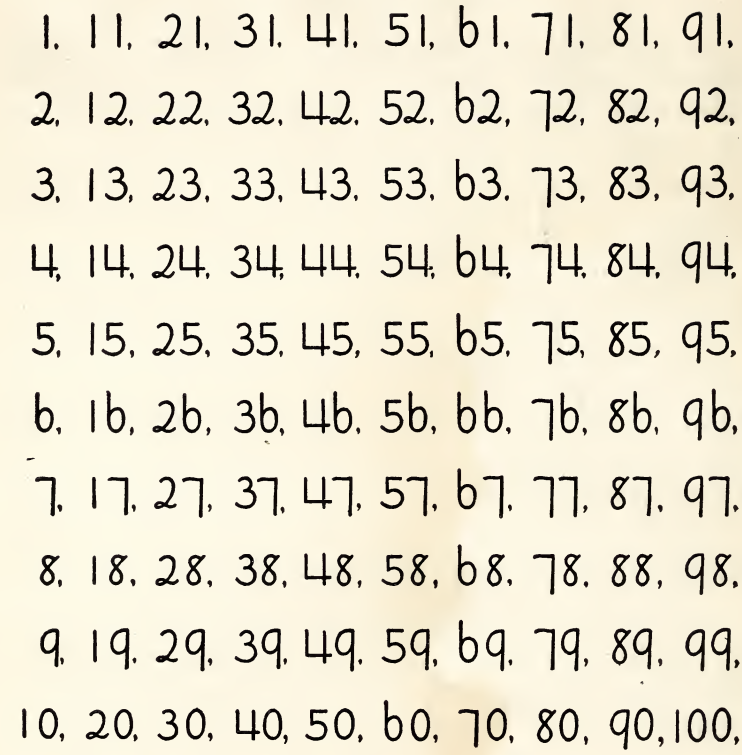
9. Count the number of lines of print upon this page.

10. Write the number of the house where you live.

11. How many chickens, or sparrows, or ducks, or cows, or horses, did you ever count together at one time?

12. Fold paper in squares and number the squares.

NUMBER TABLE



1. Write in figures ten, eleven, twelve, thirteen, fourteen, fifteen.

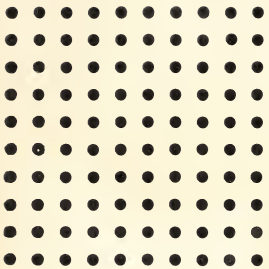
2. Write in figures sixteen, seventeen, eighteen, nineteen, twenty.

3. Write twenty-one, twenty-two, twenty-three, twenty-four.

4. Write twenty-five, twenty-six, twenty-seven, twenty-eight, twenty-nine, thirty.

5. Write forty, fifty, sixty, seventy, eighty, ninety, ninety-nine, one hundred.

THINGS TO DO



We can use instead of dots:
circles like this ○, or
crosses like this ✠, or
angles like this ⊥, or
triangles like this ▽, or
squares like this □, or
letters
C, F, H, L, N, S, T, V, Y, Z,
or any forms, such as these, —

1. Make 100 dots or squares or circles or angles or letters on paper or on blackboard.

2. Number these dots or squares or circles or angles or letters 1, 2, 3, etc., like this $\overset{1}{\bullet}$ or this $\overset{1}{\square}$ or this $\overset{1}{\bigcirc}$ or this ③ or this $\underset{24}{\perp}$ or this $\overset{73}{\vee}$, from 1 to 100.

3. Make lines around every 2 dots like this,  .

4. Make lines around every 3 dots,  or  .

5. Make lines around every 4 dots, every 5 dots, every 6 dots, every 7 dots, every 8 dots, every 9 dots.

6. Make similar lines around groups of squares or circles or letters.

7. Use red chalk or pencil and mark every alternate dot which has an even number, like this $\underline{\bullet}$ or this ⊙.

8. Use blue chalk or pencil and mark every alternate dot which has an odd number, like this $\underline{\bullet}$ or this ⊙.

9. Mark with blue, or yellow, or red chalk every third, every fourth, every fifth, every sixth dot, etc.

Use new sets of •, or □, or ▽ tables except for 1 and 2.

FORM

With a stick, or a splint, or a pencil, we can represent a line across ——, or up and down, | or slanting up to the right, or down to the right,

With two sticks we can make a cross, or a T,

or an angle like this  or this  or this 

Try and see.

With three sticks we can make a form like this

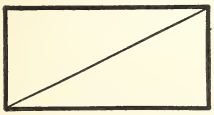
It is called a triangle because it has three angles.

FORM

With four sticks each of the same length, we can make squares like this

When we have a pair of sticks of the same length, and another pair of sticks longer than the others, two like these ═══, and two like these ═══, we can make a rectangle like this

If we draw a line through our rectangle to opposite corners, we have two triangles inside the rectangle.



When we have the longer sides twice as long as the shorter sides, then inside our rectangle we have two squares.

HALVES

When anything is divided into two equal parts, each part is called a half. Two halves make a whole.

Rectangle in halves

Circle in halves

Triangle in halves

Square in halves

Draw a line 2 inches long. Divide it into halves.
Draw a square. Divide it into halves.

One half is written ½ in figures.

1. How many halves are there in one dollar?

2. How many halves are there in a pie? If a pie cost 10 cents, how much will half a pie cost?

3. James had one dollar. He spent half a dollar for a ball. How much money had he left?

4. If you bought a cookie and ate half of it, how much of it would be left? Would the part of it left be equal to the part you ate?

5. One orange is what part of two oranges?

6. One basket is what part of two baskets?

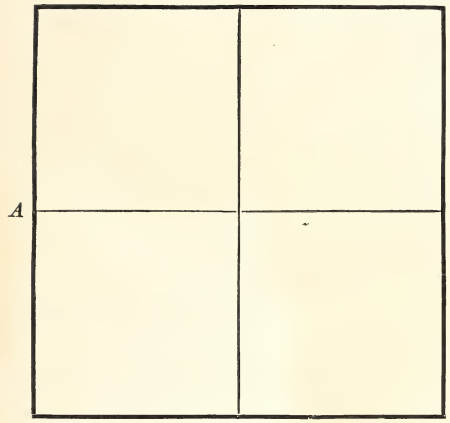
7. One half of two cents is how much?

8. One half of four cents is how many cents?

9. George earned ten cents by doing errands. He gave half of the money to his sister. How many cents did he give to her?

10. ½ of 10 cents is how many cents?

PARTS OF FORMS

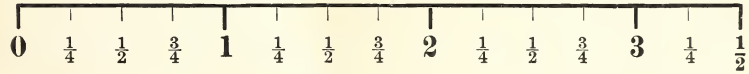


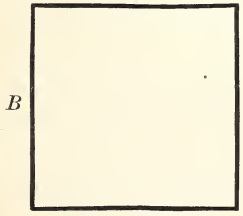
How many little squares do you find in this large square?

This square is two inches wide and two inches high.

When things are exactly like each other in size, we call them **equal.** If you find inside of the square *A* four squares each of the same size, then all four parts of *A* are equal parts.

MEASURE MARKED IN INCHES





Is this square as large as the square marked *A*? Is it as large as any part of *A* square?

Measure this square *B*, using a ruler marked with inches; cut a square out of paper of the same size as *B*, and see how many little squares as large as *B* you find in *A* square.

If you find that square *A* is four times as large as the square marked *B*, then it is right to say that *B* is one fourth as large as *A*.

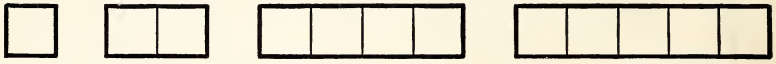
If *A* is four times *B*, then *B* is one fourth of A.

If *A* is $4 \times B$, then *B* is $\frac{1}{4}$ of *A*.

EQUAL PARTS OR FRACTIONS

Numbers tell how many of the same kind.

A *fraction* is one or more of the equal parts of some thing.



Here are four forms, *A*, *B*, *C*, and *D*.

Each is of a different size from the others.

D is divided into five parts. *C* is divided into four parts.

B is divided into two parts. *A* is not divided.

Each part of *D*, each part of *C*, and each part of *B* is of the size of *A*.

There are 5 *A*'s in *D*. Count and see.

There are 4 *A*'s in *C*, and 2 *A*'s in *B*.

Each part of *D* is equal to every other part. The five parts are equal.

Each part of *C* is equal to every other part. The four parts are equal.

One part of *B* is equal to the other part.

We call equal parts fractions.

Each part of *B* is a fraction of *B*. There are two parts.

Each part of *B* is one half of *B*. We print this, $\frac{1}{2}$.

Each part of *C* is a fraction of *C*. There are four parts.

Each part of *C* is one fourth of *C*. We print this, $\frac{1}{4}$.

The 1 above the 4 means that we are taking one part.

The 4 means that there are four equal parts in *C*.

Each part of *D* is a fraction of *D*. There are five parts.

Each part of *D* is one part of *D*. We print this, $\frac{1}{5}$.

The 1 above the 5 means that we are taking one part.

The 5 means that there are five equal parts in *D*.

PARTS

Cut out of paper a square one inch on each side.

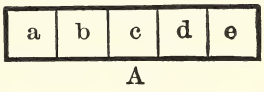
Then cut out a rectangle two inches long, one inch high.

The square is one half as large as the rectangle.

Cut the square into two equal parts, of the size one inch by $\frac{1}{2}$ inch.

Cut the rectangle into four equal parts.

Do you see that the 2 parts of the square are $\frac{2}{4}$ of the rectangle?



There are 5 equal parts in A. Each is $\frac{1}{5}$ of A.

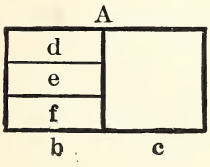
$a + b = 2$ equal fifth parts of A $= \frac{2}{5}$ of A.

$a + b + c = 3$ equal fifth parts of $A = \frac{3}{5}$ of A.

$a + b + c + d = 4$ equal fifth parts of $A = \frac{4}{5}$ of A.

$a + b + c + d + e = 5$ equal fifth parts of $A = \frac{5}{5}$ of A.

Then $\frac{5}{5}$ of A = all of $A = A$.



A is divided into two parts, b and c. $b = \frac{1}{2}$ of A. $c = \frac{1}{2}$ of A.

b is divided into three parts, d, e, f. $d = \frac{1}{3}$ of b. $e = \frac{1}{3}$ of b. $f = \frac{1}{3}$ of b.

If we divide c into three equal parts, then A will have 6 parts.

When A has 6 equal parts, then $d = \frac{1}{6}$ of A.

$d = \frac{1}{3}$ of $\frac{1}{2}$ of A, because d is $\frac{1}{3}$ of b, which is $\frac{1}{2}$ of A.

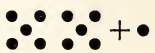
1. $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} = ?$
2. $\frac{1}{6} + \frac{1}{6} + \frac{2}{6} + \frac{2}{6} = ?$
3. $\frac{1}{3} + \frac{1}{6} = ?$
4. $\frac{1}{5} + \frac{2}{5} + \frac{2}{5} = ?$
5. $\frac{1}{2} + \frac{1}{2} = ?$
6. $\frac{1}{3} - \frac{1}{6} = ?$

Cut or fold pieces of paper to show the answers to these six questions.

ELEVEN, 11

When we have ten things and add one thing to them, the name of the number of all these things together is **eleven.**

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ + ○
1 2 3 4 5 6 7 8 9 10 + 1



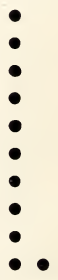
Ten and one are eleven. 10 + 1 are eleven.

$$\begin{array}{r} 10 \\ 1 \\ \hline 11 \end{array}$$

We write eleven with the figure 1 used twice: 11.

In the figures 11 for eleven, the unit one, 1, has the place of the zero, 0, in the figures 1 and 0, printed like this: 10, for the number ten.

In the number eleven, printed as 11, the second 1 shows that the first 1 stands not for one, 1, unit, but for one ten, or 10. 11 means 1 ten and 1 unit, like this group of dots:



8+3=11	7+4=11	6+5=11	11−5= 6
10+1=11	9+1+1=11	5+5+1=11	2+3+5+1=11
11−1=10	11−2= 9	9+2=11	7+2+2=11

With splints and counters, show each of the above facts.

1. John had five cents and Tom had six cents. How many cents did they have together?

2. There were ten boys; one of them had two cents, nine of them had each one cent. How many cents did they have together?

ELEVEN, 11

3. Mary had eleven cents. She spent four for apples at one cent each. How many cents were left?

4. Tell number-stories about cents, using these combinations:

11−1, 5+2+4, 10+1, 9+2, 4+7, 11−6, 8+3.

5. Add

10	3	6	9	7
1	8	5	2	4

6. Subtract:

11	11	11	11	11
1	3	5	2	7

7. Is eleven an odd or an even number? Why?

8. What is the next number after 10? before 10?

9. How many more are 11 than 10 things?

10. George had eleven marbles and Charlie had 8. Which had more than the other? How many more did he have?

11. Take 11 splints. Make 2 squares with them and one triangle.

12. How many triangles can you make with eleven splints? How many splints are left over?

13. Add:

3	2	5	3	6	4	6	5	6
6	3	4	7	4	4	3	5	2

14.

From	11	11	11	11	11	11	11	11	11
Take	6	4	3	9	5	10	8	7	2

15. Can you remember several numbers when written on the board and then quickly erased? Try and see.

TWELVE, 12

If we have ten things and add two things to them, the name of the number of all these things together is **twelve.**

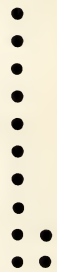
○ ○ ○ ○ ○ ○ ○ ○ ○ ○ + ○ ○
1 2 3 4 5 6 7 8 9 10 + 1 2

10
2
12

10 + 2 are twelve. Ten and two are twelve.

We write twelve with the figures 1 and 2: 12.

In the figures 12 for twelve, 2 has the place of the zero, 0, in the figures 10, for the number ten. In the number twelve, printed as 12, the figure 2 shows that the figure 1 stands not for 1 unit, but for one ten or 10.



12 means 1 ten and 2 units, like this group of dots:

In the numbers eleven and twelve, printed 11 and 12, we say that the 1 in each number where it is the first figure, reading from left to right, is in *tens*' place and that the second figure in each number is in *units*' place.

Twelve things make one dozen.

Dozen means two-ten.

When we say, "Mary's mother sent Mary to sell a dozen eggs to the grocer," we mean that Mary carried twelve eggs.

10 + 2 = 12 9 + 3 = 12 8 + 4 = 12 7 + 5 = 12
12 − 6 = 6 12 − 7 = 5 12 − 10 = 2 12 − 9 = 3

Show each of these facts with counters and dots.

USEFUL FACTS

There are two pints in a quart.

A pint is half a quart.

A dozen is four times three, three times four, six times two, and two times six. A half dozen is six. A third of a dozen is four. A quarter of a dozen is three.

Pint Quart

A table drinking-glass holds half a pint.

1. Tell number-stories about cents, or eggs, or marbles.

2. Mary had seven dozen eggs and Susan had five dozen. How many dozen have they together?

3. In twelve pints of milk are how many quarts?

4. William had a dozen tops and lost two. How many had he left?

5. Mary's white hen laid half a dozen eggs last week. How many was that?

6. Ellen and Charles had each a glass of milk. Together they had —— pint of milk.

7. How many quart bottles can be filled from six pint bottles?

8. How many pint bottles can be filled from six quart bottles?

9. How many glasses can be filled from a quart of milk?

10. Mary had a quarter of a dozen and a third of a dozen eggs. How many had she in all?

TELLING LENGTHS

12 inches make 1 foot.

12 in. = 1 ft.

in. stands for inch or inches. ft. stands for foot or feet.

3 feet make 1 yard.

3 ft. = 1 yd.

Be sure to place a period after in. for inch, ft. for foot, and yd. for yard.

A foot-rule shows twelve inches.

A yard-stick shows three feet.

A foot is a very common unit of measure. We buy boards at the lumber yard by the foot.

A yard is almost as common a unit of measure. We buy goods for dresses and suits by the yard.

An inch is the unit of measure for small things. We tell how wide and how long a photograph is by inches.

1. Measure 2 inches on a piece of paper with a ruler.

2. Cut squares 2 inches on each side.

3. Measure the size of the first picture in this book.

4. What is the size of your desk? Your teacher's desk?

5. Ask your mother how many yards of cloth she needs to make a dress. Measure that number of yards on the blackboard.

6. Find how many yards long and wide the schoolroom is.

REVIEW QUESTIONS

1. A cube has —— faces.

2. A book measured in length two inches less than a foot long. It was —— inches long.

3. Four pairs of shoes were in a closet and another was in the room. There were in all —— different shoes.

4. Mary has 7 paper dolls and Kate has 4. Together they have —— paper dolls.

5. Five apples, three oranges, and two pears make —— articles of fruit.

6. Half a dozen and a quarter of a dozen plums make —— plums.

7. In Tom's garden the cherry tree was eight years old, and the peach tree two years less. The peach tree was —— years old. The apple tree was twice as old as the peach tree. It was —— years old.

8. Fold a piece of paper into a dozen squares. Have you 3 rows of —— squares or 2 rows of —— squares or only 1 row of squares?

9. A wire fence had five rows of wire, a foot apart. The lowest wire was a foot above the ground. The highest wire was —— feet above the ground.

10. Ella has in her purse a ten-cent piece, and two cents. She has —— cents in all.

11. There are five books on a shelf and four on a table, which make —— books in all.

12. There were 7 fish in Edith's globe. One fish died, when her mother gave her two more. Edith then had —— fish.

TWELVE

$12=6+6$ $\quad 6\times 2=12$ $\quad 12\div 2=6$

Add 6 Subtract 12

6 6

1. How many are $4+4+4$? $3\times 4=?$
2. How many are $3+3+3+3$? $4\times 3=?$
3. In 1 above how many 4's do you count?
4. In 2 above how many 3's do you count?
5. Show 1 and 2 by splints, counters, pennies, or dots.
6. Is it true that $3\times 4=12$ and $4\times 3=12$?

When we find how many fours there are in twelve, we count 4's until we reach 12. $4+4$ are 8. $8+4$ are 12. There are three fours in twelve.

$12\div 4=3$. We find three fours in twelve.

NUMBER-STORIES

7. Charlie had twelve apples; and when four boys came to see him, he wanted to give each of them the same number. How many could he give to each?

8. There were two boys who had six marbles each. How many did they have together?

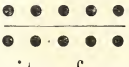
9. Lulu had an afternoon tea-party. Her mother gave her a dozen tea-biscuits. She and Clara and Mabel ate them all; each ate as many as the others. How many did each eat?

10. Walter bought 12 shingles and made boats out of them. He sold 6 boats for 2¢ each. He had —— boats left. He received —— cents for the boats sold.

DIVIDING

Often we write division-processes in this way $2\overline{)10}$ $\quad 5$ This means just the same as $10 \div 2 = 5$.

We may read $2\overline{)10}$ either, 10 divided by 2 are how many? or, How many 2's are there in 10?

Here are ten dots  We can show that we may think of them as divided into 5×2 dots or 10 dots $\div 5$ by drawing lines between every 2 dots  or as divided into 2×5 dots or 10 dots $\div 2$ by drawing a line between every 5 dots 

Dividing is the opposite of multiplying.

Dividing separates numbers; multiplying combines numbers.

SOMETHING TO DO

1. Take 12 splints. Separate them into two bunches of six splints each. This is dividing 12 splints by 2. How would you divide 12 splints by 6?

2. Take the 2 bunches, each of 6 splints, and put them together. This is multiplying 6 splints by 2. What would you do to multiply 2 splints by 6?

3. $12 \div 3 = ?$ $\quad 12 \div 4 = ?$ $\quad 3 \times 4 = ?$ $\quad 4 \times 3 = ?$

Answer these questions by dots or counters.

4. $2\overline{)4}$ $\quad 2\overline{)6}$ $\quad 2\overline{)8}$ $\quad 2\overline{)10}$ $\quad 2\overline{)12}$ $\quad 3\overline{)6}$ $\quad 3\overline{)9}$ $\quad 3\overline{)12}$ $\quad 4\overline{)8}$ $\quad 4\overline{)12}$

5. From a bushel of onions a grocer sold half a bushel. What part of the bushel did he have left?

6. One half of 6 splints = how many splints?

DIVIDING WITH A NUMBER OVER

1. Find 3's in 7. $2 \times 3 = 6$ $6 + 1 = 7$ $7 = (3 \times 2) + 1$. 7 divided by 3 gives 2 and 1 over.

2. Find 4's in 11. $2 \times 4 = 8$ $8 + 3 = 11$ $11 \div 4 = (4 \times 2) + 3$.

3. How much is $12 \div 5$? 12 divided by 5 are 2 and 2 over.

4. $5\overline{)11}$. Five is found in 11 twice and 1 over. $5\overline{)11} = (5 \times 2) + 1$

5. $7\overline{)12} = (7 \times 1) + 5$ **6.** $3\overline{)10}$ $2\overline{)9}$ $4\overline{)9}$ $10 \div 6 = ?$

7. $12 \div 10 = ?$ $8 \div 5 = ?$ $9 \div 8 = ?$ $12 \div 9 = ?$

When you see these marks ( ), called *parenthesis* marks, around numbers, they mean that we must do first what the sign inside says: $(3 \times 2) + 2 = ?$ means 3×2, which are 6, then add $2 = ?$ The answer is 8. But the answer to $3 \times (2 + 2)$ is $3 \times 4 = 12$.

REVIEW

8. If I owe you 4¢, and give you a dime, how many cents must you give me back?

9. A piece of ice weighed 10 pounds in the morning. In the evening it weighed 2 pounds less. What was its weight in the evening?

10. Harry bought a bottle of ink for 3¢, a pencil for 1¢. He gave the clerk a nickel. Should the clerk give him any change?

11. Make a story about 3 and 4; about 2 and 5; about 6 less 1; about 3 and 1 and 2; about $12 \div 6$; about $11 \div 5$; $10 \div 4$.

QUESTIONS

1. How many two-cent stamps can we buy for a dime? How many can we buy for 12 cents?

2. Frank is 10 years old. His brother is 4 years younger. How old is his brother?

3. Edgar has a dime. Willie has a nickel and 3¢. How many more cents has Edgar than Willie?

4. George earned a nickel on Saturday forenoon and another nickel in the afternoon. On Saturday evening he spent 6¢. How many cents had he left?

5. A post was 10 feet high. 2 feet of it were in the ground. How many feet were above the ground? If Tom is 4 feet tall, how much higher is the post?

6. I buy an orange for 3¢ and hand the fruit-dealer a dime. What change should he give me?

7. There were 10 plum trees in an orchard. 2 of them died. How many lived? How many more would the farmer need to plant so as to have a dozen in all?

8. Arthur gave a dime for a flag and a top. The top cost 4¢. How much did the flag cost?

9. George gave 3 apples to each of 4 boys. How many did he give in all?

10. Alice had 10 pansies. She gave away 3 of them. How many had she left? If she divided the number left among three friends, giving each two, would she then have any pansies for herself?

11. Her father gave Helen a dime. She bought 5¢ worth of braid. How many cents had she left?

12. Louis spelled 3 words and James spelled 4. How many words did both boys spell?

TWOS

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

$0 + 2 = 2$ $6 + 2 = 8$ $12 + 2 = 14$ $18 + 2 = 20$
$2 + 2 = 4$ $8 + 2 = 10$ $14 + 2 = 16$ $20 + 2 = 22$
$4 + 2 = 6$ $10 + 2 = 12$ $16 + 2 = 18$ $22 + 2 = 24$

Show by counters that each of these facts is true:

2	2	2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2	2	2	2
	4	2	2	2	2	2	2	2	2	2	2
		6	2	2	2	2	2	2	2	2	2
			8	2	2	2	2	2	2	2	2
				10	2	2	2	2	2	2	2
					12	2	2	2	2	2	2
						14	2	2	2	2	2
							16	2	2	2	2
								18	2	2	2
									20	2	2
										22	2
											24

1. Add each column.
2. How many 2's make 18?
3. Ten 2's make ——.
4. A dozen 2's make ——.
5. —— 2's make 22.

$2 \times 1 = 2$	$2 \times 7 = 14$
$2 \times 2 = 4$	$2 \times 8 = 16$
$2 \times 3 = 6$	$2 \times 9 = 18$
$2 \times 4 = 8$	$2 \times 10 = 20$
$2 \times 5 = 10$	$2 \times 11 = 22$
$2 \times 6 = 12$	$2 \times 12 = 24$

MULTIPLICATION TABLE OF TWOS

TWOS

We read the Multiplication Table of Two: Two ones are two. Or, Two times one are two. Two twos are four. Or, Two times two are four. Two threes are six. Or, Two times three are six.

$6 + 6 = 12$ Two 6's = six 2's $2 + 2 + 2 + 2 + 2 + 2 = 12$

$10 + 10 = 20$ Two 10's = ten 2's

$2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 = 20$

1. Copy the Table of Twos on paper.

2. Count by 2's to 24. Write this counting.

3. Show that two 5's are 10, two 9's are 18, two 12's are 24.

4. Show that two 4's are 8, two 7's are 14, two 11's are 22.

5. Since a dozen inches make a foot, what part of a foot do six inches make?

6. How many 2¢ stamps will two dimes buy?

7. How many shoes are there in two dozen pairs?

8. There were five children in a family and there were two years of age between each child and the next. The youngest was six years old. How old was each of the other children?

9. Three little girls were given a basket of six apples to divide equally. How many apples did each receive?

10. Tom drinks 2 glasses of milk at each meal. How many glasses of milk does he drink in a day, for his breakfast, dinner, and supper?

REVIEW

1. Draw nine chairs and two tables. These are —— objects.

2. Draw a doll-house, seven boy paper-dolls, and five girl paper-dolls. These are —— dolls.

3. 1 cake less $\frac{1}{2}$ cake leaves —— cake.

4. Draw five cherries in one bunch and four cherries in another. These are —— cherries.

5. Eleven chickens less seven chickens are —— chickens.

DRAW

chair

cake

cherries

chicken

THIRTEEN, 13

When we have ten things and add three things to them, the name of the number of all these things together is **thirteen.**

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ + ○ ○ ○
1 2 3 4 5 6 7 8 9 10 11 12 13

10
3
13

10 + 3 are thirteen. Ten and three are thirteen.

We write thirteen with the figures 1 and 3, 13. We put 1 in tens' place, and 3 in units' place. 13 means 1 ten and 3 units, like these dots :

12 + 1 = 13. A dozen and one are thirteen.

Thirteen is the first number-name that is made up with the thought of ten as one part of the name. All names of numbers above twelve as high as ninety-nine have at least a **t** in them to make us remember ten.

Show by splints that each of these number-facts is true: 11+2=13, 13−4=9, 13−6=7, 8+5=13, 13−10=3.

1. Samuel raised in his garden 9 lettuce-plants. George raised 13, or —— more than Samuel raised.

2. A hen sat for three weeks on thirteen eggs, when eleven little chickens came out of their shells. The next day the other eggs had little chickens peep out. How many chickens came out of their shells the second day?

3. Tell number-stories about these facts: 10+3, 13−5, 11 + 2, 6 + 7, 13 − 9, 1 + 2 + 3 + 7, 12 + 1.

4. Add: 12 11 9 6 5
1 2 4 7 8

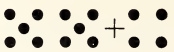
5. Subtract: 13 13 13 13 13
2 4 6 8 10

FOURTEEN, 14

When we have ten things and add four to them, the name of the number of all these things together is **fourteen.**

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ + ○ ○ ○ ○

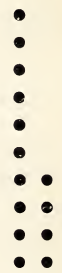
10 4



10
4
14

$10 + 4 = 14$. Ten and four are fourteen.

We write fourteen with the figures 1 and 4, 14. We put the 1 in the tens' place and the 4 in units' place. 14 means 1 ten and 4 units, like this group of dots:



$13 + 1 = 14$ $12 + 2 = 14$

A dozen and two are fourteen.

Of what does the syllable "teen" in fourteen remind us?

Show by splints that each of these number-facts is true:
$11 + 3 = 14$, $9 + 5 = 14$, $8 + 6 = 14$, $7 + 7 = 14$.

1. Tom was fourteen years old. His brother was six years old. How many years older was Tom?

2. Mary was seven years old, and Susan was seven, too. How many years had both lived?

3. Willie and his little brother together had fourteen cents. Willie took eight cents for himself and gave George the rest. How many did George have?

4. Tell number-stories about: $14-8$, $9+5$, $12+2$, $13-1$.

5. $14 \div 7 = 2$ $14 \div 2 = ?$ $7 \times 2 = 14$ $2 \times 7 = ?$

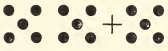
Show each of these facts by splints and counters.

FIFTEEN, 15

When we have ten things and add five to them, the name of the number of all of these together is **fifteen**.

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ + ○ ○ ○ ○ ○

10 5



We write fifteen with the figures 1 and 5, 15. We put 1 in tens' place at the left of 5 in units' place.

$10 + 5 = 15$. $\begin{array}{r} 10 \\ 5 \\ \hline 15 \end{array}$ Ten and five are fifteen.

$13 + 2 = 15$ $9 + 6 = 15$ $12 + 3 = 15$

$14 + 1 = 15$, $11 + 4 = 15$, $8 + 7 = 15$, $15 - 5 = 10$,
$15 - 7 = 8$, $15 - 9 = 6$, $15 - 12 = 3$, $15 - 2 = 13$.

MONEY

5 cents = 1 nickel. 10 cents = 1 dime. 2 nickels = 1 dime.

1 dime and 1 nickel make 15 cents. 3 nickels = 15 cents.

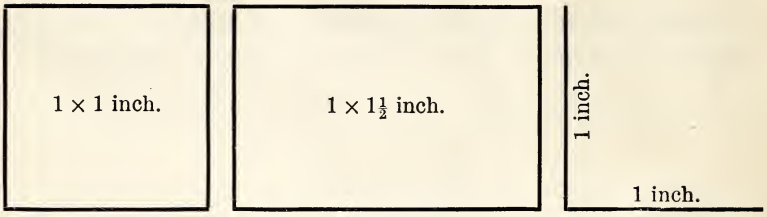
1. Three boys had three nickels. How many cents could they get for these nickels all together?

2. Willie had 6 cents, Johnny 5, and Charlie enough more to make 15 cents. How many cents did Charlie have?

3. Mary's father gave her 15¢. She spent one nickel for a little china doll, and four cents for a picture card to put in her doll-house. How many cents were left?

4. Louise had a dime, and Sarah a nickel. They spent six cents for car fares, and five cents for cookies. How many cents did they have then?

FORMS AND FRACTIONS

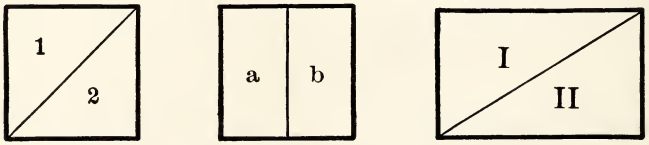


Rectangle. Square. | Rectangle. Oblong. | Right Angle.

A *rectangle* is a form in which each angle is a right angle. A rectangle always has four sides.

A *square* is a rectangle all of whose sides are equal.

An *oblong* is any rectangle that is not a square. The opposite sides of oblongs are always equal.



A B C

1. What is the name of the form *A*? *B*? *C*?
2. What is the name of the form 1? a? I?
3. Point out $\frac{1}{2}$ of *A*. $\frac{1}{2}$ of *B*. $\frac{1}{2}$ of *C*.
4. Point out right angles in *A*, *B*, and *C*.
5. Make an oblong with sides one and two inches long. Divide it into two squares.
6. Make another, and divide it into two triangles.

Each square in 5 and each triangle in 6 is $\frac{1}{2}$ of the oblong.

THREES

3 6 9 12 15 18 21 24 27 30 33 36

$0 + 3 = 3$ $3 + 3 = 6$ $6 + 3 = 9$
$9 + 3 = 12$ $12 + 3 = 15$ $15 + 3 = 18$
$18 + 3 = 21$ $21 + 3 = 24$ $24 + 3 = 27$
$27 + 3 = 30$ $30 + 3 = 33$ $33 + 3 = 36$

Show by splints that each of these facts is true:

3	3	3	3	3	3	3	3	3	3	3	3
	3	3	3	3	3	3	3	3	3	3	3
	6	3	3	3	3	3	3	3	3	3	3
		9	3	3	3	3	3	3	3	3	3
			12	3	3	3	3	3	3	3	3
				15	3	3	3	3	3	3	3
					18	3	3	3	3	3	3
						21	3	3	3	3	3
							24	3	3	3	3
								27	3	3	3
									30	3	3
										33	3
											36

1. Add each column.
2. How many 3's make 18?
3. Ten 3's make ——.
4. A dozen 3's make ——.
5. —— 3's make 33.

$3 \times 1 = 3$	$3 \times 7 = 21$
$3 \times 2 = 6$	$3 \times 8 = 24$
$3 \times 3 = 9$	$3 \times 9 = 27$
$3 \times 4 = 12$	$3 \times 10 = 30$
$3 \times 5 = 15$	$3 \times 11 = 33$
$3 \times 6 = 18$	$3 \times 12 = 36$

MULTIPLICATION TABLE OF THREES

THREES

We read the Multiplication Table of Three: Three ones are three. Or, Three times one are three. Three twos are six. Or, Three times two are six, etc.

1. Copy the Table of Threes on paper.

2. Count by 3's to 36. Write this counting in words, beginning, three, six, nine, and so on.

3. Write the Table on the blackboard without any copy.

4. Make a division table of threes, beginning it like this:

$3 \div 3 = 1$	$9 \div 3 = 3$				
$6 \div 3 = 2$	$12 \div$				

REVIEW OF TWOS AND THREES

1. Add:

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12

Of what Multiplication Table do these additions remind us?

2. Add:

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12

Of what Multiplication Table do these additions remind us?

THIRDS

When anything is divided into three equal parts, each part is called a third. Three thirds equal one whole.


Circle


Rectangle


Square


Square

Into how many parts is the circle divided? the rectangle? each square?

Draw a line three inches long. Divide it into thirds.

One third is written in figures $\frac{1}{3}$.

Two thirds are written in figures $\frac{2}{3}$.

$\frac{3}{3}=1$. Why is this true? Look and see.

1. Eddie bought a cake and ate $\frac{1}{3}$ of it. How much of the cake was left?

2. How many thirds are there in an orange?

3. How many thirds in two oranges? In one orange are three thirds. 2 times $\frac{3}{3}$ are six thirds, $\frac{6}{3}$.

4. $\frac{1}{3}$ of 6 figs = how many figs? There are six times as many thirds in the 6 figs as there are in the one fig. $6 \times \frac{1}{3} = \frac{6}{3}$. $\frac{6}{3} = 2$.

5. What is $\frac{1}{3}$ of 6? $\frac{1}{3}$ of 9? $\frac{1}{3}$ of 12?

6. Which piece is the larger, $\frac{1}{3}$ of a pie or $\frac{1}{2}$ of a pie?

7. How much more does the whole of a cake cost than $\frac{1}{3}$ of it?

8. I started to walk to the depot. After I had walked $\frac{1}{3}$ of the distance, what part of it had I still to walk?

9. If your mother gave you some money and you spent $\frac{2}{3}$ of it, what part of the money would you have left?

TELLING QUANTITIES

We buy and sell butter and cheese by pounds, but we measure potatoes and vinegar by quarts.

A quart measure for dry things like flour is larger than that for liquids like milk. With dry sand find the difference between the liquid and the dry quart. Six quarts of flour would take just a little more space than seven quarts of milk.

2 pints make 1 quart.	2 pt. = 1 qt.
1 pint makes $\frac{1}{2}$ quart.	1 pt. = $\frac{1}{2}$ qt.

1. Mrs. Brown had three quarts of milk, and six hungry children. She gave each $\frac{1}{2}$ pt. in a glass. How many quarts were left?

2. Willie bought a quart of peanuts, and gave one pint to his little brothers. What fraction of the quart did he keep himself?

4 quarts make 1 gallon. 4 qt. = 1 gal.

3. How many quarts are there in three gallons of oil?

4. Susie's mother had one gallon of maple syrup. One morning the family had three pints of maple syrup on the table for buckwheat cakes. How many pints were left in the gallon jug?

8 quarts make 1 peck.

4 pecks make 1 bushel.

8 qt. = 1 pk.	4 pk. = 1 bu.	32 qt. = 1 bu.	64 pt. = 1 bu.
4 qt. = $\frac{1}{2}$ pk.	2 pk. = $\frac{1}{2}$ bu.	16 qt. = $\frac{1}{2}$ bu.	16 pt. = 1 pk.

QUANTITIES

1. Willie bought a bushel of corn for his chickens, and fed them for 16 days 2 quarts each day. How many quarts were then left?

2. George bought 8 pecks of oats for his pony, and the grain dealer sent them in a 2-bushel bag, full. Was this correct?

3. A grocer had a barrel of apples. He sold $\frac{2}{3}$ of them. What part of the barrel of apples did he have left?

4. One boy had two thirds of an apple, another boy had one third, and still another had one half of an apple. Tell how many equal parts of apples they had all together.

5. Two quarts of walnuts will fill how many cups, if each cup holds half a pint?

6. Fill a gallon measure with water, using a pint measure. How many times do you empty the pint measure?

7. How many quarts are there in 2 pecks? Which has more quarts, a peck or a gallon? Are the quarts the same in size?

8. A peck measure is one half full of oats. How many more quarts will it hold?

9. Henry filled a peck measure one quarter full of sand. How many quarts did he put into the measure? How many more quarts would it have held?

10. How many times must you empty a quart measure full of strawberries in order to fill a peck measure?

11. What part of a bushel of wheat is a peck of wheat?

12. What part of 4 is 1? When a bushel of oats costs a dollar, what will a peck of oats cost?

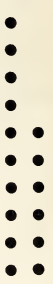
13. How many pints are there in 2 quarts? How many pecks are there in 16 quarts?

SIXTEEN, 16

We call ten and six things by the number **sixteen.**

$15 + 1 = 16$ $12 + 4 = 16$ $10 + 6 = 16$ $8 + 8 = 16$

We write sixteen with the figures 1 and 6, 16. We put the 1 in tens' place and the 6 in units' place.



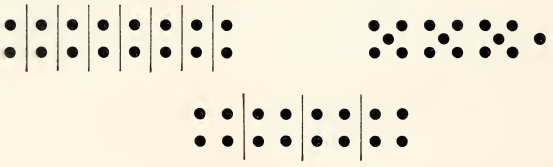
Show by splints that each of these number-facts is true: $10 + 6 = 16$, $8 + 8 = 16$, $4 + 12 = 16$, $9 + 7 = 16$, $11 + 5 = 16$.

$4 + 4 + 4 + 4 = 16$. How many 4's are there in 16?

$2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 = 16$. How many 2's are there in 16? $8 + 8 = 16$. How many 8's do we find in 16?

$4 \times 4 = 16$ $8 \times 2 = 16$ $2 \times 8 = 16$ $16 \div 4 = 4$ $16 \div 2 = 8$

Count these dots:



1. If eight girls were sent to the grocery, each with two cents to buy a yeast cake, how many cents would all have together?

2. Four boys spent sixteen cents for fishhooks: each spent as much as the others. How many cents did each spend?

3. Mary had a nickel, Kate a dime, and Annie a cent. How many cents did they have all together?

SEVENTEEN, 17

We call ten and seven things by the number seventeen.

Seven and ten make seventeen. $10+7=17$

$16+1=17$ $15+2=17$ $9+8=17$ $13+4=17$

Show each of these facts by splints and counters.

1. We cannot divide 17 by any smaller number without remainder.
2. We can divide 16 by 2, by 4, and by 8.
3. We can divide 15 by 3 and by 5.
4. We can divide 14 by 7 and by 2.
5. We cannot divide 13 without remainder.
6. We can divide 12 by 6, by 2, by 3, and by 4.
7. We cannot divide 11 without remainder.
8. We can divide 10 by 5 and by 2.
9. We can divide 9 by 3.
10. We can divide 8 by 4 and by 2.
11. We cannot divide 7 without remainder.
12. We can divide 6 by 2 and by 3.
13. We cannot divide 5 without remainder.
14. We can divide 4 by 2.
15. Tell number-stories about 17, using cents, marbles, eggs, fish, dolls, apples, or whatever interests you, to show these facts: $10+7=17$ $15+2=17$ $17-11=6$ $17-8=9$ $17-3=14$ $17-5=12$

16. Add:

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

EIGHTEEN, 18

We call ten and eight things by the number **eighteen.**

Eight and ten make eighteen. $10+8=18$

$15+3=18$ $16+2=18$ $9+9=18$ $12+6=18$

$18\div2=9$ $18\div9=2$ $9\times2=18$ $2\times9=18$

$18\div6=3$ $18\div3=6$ $6\times3=18$ $3\times6=18$

Show each of these facts by splints and counters.

15 are three 5's. 15 are ten and five.

18 are three 6's. 18 are twelve and six.

There are two 6's in 12. $6\times2=12$. $12\div6=2$.

This group of dots  is 2 times this group 

A DOZEN

A HALF DOZEN

18 are a dozen and a half dozen more.

12 inches make one foot.

18 inches are 12 inches and 6 inches more.

18 inches are a foot and a half foot.

Show these facts on the yardstick or by blackboard picture.

NUMBER–STORIES

1. John's father asked him to get at the store a dozen and a half of pens. These cost one cent each. How many cents did John pay?

2. When John came home he found a yardstick and measured the kitten, which was 18 inches long from its nose to the end of its tail. How much was that in feet?

3. Then his mother sent him on an errand to sell a dozen and a half of eggs. The grocer gave him a dime a dozen. How many cents did he bring home?

NINETEEN, 19

We call ten and nine things by the number **nineteen**.

Nine and ten make nineteen. $10+9=19$

$15+4=19$ $16+3=19$ $12+7=19$ $14+5=19$

$18+1=19$ $5+5+5+4=19$ $4+4+4+4+3=19$

Show each of these facts by splints and counters.

NUMBER-STORIES

1. There were 19 boys in the school yard. 6 of them went home. How many were left?

2. 19 boys came to school early in the morning to play marbles. When they reached the school yard 2 of them found that they had lost their marbles on the way to school. How many had their marbles with them?

3. Nineteen girls were trying to cut paper dolls out of white paper. Fourteen of them made very nice dolls. How many of them were not able to make the dolls?

4. Three times six boys went swimming. One more boy asked his mother if he could go, but she said, "No!" How many boys wanted to go?

5. Eight times two girls walked home from school together in pairs. Three girls walked side by side. How many girls were there in all?

6. Add:

$$\begin{array}{ccc} 12 & 11 & 14 \\ \underline{7} & \underline{8} & \underline{5} \end{array}$$

7. $3+5+6+5=$ **8.** $10+6+3=$

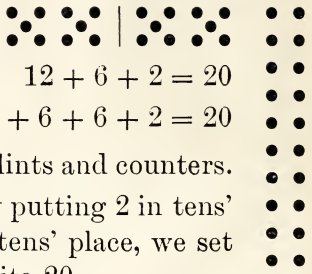
9. $8+4+3+4=$ **10.** $12+5+2=$

11. Subtract:

$$\begin{array}{ccccccccccc} 19 & & 19 & & 19 & & 19 & & 19 & & 19 \\ \underline{2} & & \underline{4} & & \underline{5} & & \underline{12} & & \underline{13} & & \underline{1} \end{array} \qquad \begin{array}{cc} 19 & 19 \\ \underline{16} & \underline{8} \end{array} \qquad \begin{array}{c} 19 \\ \underline{9} \end{array}$$

12. Tell number-stories about the combinations in **7**, **8**, **9**, **10**, and **11**.

TWENTY, 20

We call two tens **twenty.** 

$10 + 10 = 20$ $\quad 15 + 5 = 20$ $\quad 12 + 6 + 2 = 20$

$5 + 5 + 5 + 5 = 20$ $\quad 6 + 6 + 6 + 2 = 20$

Show each of these facts by splints and counters.

We write twenty in figures by putting 2 in tens' place, and to show that 2 is in tens' place, we set the zero, 0, in units' place. Write 20.

$2 \times 10 = 20$ $\quad 4 \times 5 = 20$ $\quad 3)\underline{20}\ +2$ (6)

There are six 3's or three 6's in 20 and 2 units over.

We write this: $(3 \times 6) + 2 = 20$ or $(6 \times 3) + 2 = 20$.

We place the marks of parenthesis ( ) around the 6 and 3 to show that 3 multiplies 6, and does not multiply $6 + 2$.

1. Find how many times 20 contains 3, 7, 9, with how many units over.

2. Draw on the blackboard a rectangle containing 20 square inches.

3. Add:

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

4. Subtract:

	20	20	20	20	20	20	20	20	20	20
	18	15	10	12	1	3	4	6	7	9

5. How would you divide twenty apples among five boys? among six boys?

6. Can we divide twenty oranges among seven girls so that each may have as many as any other? How many would have but two oranges each?

FACTS OF NUMBER, 11 TO 20

Additions :

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

Multiplications :

$2\times6=12$	$2\times8=16$	$2\times10=20$	$3\times5=15$	$4\times4=16$
$2\times7=14$	$2\times9=18$	$3\times4=12$	$3\times6=18$	$4\times5=20$

Copy and answer :

1. $10\div5=$	**9.** $4\times4=$	**17.** $\frac{1}{6}$ of $12=$
2. $9\div3=$	**10.** $18\div2=$	**18.** $\frac{1}{7}$ of $14=$
3. $8\div4=$	**11.** $20\div5=$	**19.** $\frac{2}{3}$ of $9=$
4. $12\div6=$	**12.** $20\div10=$	**20.** $\frac{2}{5}$ of $10=$
5. $15\div5=$	**13.** $\frac{1}{2}$ of $16=$	**21.** $\frac{3}{4}$ of $12=$
6. $16\div8=$	**14.** $\frac{1}{3}$ of $18=$	**22.** $\frac{3}{5}$ of $15=$
7. $18\div6=$	**15.** $\frac{1}{4}$ of $20=$	**23.** $18-5+6=$
8. $7\times2=$	**16.** $\frac{1}{5}$ of $15=$	**24.** $14+3-10=$

25. Subtract from 20 every number from 10 to 19.

20 20
10 11 and so on.

26. 4)16 2)18 4)20 5)15 5)20 6)18 3)12

QUESTIONS

1. A man has a dozen letters to be mailed and only four stamps. How many stamps must he buy?

2. How many cents are 10¢ and 2¢? 10¢ and 4¢? 16¢ and 1¢? 3¢ and 10¢? 14¢ and 5¢? 13¢ and 3¢? 12¢ and 8¢? 13¢ less 5¢? 19¢ less 7¢?

3. Make 12 dots in a row. Make 2 more dots under them. How many dots in all have you made? Add 5 more. How many have you made now?

4. Nine boys have twenty marbles. Four of them have ten marbles all together. Each of the rest has as many as any of the others. How many marbles has each of these?

5. Count by 2's from 1 to 19 and from 19 back to 1.

6. Count by 3's from 19 backwards to 1.

7. Count by 3's from 1 to 19.

8. Count by 4's from 0 to 20 and from 20 back to 0.

9. Count by 4's from 17 back to 1.

10. Count by 2's from 3 to 19 and from 19 back to 3.

11. Count by 3's from 2 to 20 and from 20 back to 2.

12. Count by 4's from 5 to 17.

13. Count backwards by 5's from 20 to 0.

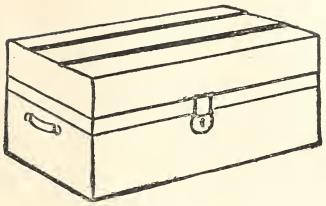
14. Count backwards by 5's from 19 to 4.

15. Count by 6's from 0 to 18 and back from 18 to 0.

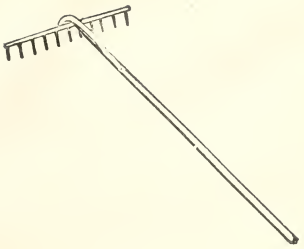
16. Begin at 3 and count by 7's to 38.

17. Begin at 4 and count by 5's to 39.

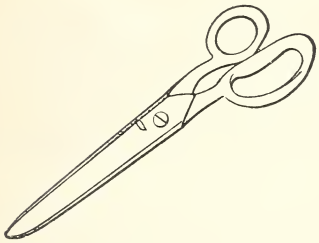
18. Begin at 2 and count by 4's to 38.



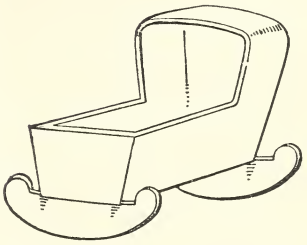
trunk



rake

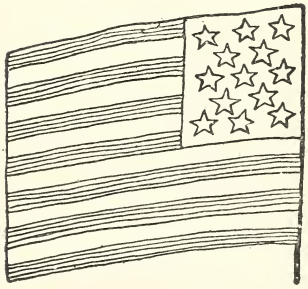


shears



cradle

pitcher



flag

Draw, or cut out of paper, various numbers of these objects.

QUESTIONS

1. Write the numbers made up of :

One ten and seven units. One ten and three units. One ten and six units. One ten and five units. One ten and eight units. One ten and two units. One ten and one unit. One ten and four units. One ten and nine units. One ten. Two tens.

Seven units. Three units. Eight units. Six units. Five units. Nine units.

2. A farmer had 19 animals in a field. Eight of them were sheep and the rest were cows. How many cows were there in the field ?

3. Ella has 11¢ and Maud has 17¢. How many more cents has Maud than Ella ?

4. Alice had 19 splints in her hand. She put 7 of them on her desk. How many splints did she keep in her hand ?

5. I had 20¢ and lost 6¢. How many cents had I left ?

6. Mrs. Smith paid $16 for a jacket and $4 for a hat. How many dollars did she spend ?

7. A farmer had 19 chickens. He sold 5 of them. How many were left ?

8. There were 20 barrels of flour in a store. Six of them were sold. How many were left ?

9. One ladder has 19 rungs. Another ladder has 14 rungs. What number tells the difference in rungs between the ladders ?

10. I paid 3¢ for a pencil and 16¢ for paper. How many cents did I spend ?

11. Emma had 20¢. She paid 2 nickels in car fares. How much money had she left ?

12. 12 lemon pies and 7 peach pies are how many pies ?

SUBTRACTING

1. John had 10 cents, and spent 7 cents for a whistle. He had three cents left.

2. Mary had 16 paper dolls, and gave away 11. She kept 5 for herself.

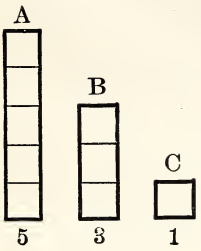
Give each boy and girl one combination to tell or write a story about.

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

3. Write out the answers to the questions in each column: $3 - 2 = 1$, $5 - 3 = 2$.

4. Tell the answers, taking turns around the class.

COMPARISONS

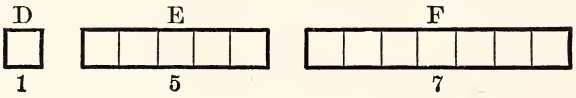


A is $5 \times C$. B is $3 \times C$.

C is $\frac{1}{5}$ of A. C is $\frac{1}{3}$ of B.

What part of A is B? of B is C? How many times does A contain C? How many does B contain C?

B is three fifths, $\frac{3}{5}$, of A. A is five thirds, $\frac{5}{3}$, of B.



What part of E is D? of F is D? How many times D is E? How many times D is F?

4 is 4 times 1 2 is 2 times 1

1 is $\frac{1}{4}$ of 4 1 is $\frac{1}{2}$ of 2

6 is 6 times 1 6 is $1\frac{1}{2}$ times 4

1 is $\frac{1}{6}$ of 6 4 is $\frac{4}{6}$ or $\frac{2}{3}$ of 6

6 is 3 times 2

3 is $\frac{1}{2}$ of 6

2 is $\frac{1}{3}$ of 6

4 is 2 times 2 2 is $\frac{1}{2}$ of 4

QUESTIONS

1. I have 3 black chicks and 5 times as many white ones. How many white chicks have I?

2. How many figs are 3 times 4 figs? 5 times 3 figs?

3. 4 pictures cost $5 apiece. How many dollars did they all cost?

4. A roll of braid costs 16¢. What will be the price of one quarter of the roll?

5. Helen had 12¢. She gave $\frac{1}{4}$ of her money to her sister Alice. How many cents did she give to Alice?

6. If Charles can ride 20 miles in 1 hour on his wheel, how far can he ride in a quarter of an hour?

7. If you bought $\frac{1}{4}$ of a dozen of bananas, how many bananas would you have? how many if you bought $\frac{2}{4}$ of a dozen? how many if you bought $\frac{1}{2}$ of a dozen?

8. A man walks 4 miles an hour. How far does he walk in 4 hours? in 5 hours? in $4\frac{1}{2}$ hours?

9. Edgar had 6¢. Arthur has 3 times as much money as Edgar. How many cents has Arthur?

10. If we use 3 crayons a day in this room, how long will 18 crayons last us?

11. If a man worked only half the working days in a week, how many days would he be idle? How many days would he be at work?

12. If you walk 1 mile every school day, how many miles do you walk in a week? If the walk is 1 mile each way, how many miles do you walk in a week, when you stay at school for noon-recess?

13. During Christmas week I was at home only 2 days. How many days was I away from home?

FOURS

4 8 12 16 20 24 28 32 36 40 44 48

$0 + 4 = 4$	$4 + 4 = 8$	$8 + 4 = 12$
$24 + 4 = 28$	$28 + 4 = 32$	$32 + 4 = 36$
$12 + 4 = 16$	$16 + 4 = 20$	$20 + 4 = 24$
$36 + 4 = 40$	$40 + 4 = 44$	$44 + 4 = 48$

Show by splints that each of these facts is true.

4	4	4	4	4	4	4	4	4	4	4	4
	4	4	4	4	4	4	4	4	4	4	4
	8	4	4	4	4	4	4	4	4	4	4
		12	4	4	4	4	4	4	4	4	4
			16	4	4	4	4	4	4	4	4
				20	4	4	4	4	4	4	4
					24	4	4	4	4	4	4
						28	4	4	4	4	4
							32	4	4	4	4
								36	4	4	4
									40	4	4
										44	4
											48

1. Add each column.
2. Add each row.
3. —— 4's = 16.
4. How many 4's make 44?
5. A dozen 4's make ——.

$4 \times 1 = 4$	$4 \times 7 = 28$
$4 \times 2 = 8$	$4 \times 8 = 32$
$4 \times 3 = 12$	$4 \times 9 = 36$
$4 \times 4 = 16$	$4 \times 10 = 40$
$4 \times 5 = 20$	$4 \times 11 = 44$
$4 \times 6 = 24$	$4 \times 12 = 48$

Multiplication Table of Fours

FOURS

1. Copy the Table of Fours on paper. 2. Learn Fours.

3. Show that 4 1's=4, 4 4's=16, 4 7's=28, 4 2's=8, 4 6's=24, 4 9's=36, 4 3's=12, 4 10's=40, 4 11's=44.

4. Write the Table on the blackboard without any copy.

5. Make a division table of fours, beginning it like this:

$4\div4=1$	$12\div4=3$	$20\div$			
$8\div4=2$	$16\div4=4$				

6. Add:

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12

7. How many 4's are there in a dozen?

8. How many dozen are there in 48?

9. Twelve fours are how many times twelve twos?

10. Begin at 2 and count by 4's to 50.

11. Take 30 splints and divide them into 4's. How many are left?

12. John received 4¢ a quart for picking strawberries. He was paid in all 40¢. How many quarts did he pick?

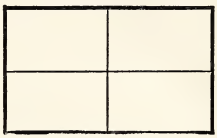
13. A cat has five claws on each front foot and four claws on each hind foot. How many claws in all has a cat?

FOURTHS OR QUARTERS

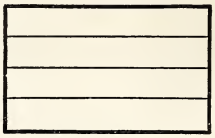
When anything is divided into four equal parts, each part is called a fourth or a quarter.

Four fourths or four quarters make one whole. $4 \times \frac{1}{4} = 1$.

Circle



Rectangle



Rectangle

Square

Into how many parts is the circle divided? Each rectangle?

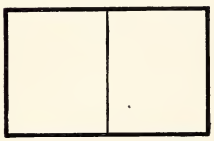
Into how many parts is the square divided?

How many fourths are there in each of these forms?

$\frac{4}{4} = 1$. Four quarters are one. One half of four is 2. $4 \div 2 = 2$. One half of four fourths is two fourths.

$\frac{1}{2}$ of $\frac{4}{4} = \frac{2}{4}$; $\frac{2}{2} = 1$; $\frac{3}{3} = 1$; $\frac{4}{4} = 1$; $\frac{1}{2} = \frac{2}{4}$.

Read each of these facts in words.



1. Make three rectangles, each one inch high by two inches long. Cut one rectangle into halves. Cut the second rectangle into fourths. Place the halves upon the third rectangle, and the fourths upon the halves. Are the two halves equal to the four fourths? Are the two halves and the four fourths equal to the third rectangle?

2. Willie had a quarter of a dollar, his aunt gave him half a dollar. How many quarters of a dollar did he have then? How many fourths of a dollar?

3. A barrel of flour contains how many fourths of a barrel? If $\frac{2}{4}$ of the flour are taken out of the barrel, how much of the flour is left in the barrel?

TELLING WEIGHTS

Did you ever buy anything at a store? Did you ever notice how much heavier 5 pounds of sugar are than 2 pounds of coffee? Did you ever lift a piece of iron weighing just one pound?

We buy some things by their weight or heaviness.

One pound is the standard measure of weight, just as a foot is for length, an hour for time, and a quart for quantity or amount.

16 ounces (oz.) make 1 pound (lb.).

1 oz. $= \frac{1}{16}$ lb. 1 lb. $= 16$ oz. $\frac{1}{2}$ lb. $= 8$ oz.

1. Name five things sold by weight.

2. If a pound of meat costs 20¢, what will $\frac{1}{2}$ of a pound cost?

3. A melon weighs 20 ounces. How many more ounces than 1 pound does it weigh?

4. What part of 16 ounces are 4 ounces?

5. If a pound of candy costs 20¢, how much will a quarter of a pound cost? How much will $\frac{3}{4}$ of a pound cost?

6. If Mr. Brown and his family use 4 pounds of sugar in 4 days, how many ounces do they use in 1 day?

7. How many ounce weights are equal to a quarter of a pound weight?

8. If a quarter of a pound of coffee costs 9¢, how many cents will a pound cost?

9. At 16¢ a pound, what will half a pound of crackers cost?

10. When pepper is 6¢ an ounce, can you buy half a pound of pepper for half a dollar?

QUESTIONS

One quarter of a dollar = 25¢

1. How many quarters of a dollar make a dollar? a dollar and a quarter? a dollar and a half? a dollar and three quarters? two dollars?

2. Two halves of a pie were each cut into two equal parts. Henry ate one of those parts. What part of the whole pie was left?

3. Mary bought a yard of ribbon, and used $\frac{2}{3}$ of it. What part of the yard of ribbon was left?

4. Willie is twice as old as Charles. Willie is 14 years old. How old is Charles?

5. Mr. Jones divided 18 boxes of figs equally among 6 children. How many boxes did each child get?

6. A farmer sold half a bushel of pears to one man and a fourth of a bushel to another man. How many fourths in all did he sell?

7. Etta bought 8 lead pencils at 3¢ apiece. She gave the clerk a quarter. What change should she get?

8. Mrs. Brown bought 3 pounds of currants at 8¢ a pound. She gave the clerk 2 dimes and a nickel. What change should she get?

9. At 3¢ a yard, how much will 7 yards of braid cost? at 4¢ a yard? at 5¢? at 6¢?

10. Irene had 9¢. She spent $\frac{1}{3}$ of her money, and gave another $\frac{1}{3}$ to her brother. What part of her money had she left? How many cents had she left?

11. In an orchard there are 15 peach trees and 12 pear trees. How many trees are there in the orchard?

12. In a can there are 2 gallons of milk. How many pints are there?

NUMBERS TWENTY-ONE TO TWENTY-THREE

21

Twenty things and one thing we call by the number **twenty-one.**

$10+10+1=21$ $20+1=21$ $16+5=21$

$15+6=21$ $10+11=21$ $12+9=21$ $18+3=21$

We write the two in tens' place and the 1 in units' place.

22

Twenty and two we call **twenty-two.**

$10+10+2=22$ $20+2=22$ $16+6=22$

$15+7=22$ $10+12=22$ $18+4=22$

$14+8=22$ $2\times11=22$ $22\div11=2$

23

Twenty and three we call **twenty-three.**

$10+10+3=23$ $20+3=23$ $16+7=23$

$15+8=23$ $10+13=23$ $18+5=23$

$14+9=23$ $23=(4\times5)+3$ $23=(6\times3)+5$

NUMBERS TWENTY-FOUR TO TWENTY-SIX

24

Twenty things and four things we call by the number **twenty-four.**

$10+10+4=24$ $20+4=24$ $16+8=24$

$15+9=24$ $10+14=24$ $18+6=24$

$14+10=24$ $6\times4=24$ $12\times2=24$

25

Twenty and five we call **twenty-five.**

5 5's are 25.

$10+10+5=25$ $5\times5=25$ $25\div5=5$ $24+1=25$

$(6\times4)+1=25$ $(3\times7)+4=25$ $(8\times3)+1=25$

26

Twenty and six we call **twenty-six.**

$10+10+6=26$ $20+6=26$ $16+10=26$

$15+11=26$ $12+14=26$ $18+8=26$

$19+7=26$ $26=(5\times5)+1$ $26=(8\times3)+2$

NUMBERS TWENTY-SEVEN TO TWENTY-NINE

27

Twenty things and seven things we call by the number **twenty-seven.**

$10+10+7=27$ $20+7=27$ $16+11=27$

$15+12=27$ $10+17=27$ $18+9=27$

$14+13=27$ $9\times 3=27$ $(6\times 4)+3=27$

28

Twenty and eight we call **twenty-eight.**

$10+10+8=28$ $20+8=28$ $16+12=28$

$15+13=28$ $14+14=28$ $18+10=28$

$19+9=28$ $7\times 4=28$ $(5\times 5)+3=28$

29

Twenty and nine we call **twenty-nine.**

$10+10+9=29$ $20+9=29$ $16+13=29$

$15+14=29$ $18+11=29$ $19+10=29$

$(7\times 4)+1=29$ $(2\times 10)+9=29$

$(8\times 3)+5=29$

21 TO 29

Twenty-one 21	Twenty-two 22	Twenty-three 23
Twenty-four 24	Twenty-five 25	Twenty-six 26
Twenty-seven 27	Twenty-eight 28	Twenty-nine 29

1. How many 10's are there in 21? What is left over?

2. How many 10's are there in 24? What are left over?

3. How many 10's and how many units, or ones, are there in 23? in 22? in 27? in 26? in 25? in 28? in 29?

4. ● ● ● ● ● ● ●
● ● ● ● ● ● ●
● ● ● ● ● ● ●
How many rows of 7 dots are there? of 3 dots? How many dots are there in all?

5. $3 \times 7 = ?$ $7+7+7=?$ $3+3+3+3+3+3+3=?$
How many 7's in 21? What is $\frac{1}{7}$ of 21? What is $\frac{1}{3}$ of 21?
How many 3's in 21? $7 \times 3 = ?$ $7\overline{)21}$ $3\overline{)21}$

$ is the sign for a dollar of money.

6. A dealer sold 7 hats at $3 each? How many dollars did he get?

7. There were 21 apples in a barrel. I took out $\frac{1}{3}$ of them. How many apples did I take out?

8. Ethel gave 2 dimes and a cent for 3 yards of braid. What was the price of the braid a yard?

9. $17 + 7 = ?$ If we wish to do so, we can find the answer by these steps:

$7 = 3 + 4$ $17 + 3 = 20$ $20 + 4 = 24$

10. $18 + 6 = ?$ $18 + 2 = 20$ $6 - 2 = 4$ $20 + 4 = 24$

11. Add:

8	7	6	2	8	7	9	5	4
6	3	2	7	3	2	2	5	3
4	5	2	14	3	2	6	4	5
2	4	11	1	5	1	3	8	10
5	4	3	1	3	9	4	1	3

20 AND 25

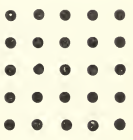
1. $2 \times 10 = ?$ $10 \times 2 = ?$ $20 \div 10 = ?$ $20 \div 2 = ?$

2. What is $\frac{1}{2}$ of 20? $\frac{1}{10}$ of 20? $\frac{2}{10}$ of 20? $\frac{3}{10}$ of 20? $\frac{4}{10}$ of 20? $\frac{6}{10}$ of 20? $\frac{8}{10}$ of 20? $\frac{9}{10}$ of 20?

3. What is the ratio of 20 to 10? of 10 to 20?

4. Edna bought a yard of lace for 18¢. She gave the clerk 2 dimes. What change should he give her?

5. How many dots are there in each of these rows? How many rows are there? How many dots are there in all?



6. $5 \times 5 = ?$ How many 5's are there in 25? How many 5's are there in 20?

7. What is the ratio of 25 to 5? of 20 to 5? of 5 to 20? of 5 to 25?

8. $25 \div 5 = ?$ $20 \div 5 = ?$ $10 \div 5 = ?$

9. At 5¢ each, how many cents will 5 oranges cost?

10. How many nickels equal a quarter of a dollar?

11. $7 + 8 + 10 - 5 = ?$ $25 - 5 - 5 - 5 = ?$

12. $1 + 17 - 10 - 5 + 2 = ?$ $23 - 3 - 5 + 4 + 1 = ?$

13. $16 + 4 + 5 - 6 - 4 = ?$ $24 - 3 - 2 + 6 = ?$

14. If one table costs $5, how many dollars will 2 tables cost? How many $5 in $10?

15. What is the cost of 5 hats at $4 each?

16. Ella has 25¢. How many paper dolls at 2¢ apiece can she buy?

17. How much money will she have left, after buying all the dolls she can at that price?

18. Multiply 1, 3, 7, 2, 9, 8, 4, 6, 5, 10, 12, 11, by 2.

19. Multiply 1, 4, 7, 9, 6, 8, 5, 3, 2, by 3.

20. Multiply 5, 2, 1, 4, 3, by 5.

1 TO 29

Copy and add by rows and columns:

1.

2	3	1	3	2	3
6	4	9	2	3	5
2	3	1	2	4	3
5	4	3	2	6	6
4	5	2	3	2	1
1	2	3	6	1	4
1	2	1	2	3	1

2.

3	3	1	4	6	2
2	5	7	2	3	4
4	1	2	6	1	5
2	7	3	1	2	1
1	1	1	8	5	2
8	7	6	5	1	2
2	3	5	2	5	4

Copy and complete:

3.	**4.**	**5.**	**6.**
$12 = \ ? \times 6$	$8 = ? \times 4$	$18 = ? \times 9$	$22 = 11 \times ?$
$14 = \ ? \times 7$	$28 = ? \times 7$	$15 = 5 \times ?$	$25 = \ 5 \times ?$
$10 = \ ? \times 5$	$12 = 4 \times ?$	$9 = 3 \times ?$	$16 = \ ? \times 4$
$20 = \ 5 \times ?$	$14 = ? \times 7$	$6 = 2 \times ?$	$18 = \ 2 \times ?$
$10 = \ 2 \times ?$	$12 = 3 \times ?$	$14 = 2 \times ?$	$18 = \ ? \times 6$
$20 = 10 \times ?$	$28 = 4 \times ?$	$27 = 3 \times ?$	$24 = \ ? \times 8$

7. $9 - 1 + 2 - 3 - 4 + 6 + 8 - 10 = —.$
$27 - 6 - 1 - 10 + 2 - 8 + 4 - 2 = —.$
$19 + 1 - 2 - \ 8 - 8 + 8 - 9 + 1 = —.$

8. $24 - 12 - 6 - 3 - 2 + 1 - 2 = —.$
$19 - 8 - 10 + 7 + 6 - 3 - 6 = —.$
$23 - 17 + 6 - 10 + 2 + 2 + 2 = —.$

9. $28 - 8 - 4 - 3 - 3 - 3 - 3 = —.$
$26 - 6 - 5 - 4 - 3 - 2 - 1 = —.$
$29 - 9 - 8 + 12 - 4 - 10 - 10 = —.$

10. Try these questions: $(25 \div 5) + 3 = ?$
$(5 \times 2) + 6 = ?$ $2 + (3 \times 6) = 10 \times ?$

QUESTIONS

1. $3+4+4+3=?$ $\quad$ $28-8-5-5=?$

$18-8-5-5=?$ $\quad$ $29-1-7-1=?$

$29-8+1-2-10-4-1=?$

$28-8+1+2+2-4-1=?$

$20-10+2-3+4-1+5-3=?$

$22-20+4+10-2-3+1-7=?$

$1+7+9+3+9-8-1-5-4-3=?$

2. Add:

5	3	2	3	9	5	7	5
11	1	6	7	1	4	2	8
1	4	2	4	4	3	3	6
2	7	1	2	3	6	6	7
1	2	5	1	6	5	1	3

3. Count from:

0 by 3's to 27	0 by 4's to 28	0 by 8's to 24
0 by 6's to 24	0 by 7's to 28	0 by 11's to 22
0 by 9's to 27	0 by 10's to 20	0 by 12's to 24
1 by 3's to 22	1 by 3's to 25	1 by 6's to 25
2 by 4's to 26	1 by 5's to 26	4 by 3's to 25
1 by 7's to 29	3 by 2's to 29	6 by 3's to 27
5 by 6's to 29	2 by 7's to 23	5 by 2's to 29
2 by 5's to 27	3 by 4's to 27	

4. How many:

2's in 8? 10? 16? 20? 14? 12? 24? 22?

3's in 9? 27? 18? 12? 24? 15? 21?

4's in 12? 24? 16? 20? 28?

5's in 10? 25? 15? 20?

6's in 18? 24? 12?

7's in 21? 14? 28?

8's in 24? 16? 8?

9's in 27? 18? 9?

10's in 20? 10?

11's in 22?

12's in 24?

THE NUMBERS THIRTY TO NINETY-NINE

We call three tens **thirty** and four tens **forty.**

$$10 + 10 + 10 = 30$$

$$20 + 10 = 30$$

We write thirty with 3 in tens' place and 0 in units' place.

$$10 + 10 + 10 + 10 = 40$$

$$2 \times 20 = 40$$

We write forty with 4 in tens' place and 0 in units' place.

TABLE OF TENS, ADDING UNITS

● ● ● ● ● ● ● ● ● ●	10	+	●	=	11
● ● ● ● ● ● ● ● ● ●	20	+	● ●	=	22
● ● ● ● ● ● ● ● ● ●	30	+	● ● ●	=	33
● ● ● ● ● ● ● ● ● ●	40	+	● ● ● ●	=	44
● ● ● ● ● ● ● ● ● ●	50	+	● ● ● ● ●	=	55
● ● ● ● ● ● ● ● ● ●	60	+	● ● ● ● ● ●	=	66
● ● ● ● ● ● ● ● ● ●	70	+	● ● ● ● ● ● ●	=	77
● ● ● ● ● ● ● ● ● ●	80	+	● ● ● ● ● ● ● ●	=	88
● ● ● ● ● ● ● ● ● ●	90	+	● ● ● ● ● ● ● ● ●	=	99
● ● ● ● ● ● ● ● ●	99	+	●	=	100

TENS AND ONE HUNDRED

We write:

Nine . . .	9	Forty . . .	40
Ten . . .	10	Fifty . . .	50
Nineteen . . .	19	Sixty . . .	60
Twenty . . .	20	Seventy . . .	70
Twenty-nine . .	29	Eighty . . .	80
Thirty . . .	30	Ninety . . .	90

But after ninety-nine, 99, we write one hundred, 100

1 ten is written .	10	6 tens . . .	60
2 tens are written .	20	7 tens . . .	70
3 tens . . .	30	8 tens . . .	80
4 tens . . .	40	9 tens . . .	90
5 tens . . .	50	10 tens are written	100

1. Write in figures: thirty-two, forty-four, fifty-six, sixty-three, seventy-nine, eighty-seven, ninety-eight.

2. Write in words: 37, 84, 76, 53, 45, 92, 69, 100.

3. Add:

20	80	70	10	40	50	60	30	40
50	10	20	60	10	40	30	50	60

SUBTRACTING

$$\begin{array}{r} 73 \\ 28 \\ \hline 45 \end{array}$$

In subtracting when the figure to be subtracted is larger than the figure from which it is to be subtracted, we add ten to the latter.

8 is larger than 3.

$8 + 5 = 13$.

Set down 5 in units' place.

We now add 1 (ten) to 28 : making it 38.

3 (tens) + 4 (tens) = 7 tens.

Set down 4 in tens' place. See page 213.

1. A peach orchard yielded 95 bushels of peaches. 68 bushels were sold. How many bushels were not sold?

2. In a school there were 87 pupils. 49 were boys. How many were girls?

3. A man had $75. He paid $41 for a bicycle and $18 for a suit of clothes. How many dollars had he left?

4. There are 27 sheep in one pen and 22 in another. How many sheep in both pens? 19 of them were sold. How many sheep were left?

5. Subtract :

91	73	43	91	23	72	55	93	45	80
26	38	28	46	19	53	27	46	26	34
95	100	66	89	74	40	70	60	38	27
37	25	17	39	29	11	26	19	29	22
98	64	83	44	77	81	82	53	75	46
45	28	29	26	58	62	37	36	38	18

Arithmetic
Walter Livingston

1. $15 + 26 + 32 = 73$

2. $29 + 17 + 35 = 81$

3. $4 \times 5 = 20 \quad 20 - 6 = 14$

4. $36 - 19 = 17$

5. $27 \div 3 = 9$

6. Eleven, eight and seven are twenty-six which is twice thirteen.

FRACTIONS

The equal parts of numbers are called **fractions.**

Fold or cut paper or make drawings to show these facts.

1. $\frac{1}{2}$ of $6 = \frac{6}{2}$. Six halves are three wholes or units, because two halves equal one whole, and six are three times two. $\frac{6}{2} = 3$. $\frac{1}{2}$ of $6 = 3$. $\frac{1}{2} \times 6 = \frac{6}{2} = 3$.

2. $\frac{1}{2}$ of $8 = \frac{8}{2}$. $\frac{8}{2} = 4$. $\frac{1}{2}$ of $8 = 4$. $\frac{1}{2} \times 8 = 4$.

3. $\frac{1}{3}$ of $6 = \frac{6}{3}$. Six thirds are two wholes, or units, because three thirds equal one whole, and six are two times three. $\frac{6}{3} = 2$. $\frac{1}{3}$ of $6 = 2$. $\frac{1}{3} \times 6 = \frac{6}{3} = 2$.

4. $\frac{1}{3}$ of $9 = \frac{9}{3}$. $\frac{9}{3} = 3$. $\frac{1}{3}$ of $9 = 3$. $\frac{1}{3} \times 9 = 3$

5. What part of 10 is 5?

6. What part of 12 is 6?

7. What part of 14 is 7?

8. $\frac{1}{2}$ of $16 = ?$

9. $\frac{1}{3}$ of $12 = ?$

10. $\frac{1}{3}$ of $15 = ?$

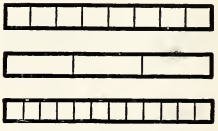
11. $\frac{1}{3}$ of $18 = ?$

12. $\frac{1}{3}$ of $21 = ?$

13. $\frac{2}{3}$ of $9 = ?$ $\frac{2}{3} \times 9 = \frac{18}{3}$ because 9 times two thirds are 18 thirds. $\frac{18}{3} = 6$, because $18 \div 3 = 6$.

14. $\frac{2}{3}$ of $12 = ?$ $\frac{2}{3} \times 12 = \frac{24}{3} = 8$.

15. $\frac{1}{4}$ of $8 = ?$ $\frac{1}{4} \times 8 = \frac{8}{4} = 2$.



Count and see.

16. Find $\frac{3}{4}$ of 8, $\frac{3}{4}$ of 12, $\frac{3}{4}$ of 16, $\frac{3}{4}$ of 20.

17. Find $\frac{2}{5}$ of 10, $\frac{2}{5}$ of 15, $\frac{2}{5}$ of 20, $\frac{2}{5}$ of 25.

18. Find $\frac{3}{5}$ of 15, $\frac{4}{5}$ of 20, $\frac{3}{5}$ of 30, $\frac{2}{5}$ of 40.

19. What number is $\frac{2}{3}$ of 18? 15? 6? 9? 21? 24? 27? 30?

20. Find $\frac{4}{5}$ of 20, 10, 15, 5, 25, 30, 35, 40.

21. Find $\frac{2}{6}$, $\frac{4}{6}$, and $\frac{5}{6}$ of 18, 6, 12, 24, 30, 36, 42, 48.

22. Find $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, $\frac{5}{7}$, and $\frac{6}{7}$ of 14, 7, 21, 28.

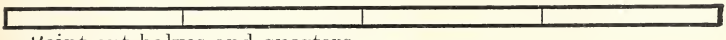
23. What are $\frac{2}{8}$, $\frac{3}{8}$, $\frac{4}{8}$, $\frac{5}{8}$, $\frac{6}{8}$, and $\frac{7}{8}$ of 16, 8, 24, 32, 40?

FRACTIONS

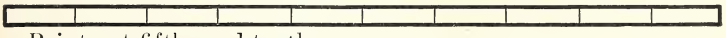
$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$, $\frac{1}{12}$ are fractions. So also are $\frac{2}{3}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{5}{6}$, $\frac{2}{10}$, $\frac{3}{10}$, $\frac{4}{10}$, $\frac{5}{10}$, $\frac{6}{10}$, $\frac{7}{10}$, $\frac{8}{10}$, $\frac{9}{10}$. Read these.

3 numerator
4 denominator

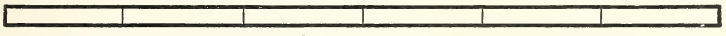
The number below the line tells into how many parts the thing is divided, and the number above the line tells how many parts we are talking about. $\frac{5}{12}$ means that there are 12 equal parts, and we are talking about 5 of them.



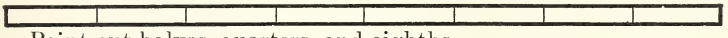
Point out halves and quarters.



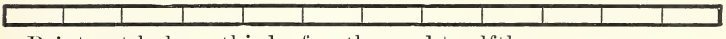
Point out fifths and tenths.



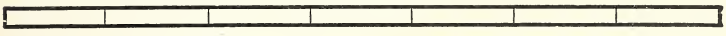
Point out thirds and sixths.



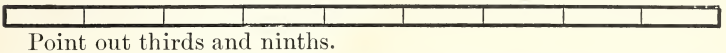
Point out halves, quarters, and eighths.



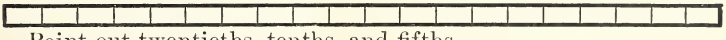
Point out halves, thirds, fourths, and twelfths.



Point out sevenths.



Point out thirds and ninths.



Point out twentieths, tenths, and fifths.

1. Draw on the blackboard forms of figures showing halves, thirds, quarters, fifths, sixths, sevenths, eighths, ninths, tenths, twelfths, twentieths, and fortieths.

2. Tell why the larger the number of equal parts of anything the smaller each part is.

3. What is $\frac{1}{2}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{3}$? $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{4}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{5}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{5}$? $\frac{1}{4}$ of $\frac{1}{5}$? $\frac{1}{5}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{3}$? $\frac{1}{2}$ of $\frac{1}{6}$? $\frac{1}{2}$ of $\frac{2}{6}$? $\frac{1}{2}$ of $\frac{3}{6}$? $\frac{2}{3}$ of $\frac{1}{2}$? $\frac{2}{3}$ of $\frac{1}{4}$?

4. Fold or cut paper to show fractions.

QUESTIONS

1. $\frac{2}{4}$ of 8 = ? $\frac{1}{2}$ of 8 = ? $\frac{1}{2}$ of 20 = ? $\frac{2}{4}$ of 20 = ? $\frac{1}{2}$ of 44 = ? $\frac{2}{4}$ of 44 = ? $\frac{1}{2}$ of 28 = ? $\frac{2}{4}$ of 28 = ?

2. One half equals how many fourths?

3. How many times 4 is 28? What part of 28 is 4?

4. Compare 4 with 36. 4 is $\frac{1}{9}$ of 36. 36 is 4 times 9.

5. 24 is —— times 4; —— times 6; —— times 12.

6. What part is 4 of: 8? 32? 16? 40? 48? 44? 24? 20? 12? 4?

7. How many times 4 is each number in 6?

8. If a hat costs $4, what will a dozen hats cost?

9. Divide 24 pears equally among 6 boys. How many pears will each boy get?

10. There were 2 dozen eggs in a basket. One third of them were used for breakfast. How many were left?

11. James had 28¢. He spent $\frac{1}{4}$ of his money. How many cents had he left?

12. Three tops cost 18¢. What was the price of one top?

13. Eddie bought 9 apples at 2¢ each. How many cents did he pay for them?

14. Katie got 4 spools of thread at 3¢ apiece. How many cents did she pay for the 4 spools?

15. George has 3 nickels. How many cents has he?

16. Alice had 14 cherries. She gave $\frac{1}{7}$ of them to Lucy. How many cherries did Lucy get?

17. It is 18 miles from Brooklyn to Garden City. I walked $\frac{1}{6}$ of that distance. How many miles did I walk? Illustrate on the blackboard, calling a foot one mile.

QUESTIONS

1. A bushel basket is half full of potatoes. How many more pecks of potatoes will it hold?

2. How many quarts are there in a bushel of chestnuts? in a bushel of corn? in a bushel of apples?

3. If a bushel of wheat weighs 60 pounds, how many pounds does a peck of wheat weigh?

4. 8 quarts are what part of a bushel? 2 pecks make what part of a bushel?

5. If 2 bushels of apples cost four dollars, what will 2 pecks cost?

6. How many bushels are there in 64 quarts?

7. How many bushels are there in 72 quarts?

8. Arthur gathered half a bushel of chestnuts. He sold a peck of the nuts and then gave a quart each to five boys. He had —— quarts left.

9. How many quarts are there in a bushel? in half a bushel? How many quarts are there in a quarter of a bushel? How many quarts in 2 quarters of a bushel? in $\frac{3}{4}$ of a bushel?

10. If you had $\frac{1}{8}$ of a bushel of berries, how many quarts would you have?

11. If a pint of walnuts costs 6 cents, what will 4 quarts cost? What will half a peck cost?

12. A dish holds 3 pints of berries. How many quarts will 6 such dishes hold?

13. At 9¢ a qt., what will a pk. of cranberries cost?

14. At 5 cents a quart, what will 1 peck of beans cost?

15. How many pecks are there in 9 bushels? in 6 bushels? in 3 bushels? in 5 bushels?

QUESTIONS

1. How many inches are there in a quarter of a yard? in $\frac{3}{4}$ of a yard? in $\frac{1}{2}$ of a yard? Look and see.

2. Harriet bought a yard of ribbon and divided it equally, for dress trimming, among her six dolls. How many inches of ribbon did she cut off for each doll?

3. If you drew a line a foot long and divided it into 12 equal parts, what would be the name of any of those parts?

4. George drew a triangle that was $\frac{1}{4}$ of a foot on each side. How many inches was it around the triangle?

5. How many inches are there in $\frac{1}{6}$ of a foot?

6. How many inches is it around a desk top 2 feet long and 18 inches wide?

7. A ribbon was 3 feet in length. How many inches long was it?

8. If it takes 7 yards of lace to trim a dress, how many yards will it take to trim 9 dresses?

9. A log of walnut was 30 feet long, but $\frac{1}{3}$ of it was cut off. How many feet were cut off?

10. Mrs. Smith bought 10 yards of silk at $1 a yard. She used $\frac{1}{2}$ of the silk. How many yards were left? What was the value of the piece of silk she used?

11. A bench is 12 feet long and 16 feet wide. How many yards long is each side of the bench?

12. How many feet are there in 28 inches? How many inches over?

13. A square room has sides 5 yards and 1 foot long. How many feet is it around the room?

14. A string 1 foot long is to be cut into inch pieces. How many pieces will there be?

QUESTIONS

1. Draw a rectangle 2 inches wide and 4 inches long. Divide it into 1-inch squares. How many squares are there in the oblong?

2. A room is 3 yards and 1 foot wide. How many steps will a boy take in crossing the room if he steps 2 feet at each step?

3. Measure the distance between 2 windows in your room. Measure the length and the width of the room.

4. In a room the distance between a door and a window was measured and found to be 3 yards and 1 foot. How many feet were there in that distance?

5. Louise bought a roll of braid, and, on measuring it, found that there were 9 feet in the roll. How many yards were there in it?

6. Mrs. Smith bought 9 yards of silk. She used $\frac{1}{3}$ of it. How many feet were in the piece she used?

7. Draw a square with sides 3 inches long. Mark the inches on its sides. Divide the square into 9 smaller squares.

8. Draw a rectangle 1 inch wide and 4 inches long. How many 1-inch squares can you make in it?

9. On the board make 2 dots, 1 foot apart, guessing the distance. Measure the distance between the dots.

10. Judge a distance of 1 yard, making the distance by putting 2 dots on the board. Measure the distance guessed.

11. Draw a line that you think is 3 inches long. Measure it.

12. Draw a square that you judge to be $\frac{1}{2}$ of a foot in length. Measure the square.

HUNDREDS

We call ten tens one hundred.

$10 \times 10 = 100$ $\quad 99 + 1 = 100$ $\quad 50 + 50 = 100$

We write one hundred in figures, 100. We put the 1 in hundreds' place by setting two zeros, 00, at the right to show that the 1 is neither in units' place nor in tens' place.

We call twenty tens two hundred, and write two hundred in figures with a 2 in hundreds' place.

$100 + 100 = 200$ $\quad 20 \times 10 = 200$

Two hundred and one hundred are three hundred.

$100 + 100 + 100 = 300$ $\quad 200 + 100 = 300$

Four hundred, 400. Five hundred, 500.

Six hundred, 600. Seven hundred, 700.

Eight hundred, 800. Nine hundred, 900.

Above one hundred we count units and tens as we do below one hundred.

We write one hundred eleven in figures, 111.

We write six hundred ninety-two in figures, 692.

1. $90 + 11 = 101$. $11 = 10 + 1$. Nine tens and one ten make ten tens. Ten tens are one hundred. The unit we set in units' place.

2. $84 + 20 = 104$. $84 = 80 + 4$. Eight tens and two tens make ten tens. Ten tens are one hundred. The four we set in units' place.

3. $70 + 42 = ?$ $\quad 42 = 30 + 12$ $\quad 70 + 30 = ?$

Add and subtract:

1.	1	2	3	4	5	6	7	8	9
	1	1	1	1	1	1	1	1	1
2.	2	3	4	5	6	7	8	9	3
	2	2	2	2	2	2	2	2	3
3.	4	5	6	7	8	9	4	5	6
	3	3	3	3	3	3	4	4	4
4.	7	8	9	5	6	7	8	9	6
	4	4	4	5	5	5	5	5	6
5.	7	8	9	7	8	9	8	9	9
	6	6	6	7	7	7	8	8	9
6.	11	21	31	41	51	61	71	81	91
	10	10	10	10	10	10	10	10	10
7.	12	22	32	42	52	62	72	82	92
	10	20	20	20	20	20	20	20	20
8.	33	43	53	63	73	83	93	44	54
	30	30	30	30	30	30	30	40	40
9.	64	74	84	94	55	65	75	85	95
	40	40	40	40	50	50	50	50	50
10.	66	76	86	96	77	87	97	88	98
	60	60	60	60	70	70	70	80	80
11.	111	122	133	144	155	166	177	188	199
	83	94	75	67	56	88	99	98	65
12.	234	245	256	267	278	289	346	357	368
	45	68	79	58	33	66	87	63	79
13.	379	458	469	579	654	643	732	853	935
	95	64	82	35	28	19	17	56	77

METAL MONEY

One dollar is equal to one hundred cents.

$ is the sign for one dollar, or 100 cents.

A half dollar is half 100 cents, or 50 cents.

A quarter dollar is equal to a fourth, or quarter, of 100 cents, or 25 cents. ¢ is the sign for cents.

A dime is one tenth of one dollar. $100 \div 10 = 10$.

A dime is worth ten cents. Ten dimes equal a dollar.

The coins for dollars, half dollars, quarter dollars, and dimes are made of nearly pure silver metal by *Our Country*. That is one important thing Our Country, whose flag we know so well, does for us.

A nickel is equal to five cents, 5¢.

The penny is one cent, one hundredth part of one dollar.

$\$1 = 100¢$. $\qquad 100¢ \div 100 = 1¢ =$ one cent.

Nickels are made of nickel metal. Cents, sometimes called pennies, are made of copper and nickel.

1. Two quarter dollars equal how many half dollars?

2. How many cents are three quarter dollars worth?

3. Which is more, seven dimes or three quarter dollars? By how much?

4. How many cents are there in four dimes and a nickel?

5. When we divide a dollar into one hundred parts, what is the value of each hundredth part?

6. How many dimes equal a half dollar?

NUMBER-STORIES

1. Mary and Tom are at the grocery. They have three quarters to spend. Mother wishes them to ask the grocer for three pounds of sugar, half a pound of tea, and a dozen eggs. The grocer tells them that sugar is five cents a pound, tea is forty cents a pound, and eggs are twenty-five cents a dozen. Tom will carry the things home in the basket. Why does the grocer weigh the sugar? When Mary takes the "change," or money, he gives back to her with the packages and the eggs, how many cents does she have to take home to mother?

3 quarters = three 25¢ pieces of silver. $3 \times 25¢ = 75¢$.

3 pounds of sugar at 5¢ a pound cost three times 5¢. $3 \times 5¢ = 15¢$.

$\frac{1}{2}$ pound of tea at 40¢ a pound costs one half of 40¢. $\frac{1}{2}$ of $40¢ = 20¢$. The eggs cost 25¢.

$$15¢ + 20¢ + 25¢ = 60¢. \qquad 75¢ - 60¢ = 15¢.$$

Mary has fifteen cents to take back to her mother.

Do you see now why we have to learn about numbers?

2. Tell a number-story about Charlie and Susan. They have fifty cents. They wish to buy two pounds of sugar at five cents a pound, a loaf of bread at eight cents, and a pound of butter at twenty-eight cents. How much will they have left?

3. Make up a story about Willie and Jennie, who have one hundred cents. They ask the grocer for half a dozen eggs, two pounds of butter, and three large loaves of bread. He asks them twenty-eight cents a dozen for his very best eggs and twenty-eight cents a pound for table butter and ten cents for large loaves of bread. They gave him a silver dollar. Was this correct?

READING AND WRITING HUNDREDS

Hundreds	Tens	Units
7	0	0
	7	0
		7
7	7	7

Hundreds	Tens	Units
4	0	0
	2	0
		2
4	2	2

Hundreds	Tens	Units
4	0	0
	5	0
		1
4	5	1

Hundreds	Tens	Units
9	0	0
	8	0
		7
9	8	7

1. Read the numbers: 299, 643, 110, 444, 770, 801, 999.

2. How many more hundreds has 897 than 153? how many more tens has 897? how many more units?

3. Tell how many hundreds, how many tens, and how many units there are in:

393	406	744	985	112	630	808	299	681
515	600	401	642	371	755	423	691	717
350	404	199	878	555	802	576	603	979
611	225	111	226	414	901	584	717	205
660	218	922	660	832	961	321	201	1000

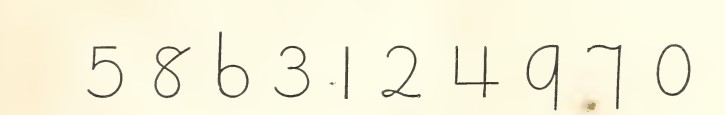
4. Write by figures:

One hundred twenty-five.
One hundred ninety-nine.
One hundred six.
Two hundred forty-six.
Two hundred eighteen.
Two hundred two.
Three hundred eleven.
Three hundred thirteen.
Four hundred twenty-eight.
Four hundred eighty-one.
Four hundred ninety.
Five hundred five.
Five hundred fifty-five.
Six hundred ninety.
Six hundred eight.
Seven hundred seventeen.
Seven hundred seven.
Eight hundred forty-eight.
Eight hundred thirty-six.
Nine hundred twenty-one.
Nine hundred fifty.
Nine hundred ninety-one.

PAPER

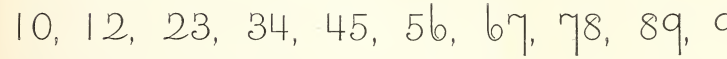
Write with a soft lead pencil or with pen and ink. When a pencil is so hard that its graphite must be softened by moisture from any source, it is too hard for the use to which it is being put.

These figures are $\frac{1}{4}$ in. high. See pages vi and 15.

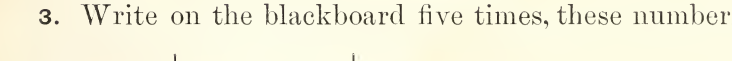


1. Copy on the blackboard one or more times:

2. Copy on the blackboard one or more times:



3. Write on the blackboard five times, these numbers:



4. Write a *number table* from 1 to 100.

5. Write all the *odd* numbers in a *number table* from 1 to 199.

6. Write all the *even* numbers in a *number table* from 2 to 200.

7. Write *number tables*, counting: by threes to 300; by fours to 400; by fives to 500; by sixes to 600; by sevens to 700; by eights to 800; by nines to 900; by tens, by elevens, and by twelves to 1000.

THOUSANDS

We call ten hundreds a **thousand.**

$10 \times 100 = 1000$ $\quad 999 + 1 = 1000$ $\quad 500 + 500 = 1000$

We write one thousand in figures, 1000. The three zeros, 000, at the right show that the 1 is neither in units' place nor in tens' place nor in hundreds' place.

We call twenty hundreds two thousand and write two thousand in figures with a 2 in thousands' place.

$1000 + 1000 =$ 2000 $\quad 20 \times 100 = 2000$

Two thousand and one thousand are three thousand.

$1000 + 1000 + 1000 =$ 3000 $\quad 2000 + 1000 = 3000$

We write:

Four thousand,	4000	Seven thousand,	7000
Five thousand,	5000	Eight thousand,	8000
Six thousand,	6000	Nine thousand,	9000

We write one hundred 100. We may write one thousand 1000. The comma is to help us see that there are three zeros, and to read thousands quickly.

1. Add:

100	200	200	200	300	200
200	200	300	400	400	500

2. Add:

400	400	500	300	200	300
400	500	500	600	800	700

3. Subtract:

1000	1000	1000	1000	1000	1000
900	100	200	300	400	500

THOUSANDS

1. One thousand one, 1001. One thousand nine, 1009.
One thousand ten, 1010. One thousand eighteen, 1018.
One thousand one hundred eighteen, 1118.
Two thousand seven hundred four, 2704.
Three thousand thirty-six, 3036.
Five thousand six hundred sixty, 5660.
Seven thousand seven hundred seventy-seven, 7777.
Eight thousand one hundred one, 8101.
Eight thousand eight hundred fifteen, 8815.
Nine thousand four hundred ninety-seven, 9497.

2. Read: 1246, 9223, 4780, 6111, 4644, 8707, 3136, 4598, 9610, 7000, 3688, 2080, 6202, 7100, 8004, 9110, 7333, 9909, 4707, 8118, 7656, 8771, 4919, 7223, 2743, 4339, 4716, 3188, 7007, 3010.

3. Write by figures: one thousand two hundred sixteen; three thousand seven hundred twenty-eight; nine thousand four hundred sixty-three; seven thousand seven hundred; eight thousand nine hundred seventy; two thousand seventy-five; four thousand four; six thousand six hundred sixty-six; nine thousand ten; eight thousand; three thousand one hundred forty-four; five thousand eight hundred eighty-one.

4. Write in words: 7414, 3602, 8433, 1014, 5005, 2110, 6116, 9711, 4419, 2829, 1990, 3333, 5208.

5. Give the number of thousands, of tens, and of ones in each of the numbers in 2 and 4.

6. Count by hundreds from 1000 to 2000.

7. Count by thousands from 2000 to 9000.

8. What is the greatest number that can be expressed by three figures? by four figures?

FIVES

5 · 10 15 20 25 30 35 40 45 50 55 60

$0 + 5 = 5$ $5 + 5 = 10$ $10 + 5 = 15$
$15 + 5 = 20$ $20 + 5 = 25$ $25 + 5 = 30$
$30 + 5 = 35$ $35 + 5 = 40$ $40 + 5 = 45$
$45 + 5 = 50$ $50 + 5 = 55$ $55 + 5 = 60$

5	5	5	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5	5	5
	10	5	5	5	5	5	5	5	5	5	5
		15	5	5	5	5	5	5	5	5	5
			20	5	5	5	5	5	5	5	5
				25	5	5	5	5	5	5	5
					30	5	5	5	5	5	5
						35	5	5	5	5	5
							40	5	5	5	5
								45	5	5	5
									50	5	5
										55	5
											60

1. Add each column.
2. Add each row.
3. How many 5's are there in 40?
4. —— 5's = 55.
5. A dozen 5's = ?

$5 \times 1 = 5$	$5 \times 7 = 35$
$5 \times 2 = 10$	$5 \times 8 = 40$
$5 \times 3 = 15$	$5 \times 9 = 45$
$5 \times 4 = 20$	$5 \times 10 = 50$
$5 \times 5 = 25$	$5 \times 11 = 55$
$5 \times 6 = 30$	$5 \times 12 = 60$

MULTIPLICATION TABLE OF FIVES

FIVES

1. Add:

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12

2. Make a division table, beginning it like this:

$5 \div 5 = 1$	$15 \div 5$				
$10 \div 5 = 2$	$20 \div$				

TENS

10 20 30 40 50 60 70 80 90 100 110 120

$0 + 10 = 10$	$10 + 10 = 20$	$20 + 10 = 30$
$30 + 10 = 40$	$40 + 10 = 50$	$50 + 10 = 60$
$60 + 10 = 70$	$70 + 10 = 80$	$80 + 10 = 90$
$90 + 10 = 100$	$100 + 10 = 110$	$110 + 10 = 120$

$10 \times 1 = 10$	$10 \times 7 = 70$
$10 \times 2 = 20$	$10 \times 8 = 80$
$10 \times 3 = 30$	$10 \times 9 = 90$
$10 \times 4 = 40$	$10 \times 10 = 100$
$10 \times 5 = 50$	$10 \times 11 = 110$
$10 \times 6 = 60$	$10 \times 12 = 120$

Multiplication Table of Tens

3. Make columns of 10's, and add.
4. Make columns of ten 1's, ten 2's, etc., and add.

FIFTHS AND TENTHS

When anything is divided into five equal parts, we call each part one fifth. Five fifths make one whole.

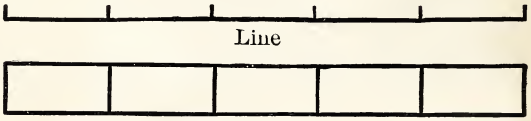
Circle

Square

Rectangle

Pentagon

Star



Line

Rectangle

Into how many equal parts is each of these forms divided?

1. Point out two fifths of each of these forms; three fifths; four fifths.
2. Make drawings like these forms on paper but larger.
3. Make drawings like these forms on the blackboard.

When anything is divided into tenths, it has ten equal parts. Ten tenths make one whole.

Into how many parts is each of these forms divided? Count and show the parts.

Make drawings like these forms both on paper and on blackboard.

SIXES

6 12 18 24 30 36 42 48 54 60 66 72

0+6= 6 6+6=12 12+6=18 18+6=24
24+6=30 30+6=36 36+6=42 42+6=48
48+6=54 54+6=60 60+6=66 66+6=72

6	6	6	6	6	6	6	6	6	6	6	6
	6	6	6	6	6	6	6	6	6	6	6
		6	6	6	6	6	6	6	6	6	6
			6	6	6	6	6	6	6	6	6
				6	6	6	6	6	6	6	6
					6	6	6	6	6	6	6
						6	6	6	6	6	6
							6	6	6	6	6
								6	6	6	6
									6	6	6
										6	6
											6

1. Add each row.
2. Add each column.
3. Learn the Table of Sixes.

6 × 1 = 6	6 × 7 = 42
6 × 2 = 12	6 × 8 = 48
6 × 3 = 18	6 × 9 = 54
6 × 4 = 24	6 × 10 = 60
6 × 5 = 30	6 × 11 = 66
6 × 6 = 36	6 × 12 = 72

MULTIPLICATION TABLE OF SIXES

TWELVES

12 24 36 48 60 72 84 96 108 120 132 144

0+12= 12 12+12= 24 24+12= 36 36+12= 48

48+12= 60 60+12= 72 72+12= 84 84+12= 96

96+12=108 108+12=120 120+12=132 132+12=144

Make up bundles of splints, each with twelve splints, and show that these facts are true.

12 12 12 12 12 12 12 12 12 12 12 12

12 12 12 12 12 12 12 12 12 12 12

12 12 12 12 12 12 12 12 12 12

Complete this series to twelve numbers and add by rows and columns.

12 × 1 = 12	12 × 7 = 84
12 × 2 = 24	12 × 8 = 96
12 × 3 = 36	12 × 9 = 108
12 × 4 = 48	12 × 10 = 120
12 × 5 = 60	12 × 11 = 132
12 × 6 = 72	12 × 12 = 144

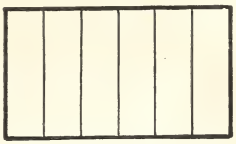
MULTIPLICATION TABLE OF TWELVES OR DOZENS

Add in columns twelve ones, twelve twos, etc., to twelve twelves.

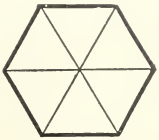
SIXTHS AND TWELFTHS

When anything is divided into six equal parts, we call the parts sixths. Six sixths make one whole.

Circle



Rectangle



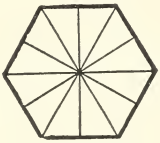
Hexagon

1. Show that each of these forms is divided into halves.
2. Show that each is divided into thirds; into sixths.
3. Make larger drawings of each of these forms on paper; on the blackboard.

When anything is divided into twelve equal parts, we call the parts twelfths. Twelve twelfths make one whole.

Circle

Rectangle



Hexagon

1. Show the various halves in the circle and hexagon.
2. Show thirds of each of these forms.
3. Show fourths of each. 4. Show sixths of each.
5. Make larger drawings of each of these forms on paper; on the blackboard.
6. $\frac{6}{6} = 1$; $\frac{12}{12} = 1$; $\frac{3}{3} = 1$; $\frac{4}{4} = 1$. Read these facts.
7. Which is larger, $\frac{1}{3}$ or $\frac{1}{6}$? Why? $\frac{1}{6}$ or $\frac{1}{12}$? Why?
8. Cut out forms to show the answers to 6 and to 7.
9. Which is larger, $\frac{1}{6}$ or $\frac{2}{12}$? $\frac{2}{6}$ or $\frac{1}{3}$? $\frac{1}{3}$ or $\frac{4}{12}$?

DIVISION TABLES

Make a division table, beginning it like this:

$10 \div 10 = 1$	$30 \div 10 = 3$				
$20 \div 10 = 2$	$40 \div$				

Make a division table, beginning it like this:

$6 \div 6 = 1$	$18 \div 6 =$				
$12 \div 6 = 2$	$24 \div$				

Make a division table, beginning it like this:

$12 \div 12 = 1$	$36 \div 12 = 3$				
$24 \div 12 = 2$	$48 \div 12 =$				

RECITE

QUESTIONS

1. How many school days are there in 4 weeks? How many working days?

2. How many hours are there in a quarter of a day?

3. Which is the greater fraction, $\frac{1}{4}$ or $\frac{1}{5}$?

4. A cake is cut into sevenths. Another cake of equal size is cut into tenths. Would one of these sevenths be a larger or smaller piece of cake than a tenth?

5. How many 10's are there in 96? how many units?

6. If a can of peaches cost 25¢, how many cans will \$1 buy? 75¢?

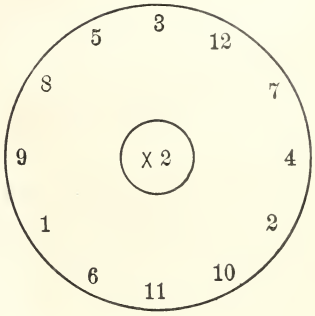
7. What part of 48 is 6? How many times 6 is 48?

8. If 2 yards of tape cost 24¢, what will 1 yard cost? what will $\frac{1}{4}$ of a yard cost?

9. A strip of carpeting is $\frac{3}{4}$ of a yard wide. How many inches wide is the carpeting?

REVIEW

This disk may be used as the basis of different drills.



1. What is 2×2? 2×7?

2. What is $(2 \times 12) + 7$?

3. Add all the way round: $12 + 7 + 4$, and so on to 3.

4. Add in 2 each time: $12 + 2 + 7 + 2$, and so on to 3.

5. Begin at other numbers, 7 or 4 or 2, and do as in **3** and **4**.

6. Go around in the opposite way: $3 + 5 + 8$, etc.

7. Add any two numbers and subtract the next, or subtract the center number.

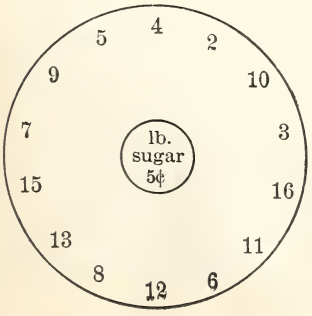
8. Divide 12 by 2, 7 by 2, and so on.

9. Substitute for 2, or any other number of units, the fractions one half, one third, and so on.

10. Use a large number at the center, 24, 36, 60, 96, or 100, and divide it by each number of the disk.

11. Call these numbers 12 minutes, 12 apples, 12 cents, and let the pupils make problems.

12. Point at the same time to any two numbers, using two pointers; add, subtract, multiply, or divide at sight.



13. Sugar . . . 5¢ a lb.
Milk . . . 7¢ a qt.
Eggs . . . 2¢ each.
Bread . . . 8¢ a loaf.

Make a list quoting prices and buy the quantities indicated by the figures as in this case.

DATES

There are seven days in the week. There are always at least four weeks in every month. There are twelve months in the year. A hundred years make one **century**.

This is the *twentieth century*, for more than nineteen centuries have passed since Jesus Christ was born.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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				

March, 1903

When we write letters, we put three facts at the top, called the **date**. We tell the year, the month, and the day of the month: sometimes also the day of the week. We may write the date, January 1, 1900, or Tuesday, Jan. 1, 1900. The **calendar** tells us how to know the month, the day of the month, the year, and the day of the week.

This calendar is true for any month when the first day of the month falls on Sunday and when the month has 31 days.

The names of the months are: January, February, March, April, May, June, July, August, September, October, November, December.

The year has 365 days, except "leap year," which has 366 days. Leap year comes every four years; then February gains another day.

Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Excepting February alone.
Twenty-eight are all its store
Till leap year gives it one day more.

Until the year 2400 every year we can divide by 4 will be leap year. We usually call thirty days a month unless we know the exact month in question.

THE CALENDAR

1. Get a calendar for the present year. On what week day did the first day of this month fall? On what week day will the first days of all the rest of the months of the year fall? On what week day did the first days of the past months fall?

2. What months of each year usually have the same days of the months on the same days of the week? Why is this not true in leap year?

3. Tell the names of the longest months.

4. How many days are there in seven weeks? in three weeks? in eleven weeks?

5. How many weeks are there in thirty-five days? in forty-nine days? in eighty-four days?

6. Which is the longer time, six weeks or two months? ten weeks or three months? one hundred days or three months?

7. Make a rectangle upon a sheet of paper seven inches long, five inches high. Mark the inch spaces on it on each side. Draw lines across and up and down so as to make thirty-five squares, one inch on each side.

8. Cut out thirty-one squares; number them from 1 to 31.

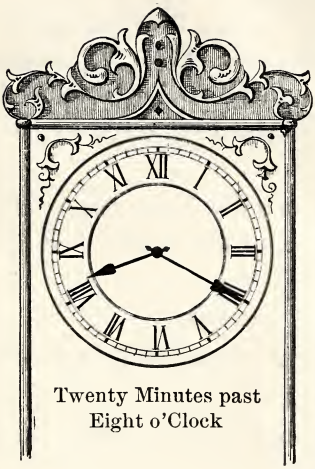
9. Place these squares on the sheet of paper to show the present month. Write at the top of the calendar, S for Sunday, M for Monday, T for Tuesday, W for Wednesday, T for Thursday, F for Friday, S for Saturday.

10. Make a large monthly calendar on the blackboard.

11. Make with the squares, as in 1 above, a calendar for the next month; the last month.

12. Make February of this year; of the next leap year.

TELLING TIME



Twenty Minutes past Eight o'Clock

A **day** is divided into twenty-four hours.

Midnight separates one day from another.

Each day is divided into two equal parts.

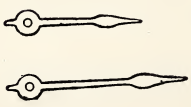
Noon separates the first half of the day from the second half.

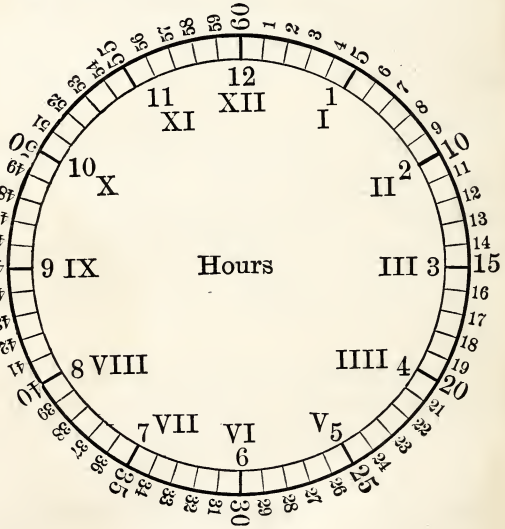
Each half day is divided into twelve equal parts.

Each twelfth part of a half day is an **hour.**

Each *hour* is divided into sixty **minutes.**

1	one	I
2	two	II
3	three	III
4	four	IIII
5	five	V
6	six	VI
7	seven	VII
8	eight	VIII
9	nine	IX
10	ten	X
11	eleven	XI
12	twelve	XII





Key to clock face.

1 hour is the same place as 5 minutes. There are two hands on every clock, the hour hand and the minute hand.

The hour hand is always shorter than the minute hand.

TELLING TIME

I = 1; V = 5; X = 10. I after V means V + I. I before X means X − I.

60 minutes make 1 hour.
12 hours make 1 half day.
24 hours make 1 day.

Sign for morning hours, A.M.
Sign for afternoon and evening hours, P.M.

When we studied the fives' table, we found that $5 \times 12 = 60$. There are 60 minutes in every hour, and 12 hours in every day.

The hour hand goes from XII to I in one hour, but the minute hand every hour goes all the way around from XII past I, II, III, and so on to XII. The minute hand goes twelve times as fast as the hour hand.

There are twelve numbers on the clock face to mark 60 minutes. Each number means in minutes just 5 times as much as it does in hours, on the clock.

I means in hours 1, but in minutes it means 5, $5 \times 1 = 5$.

II means in hours 2, but in minutes it means 10.

III means in hours 3, but in minutes it means 15.

IIII means in hours 4, but in minutes it means 20.

V means in hours 5, but in minutes it means 25.

VI means in hours 6, but in minutes it means 30.

VII means in hours 7, but in minutes it means 35.

VIII means in hours 8, but in minutes it means 40.

6 hours 40 minutes are twenty minutes before 7 hours.

IX means in hours 9, but in minutes it means 45.

X means in hours 10, but in minutes it means 50.

XI means in hours 11, but in minutes it means 55.

XII means 12 hours, or 60 minutes, or 0 (no) minutes.

TELLING TIME

We say, "It is two o'clock." This means "It is two hours of the clock." When it is 2 o'clock, we find the minute hand at XII hours or 60 or 0 minutes.

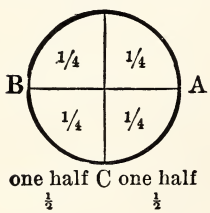
2 o'clock

10:20 o'clock
twenty minutes after ten

4:45 o'clock
quarter of five o'clock

7 o'clock

This circle is divided into quarters. When the minute hand reaches 15 minutes after XII or 60, we say it is quarter past whatever hour the hour hand is nearest. *A* is at III or 15 minutes. When the minute hand reaches 45 minutes after XII or 15 minutes $(60 - 45 = 15)$ before XII, we say it is quarter before the hour the hour hand is nearest: that is, the hour toward which the hour hand is traveling. When the minute hand is at VI or 30 minutes, we say it is half past. $30 = 60 \div 2$. $30 = \frac{1}{2}$ of 60.



1. Where should the hands be to show quarter past 9; quarter to 11; half past 9; quarter to 12; quarter past 10; half past 8; half past 3; half past 7; quarter to 12; quarter past 1; quarter past 6; half past 5?

2. Where is each hand at quarter past 12? at quarter past 2? at quarter to 3? at half past 4? at half past 6? at quarter to 9? at half past 11? at quarter to 8? at half past 3? at 10 minutes after 10?

TELLING TIME

1. Make a large clock face on thick paper or cardboard, or on the blackboard.

2. Draw the hands to show 5 minutes past 9 o'clock, 10 minutes past 10 o'clock, 15 minutes past 11 o'clock, 20 minutes past 12 o'clock, 25 minutes past 1 o'clock.

3. Draw the hands to show 25 minutes of 3 o'clock, 20 minutes of 4 o'clock, 15 minutes of 5 o'clock, 10 minutes of 6 o'clock, 5 minutes of 7 o'clock, and 8 o'clock.

4. Draw quarter past nine o'clock, half past ten o'clock, quarter of eleven o'clock, and six o'clock.

5. Draw each one of the hours one o'clock, two, three, four, five, six, seven, eight, nine, ten, eleven.

6. Make out of cardboard a clock face, and hands out of cardboard or wood, and set the time to suit your own ideas. Make all the different times o'clock in **2**, **3**, **4**, and **5** above.

7. Draw a picture of the clock in your schoolroom. What time does it tell? Perhaps it took you quite a long time to draw that picture. Draw another, telling what time it is now. How many minutes apart are the two times on the two clocks?

8. School begins at —— o'clock. Recess is at —— o'clock. Recess is over at —— o'clock. The morning session ends at —— o'clock. Draw four clock faces to show these times.

9. Do you have a daily program at school? When did this lesson begin? When will it end? Make clock faces to show these times. Show the times for other lessons.

10. Make clock faces showing the time when you get up in the morning, when you eat breakfast and other meals, and when you go to bed at night.

TELLING TIME

Morning is any time between midnight and noon.

Afternoon is any time between noon and six o'clock P.M.

Evening is any time between six o'clock P.M. and midnight.

Twilight is from dawn till sunrise and from sunset till darkness.

Day is from morning twilight till evening twilight.

Night is from evening twilight till morning twilight.

On most watches and on some clocks there is a third hand that tells seconds.

Each *minute* may be divided into sixty **seconds.**

Twenty minutes past eight o'clock is written 8.20 A.M. when in the morning, and 8.20 P.M. when in the evening.

Fifteen minutes before eleven o'clock in the morning is written 10.45 A.M.

Fifteen minutes make a quarter of an hour after the hour. Quarter past ten is written 10.15.

Forty-five minutes make a quarter of an hour before the next hour. Quarter of eleven is written 10.45.

Thirty minutes make a half hour. Half-past ten is written 10.30.

Draw clock faces to show:

1. Quarter past twelve o'clock.
2. Quarter of six o'clock.
3. Half-past nine o'clock.
4. Quarter of eleven o'clock.
5. Half-past ten o'clock.
6. Quarter past eight o'clock.

7. 1.50	8. 7.10	9. 8.55	10. 8.35	11. 2.05
12. 6.45	13. 7.55	14. 11.25	15. 9.20	16. 3.30
17. 6.40	18. 5.15	19. 12.25	20. 4.50	21. 10.10

READING PROBLEMS

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
1.	123	142	156	116	111	121	133	145	134	144
	+16	+12	+13	+22	+27	+18	+15	+14	+24	+14

We may read **1** *a*. — Add 123 and 16.

	k	*l*	*m*	*n*	*o*	*p*	*q*	*r*	*s*	*t*
2.	118	124	136	128	137	148	125	132	149	150
	−14	−12	−15	−23	−14	−37	−24	−11	−39	−100

We may read **2** *k*. — From 118 take, or subtract, 14.
Read the other problems in **2**, using the word "subtract."

	u	*v*	*w*	*x*	*y*	*z*	*aa*	*bb*	*cc*	*dd*
3.	21	34	42	50	111	93	61	222	1000	2000
	×4	×2	×5	×5	×3	×2	×5	×4	×5	×3

We may read **3** *u*. — 21 multiplied by 4 are how many?
Or, — Multiply 21 by 4. Or, — 4 times 21 is how much?
Read the other problems in **3**, using the word "multiply."

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
4.	5)55	6)64	3)21	7)70	6)48	9)27	7)28	8)32

4 *A*. Divide 55 by 5. Read the other problems.

	I	*J*	*K*	*L*	*M*	*N*	*O*
5.	4)128	3)164	5)155	4)164	3)99	5)500	7)728

6. $23 \times 3 = ?$ Read, 23 multiplied by 3 is how much?
Or, — 3 times 23 is how much?

7. $44 \div 2 = ?$ $66 \div 3 = ?$ $36 \div 4 = ?$ $48 \div 4 = ?$ $100 \div 10 = ?$
$96 \div 4 = ?$ $33 \div 11 = ?$ $60 \div 5 = ?$ $72 \div 12 = ?$ $100 \div 4 = ?$

NUMERATION TABLE

Periods	3d Millions			2d Thousands			1st Units		
Orders	3d hundreds	2d tens	1st units	3d hundreds	2d tens	1st units	3d hundreds	2d tens	1st units
	3	2	4	8	5	5	9	3	2

In the left-hand period of a number there may be one, two, or three figures, but in every other period there must be three figures.

In reading numbers we begin with the left-hand period.

1. Read the number in the table: Four million, eight hundred fifty-five thousand, nine hundred thirty-two.

2. Read: 70,203; 288,691; 830,020; 700,014; 1,199,001; 3,910,001; 1,660,608; 5,877,707; 1,767,100; 5,658,293; 1,500,000.

3. How many figures are needed to write one million?

4. Write 555 in the first three periods, and read the number 555,555,555. Five hundred fifty-five million, five hundred fifty-five thousand, five hundred fifty-five.

Write by figures:

5. Ten thousand, two hundred sixteen.

6. Thirty-seven thousand, five hundred twenty-two.

7. Sixty-nine thousand, seven hundred forty-six.

8. Four hundred thirty-nine thousand, six hundred.

9. Nine million, two hundred sixty thousand, twelve.

10. Eight million, seventy-one thousand, four.

NUMBERS

One hundred one	101
One hundred eleven . . .	111
One hundred twenty . . .	120
One hundred ninety-nine .	199
Two hundred	200
Two hundred seven . . .	207
Two hundred eighty-eight .	288
Three hundred thirty . .	330
Six hundred sixty-six . .	666
Eight hundred	800
Eight hundred eighty . .	880
Nine hundred ninety-one .	991

1. Cover the figures and read the numbers, telling what figures would represent them.

2. Cover the words, and read the figures in words.

3. Explain why we use the zero in each of these different cases.

4. Write the figures for these numbers :

a. Seven hundred thousand, one hundred ten.

b. One million, two hundred nineteen thousand, seven.

c. Nine million, five hundred twenty thousand, two hundred twenty.

d. Two million, four hundred eighty-six thousand, three hundred fifteen.

e. Five million, six hundred thirty-four thousand, twenty-two.

f. Three million, twenty thousand, one hundred twenty-eight.

5. Count by hundreds from 1000 to 2000 and back.

6. Count by hundreds from 99,000 to 100,000 and back.

7. Count by thousands from 101,000 to 121,000.

8. Count by ten-thousands from 900,000 to 1,000,000.

9. In the number 8,007,010 are how many units? tens? hundreds? thousands? ten-thousands? hundred-thousands? millions?

SUBTRACTION

Subtraction takes one number from another.

The *minuend* is the number from which another number is taken or subtracted.

The *subtrahend* is the number to be taken or subtracted from the minuend.

The result of subtraction is the *difference.*

From 35 subtract 14.

35	4 and 1 = 5	35
−14	1 and 2 = 3	14
		21

Proof: 14 and 21 = 35

14
21
35

Subtract:

1. from 78: 18, 17, 16, 15, 14, 13, 12, 11; 21, 22, 23, 24, 25, 26, 27, 28; 31, 42, 53, 64, 75.

2. from 99 the same numbers as in 1.

3. from 57: 46, 35, 24, 13; 14, 25, 36, 47; 45, 33, 22, 11.

4. from 69 the same numbers as in 3.

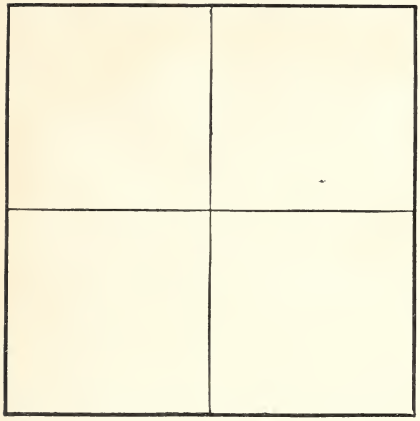
5. John's father gave him 96 tin soldiers. He gave away 2 dozen of them to his schoolmates, and later lost a half dozen. After his gifts to the other boys, how many soldiers had John left? After his loss, how many had he left?

6. Mary made dolls out of 66 clothes-pins. 25 of the dolls were very nice dolls. How many dolls were there that she did not like very well?

7. Make up questions like 5 and 6, using the numbers in 1, 2, 3, and 4. Answer these orally.

SQUARE MEASURE

How long is each side of this figure? How many squares do you see here? How many square inches are there?



This square is two inches long by two inches wide.

Its size is 2 in. × 2 in.

In square measure × is read *by*.

Its area is found by multiplying together the numbers that tell in inches its length and width.

2 sq. in. × 2 = 4 square inches = 4 sq. in.

The size of the surface of any figure is told by square measure. The surface of any figure or object which is level or flat, or "plane," as it is often called, has always length and breadth. The surface size is called **area**.

1. Show by a drawing that the area of a square with sides 3 inches in length is 9 square inches.

2. Show by a drawing that the area of an oblong with length of 5 inches and breadth of 3 inches is 15 sq. in.

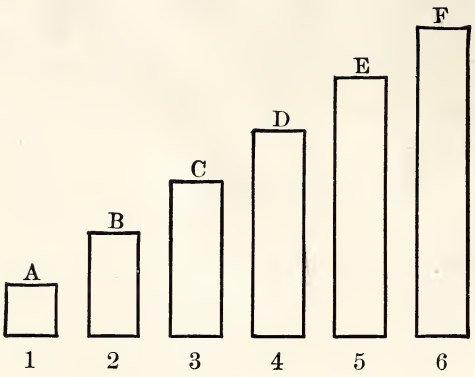
3. Find the area of an oblong measuring 4 feet × (by) 6 feet.

4. Find the area of an oblong 10 yards × 12 yards.

5. Find the area of a township 4 miles × 5 miles.

6. Tell the area of a picture 10 inches × 14 inches.

COMPARISONS AND RELATIONS



When A is 1, then B is 2, C is 3, etc.

When A is 2, then B is 4. What is C? D? E? F?

When A is $\frac{1}{2}$, what is B? C? D? E? F?

When D is 1, what is A? B? C? E? F?

Call A 3, and name the relations of the rest.

Call C 3, and name the relations of the rest.

When B is 4, what is C? E? F?

What figure is $\frac{1}{4}$ of D? $\frac{1}{3}$ of F? $\frac{1}{2}$ of E?

What figure is $\frac{2}{5}$ of E? $\frac{2}{3}$ of F? $\frac{1}{2}$ of D?

DRAW

Draw on the blackboard squares and oblongs showing the relations of 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, to each other.

Draw on the blackboard squares and oblongs showing the relations of $\frac{1}{3}$, $\frac{2}{3}$, 1, $1\frac{1}{3}$, $1\frac{2}{3}$, to each other.

Draw on the blackboard lines showing the relations of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, to each other.

ONE-HALF AND TWO — DIVIDING BY A FRACTION

1. $\frac{1}{2}$ of $6 = ?$ $\frac{1}{2}$ of $18 = ?$ $\frac{1}{2}$ of $12 = ?$ $\frac{1}{2}$ of $2 = ?$
2. $\frac{1}{2}$ of $20 = ?$ $\frac{1}{2}$ of $10 = ?$ $\frac{1}{2}$ of $8 = ?$ $\frac{1}{2}$ of $14 = ?$
3. $2\overline{)16}$ $2\overline{)8}$ $2\overline{)12}$ $2\overline{)14}$ $2\overline{)10}$ $2\overline{)18}$ $2\overline{)20}$ $2\overline{)4}$

4. How many 2's are there in 11? Five 2's and 1 over; that is, 11 contains five 2's and one 1.

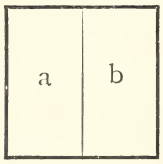
$$(5 \times 2) + 1 = ? \quad 2\overline{)11}$$
$$5 + 1$$

1 is called a **remainder.**

5. $5 \div 2 = ?$ $3 \div 2 = ?$ $7 \div 2 = ?$ $9 \div 2 = ?$
   $15 \div 2 = ?$ $17 \div 2 = ?$ $19 \div 2 = ?$ $13 \div 2 = ?$
6. $2\overline{)9}$ $2\overline{)13}$ $2\overline{)17}$ $2\overline{)19}$ $2\overline{)15}$ $2\overline{)7}$ $2\overline{)11}$ $2\overline{)3}$

MULTIPLYING A FRACTION

7. $a + a = S.$
   $2 \times a = S.$
   $2 \times \frac{1}{2} = 1.$



Square

MULTIPLYING A WHOLE NUMBER AND FRACTION

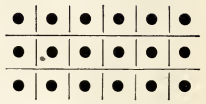
8. $2 \times 1\frac{1}{2} = ?$ Call a $1\frac{1}{2}$, then $S = 2 \times 1\frac{1}{2}$. Divide each a into three halves. $S =$ six halves. Two halves equal one. Six halves equal three. $2 \times 1\frac{1}{2} = 3.$

9. $2 \times 2\frac{1}{2} = ?$ $2 \times 3\frac{1}{2} = ?$ $2 \times 4\frac{1}{2} = ?$ $2 \times 5\frac{1}{2} = ?$

10. John had seven apples. He gave one half of them to his sister. How many apples did she receive?

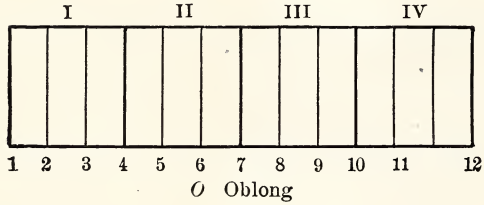
COMPARISONS AND RELATIONS

1. How many 3's are there in 18? $\frac{1}{3}$ of 18 = ?
How many 6's are there in 18?
$\frac{1}{6}$ of 18 = ?



2. How many 3's are there in 15?
How many 4's are there in 12? $\frac{1}{3}$ of 12 = ? $\frac{1}{4}$ of 12 = ?

3. How many 5's are there in 15? $\frac{1}{3}$ of 15 = ? $\frac{1}{5}$ of 15 = ?



4. 3 × ? = 12.
$\frac{1}{4}$ of 12 = ?

5. Into how many parts is the oblong divided?

Point out $\frac{1}{4}$ of *O*; $\frac{1}{3}$ of *I*; $\frac{1}{12}$ of *O*.

An **oblong** is a figure whose sides are parallel, whose angles are right angles, and which is longer than it is broad. It is a *rectangle* that is not a *square*.

6. Draw a square 2 in. by 2 in.
Divide it into 16 smaller squares.
16 ÷ 4 = ? 16 ÷ 8 = ?
Point out $\frac{1}{4}$ of the square; $\frac{3}{4}$; $\frac{1}{8}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$.

7. Cut out of paper an oblong measuring 3 in. × (by) 8 in. Fold it in thirds; in eighths; and mark upon it sixths and twelfths.

When anything is divided into equal parts, we may call the parts **fractions**.

MULTIPLYING MIXED NUMBERS

$1\frac{1}{2}$, $2\frac{1}{4}$, $3\frac{1}{8}$ are called **mixed numbers.** They are made up of *whole numbers* and *fractions.*

1. A newsboy bought 10 papers at $1\frac{1}{2}$ ¢ each, and sold them at 2 ¢ each. How many cents did he make or lose?

He paid 10 ¢ and $10 \times \frac{1}{2}$ ¢ for the papers. Ten half cents is how much?

What did he pay? What did he receive?

2. One boy one day was just twice as old as his brother, who was four and a quarter years old. How old was the older brother?

4 times 2 = ? 4 times $\frac{1}{4}$ = ? $4 \times 2\frac{1}{4}$ = ?

3. A square room was $3\frac{1}{3}$ yards on each side. How long was the distance around it?

4 times $3\frac{1}{3}$ yd. = ? $4 \times 3 = 12$. $4 \times \frac{1}{3} = \frac{4}{3} = 1\frac{1}{3}$.

Four thirds make one and one third because three thirds make one. $\frac{4}{3} = 3 + \frac{1}{3} = 1\frac{1}{3}$.

4. $4 \times 3\frac{1}{5} = ?$ **5.** $6 \times 3\frac{2}{3} = ?$ **6.** $2 \times 1\frac{3}{5} = ?$

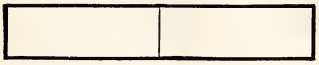
7. $3 \times 2\frac{3}{4} = ?$ **8.** $5 \times 6\frac{1}{5}$ ¢ $= ?$ **9.** $8 \times 3\frac{1}{2}$ yd. $= ?$

10. $4 \times 4\frac{1}{6}$ yr. $= ?$ **11.** $10 \times \$\, 2\frac{1}{4} = ?$ **12.** $5 \times \$\, 3\frac{3}{4} = ?$

Draw lines on paper or on the blackboard to show the above number-relations.

Tell or write problems showing mixed numbers multiplied by whole numbers.

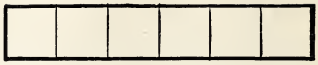
COMPARISONS AND RELATIONS



$2 \div \frac{1}{2} = ?$ $\frac{1}{2}$ of $2 = ?$

$\frac{1}{2} + \frac{1}{2} = ?$ $2 \times \frac{1}{2} = ?$

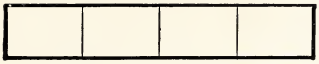
$1 - \frac{1}{2} = ?$ $1 \div \frac{1}{2} = ?$



$\frac{1}{3}$ of $\frac{1}{2} = ?$ $\frac{1}{3}$ of $6 = ?$

$\frac{1}{3} + \frac{4}{6} = ?$ $\frac{1}{2}$ of $6 = ?$

$6 \div \frac{1}{3} = ?$ $\frac{1}{3} + \frac{1}{2} = ?$



$\frac{1}{4}$ of $4 = ?$ $\frac{1}{2}$ of $4 = ?$

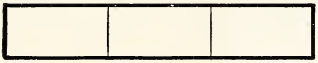
$\frac{1}{2} + \frac{1}{4} = ?$ $\frac{1}{4}$ of $2 = ?$

$\frac{3}{4} + \frac{1}{4} = ?$ $\frac{1}{2}$ of $\frac{1}{2} = ?$

$\frac{3}{5} + \frac{2}{5} = ?$ $\frac{1}{5}$ of $5 = ?$

$\frac{1}{5} + \frac{4}{5} = ?$ $5 \times \frac{1}{5} = ?$

$\frac{2}{2} = \frac{6}{6} = \frac{4}{4} = \frac{5}{5}$



$3 \div \frac{1}{3} = ?$ $\frac{1}{3} + \frac{2}{3} = ?$

$1 - \frac{2}{3} = ?$ $3 \times \frac{1}{3} = ?$

$\frac{1}{3}$ of $3 = ?$ $1 - \frac{1}{3} = ?$

$10 \div \frac{1}{5} = ?$ $10 \times \frac{1}{10} = ?$

$\frac{2}{5} + \frac{1}{10} = ?$ $\frac{1}{10}$ of $10 = ?$

$\frac{10}{10} - \frac{7}{10} = ?$ $\frac{1}{2}$ of $10 = ?$

COPY AND ANSWER

1.

23	32	43	50	333	2000	123	400	99	99
$\times 4$	$\times 3$	$\times 6$	$\times 8$	$\times 3$	$\times 4$	$\times 5$	$\times 10$	$\times 5$	$\times 7$

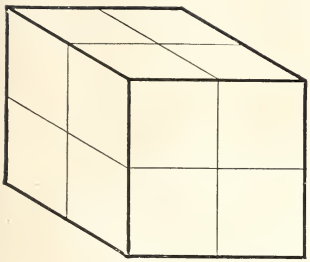
2. Add 63, 95, 18, 100, 74. **3.** Add 1544, 10, 987, 1009.

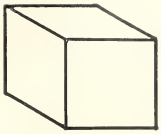
4. Subtract from 89: 19, 27, 32, 76, 54, 49, 11, 55, 68.

5. Draw clock faces to show: a quarter after eight o'clock; 10.25; and ten minutes of four o'clock.

6. A room was 4 yd. by $4\frac{1}{4}$ yd. in size. What was its size in square yards?

CUBIC MEASURE





Each of these blocks has square sides and right angles. Each block is called a **cube.**

How many small cubes do you find in the large cube? If we multiply together the lengths in inches or feet or yards of each side of a cube, we get its size in cubic inches or cubic feet or cubic yards. The size in cubic measure of any object is often called its **volume.** If each side of a cube is 2 inches long, then its volume is 8 cubic inches. 2 in. × 2 in. × 2 in. = 2 cu. in. × 2 × 2 = 8 cu. in.

Read ×, *by;* or, *multiplied by.*

1. What is the volume of a cube each side of which is 3 inches long?

2. What is the volume of a cube 2 in. × 3 in. × 4 in.?

3. What is the volume of a cube 1 ft. × 2 ft. × 4 ft.?

4. Measure in inches the size of boxes.

REVIEW QUESTIONS

5. The difference between two numbers is 7, and the smaller number is 6. What is the larger number?

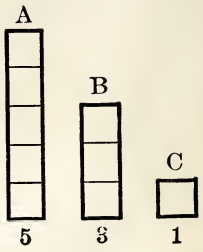
6. How many 9's are there in 18? How many 2's? 9 is what part of 18?

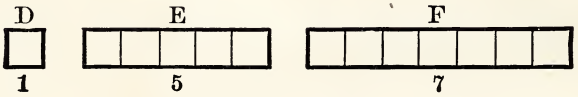
7. What is the ratio of 2 to 16? of 4 to 16? of 16 to 2? of 16 to 4?

COMPARISONS AND RELATIONS

A is $5 \times C$. B is $3 \times C$.
C is $\frac{1}{5}$ of A. C is $\frac{1}{3}$ of B.

When A is 1, C is $\frac{1}{5}$, B is $\frac{3}{5}$.
When A is 2, C is $\frac{2}{5}$, B is $\frac{6}{5}$.
When A is 3, C is $\frac{3}{5}$, B is $\frac{9}{5}$.
When A is 4, C is $\frac{5}{4}$, B is $\frac{15}{4}$.
When A is 5, C is 1, B is 3.





When D is 1, E is 5, F is 7.
When D is 2, E is 10, F is 14.
When F is 1, D is $\frac{1}{7}$, E is $\frac{5}{7}$.

1 is $\frac{1}{6}$ of 6.
2 is $\frac{2}{6}$ of 6, or $\frac{1}{3}$.
4 is $\frac{4}{6}$ of 6, or $\frac{2}{3}$.
1 is $\frac{1}{2}$ of 2.
6 is $\frac{3}{2}$ of 4.

1. What part of 5 is 3? of 7 is 5?
2. What part of 6 is 4? of 4 is 3?
3. Compare 3 and 7.
   3 is $\frac{3}{7}$ of 7. 7 is $\frac{7}{3}$ of 3.
4. Compare 10 and 5.
   5 is $\frac{1}{2}$ of 10. 10 is 2×5.
5. Compare 15 and 3.
   15 is 5×3. 3 is $\frac{1}{5}$ of 15.

REVIEW

1. Walter had 134 marbles. He lost 23, and had —— left.

2. Susan's paper dolls cost $2\frac{1}{2}¢$ each. She had 6 of them costing ——$¢$ all together.

3. A ball costing $75¢$, a bat $35¢$, and catcher's gloves $\$1$ made Harold's baseball outfit, which cost in all $\$$——.——.

4. Helen's mother made a cake, using 8 eggs that cost $2\frac{1}{4}¢$ each and also $10¢$ worth of other things. The cake cost ——$¢$.

5. One hundred thousand is written in figures ——.

6. John's tin soldiers stood $1\frac{1}{2}$ inches apart, and there were 21 of them in one line, which was —— long.

[Find how far apart were the first and the twenty-first.]

7. Tom's building blocks were 2 inches thick, and he built a tower with them 30 blocks high. The tower was —— inches high.

8. Mary drew 18 doll's faces, and her mother gave her $\frac{1}{2}¢$ for each doll. This made in all ——$¢$.

9. Between midnight and noon are —— hours.

10. 1 equals —— halves, —— thirds, —— fourths, —— fifths, —— sixths.

11. Anne gave $\frac{1}{4}$ of her 20 roses to her sister Lucy and $\frac{1}{3}$ of the remainder to her mother. Lucy received —— roses, and her mother —— roses.

COMPARISONS AND RELATIONS

1. Do you see 4 balls or spheres together? Is there 1 ball near them? Do you see the 3 balls hanging from the door? How many balls do you see in all?

2. Do you see five piles of cylinders and one single cylinder? Count the number of cylinders in each pile.

3. Do you see six piles of cubes? Count the number of cubes in each pile. Do you see one cube separate from the rest?

4. Point to 1 cube and 7 cubes. 7×1 cube $= 7$ cubes. 7 cubes $\div 1 = 7$ cubes.

5. Point to 2 cubes and 6 cubes. 3×2 cubes $= 6$ cubes. 6 cubes $\div 2 = 3$ cubes.

6. Point to 1 sphere and to 8 spheres. 8×1 sphere $=$ 8 spheres. 8 spheres $\div 1 = 8$ spheres. Compare them.

7. Point to 4 cubes and 6 cubes. Compare them.

8. Point to 2 cubes, to 4 cubes, to 3 cubes, and to 6 cubes.

9. How much higher is the pile of 4 cubes than the pile of 2 cubes?

10. How much higher is the pile of 6 cubes than the pile of 3 cubes?

11. How high is the pile of 2 cubes compared with the pile of 4 cubes?

12. How high is the pile of 3 cubes compared with the pile of 6 cubes?

COMPARISONS AND RELATIONS

1. How many 3's are there in 24? What is $\frac{1}{3}$ of 24? $8 \times 3 = ?$ $3 \times 8 = ?$

2. How many 3's are there in 27? $3 \times 9 = ?$ $9 \times 3 = ?$ $\frac{1}{9}$ of $27 = ?$ How many 9's are there in 27? $\frac{2}{9}$ of $27 = ?$ $\frac{1}{3}$ of $27 = ?$ $\frac{2}{3}$ of $27 = ?$

3. How many 3's are there in 30? What is $\frac{1}{3}$ of 30? $\frac{2}{3}$ of $30 = ?$ How many 10's are there in 30? $\frac{1}{10}$ of $30 = ?$ $10 \times 3 = ?$ $3 \times 10 = ?$

4. How many 3's are there in 33? $3 \times 11 = ?$ $11 \times 3 = ?$ $\frac{1}{3}$ of $33 = ?$ $\frac{2}{3}$ of $33 = ?$ $\frac{1}{11}$ of $33 = ?$ $\frac{3}{11}$ of $33 = ?$ $\frac{7}{11}$ of $33 = ?$ $\frac{9}{11}$ of $33 = ?$ How many 11's are there in 33? $33 + 3 = ?$

5. How many 3's are there in 36? What is $\frac{1}{3}$ of 36? What is $\frac{1}{12}$ of 36? How many 12's are there in 36? $3 \times 12 = ?$ $12 \times 3 = ?$

6. $\frac{1}{3}$ of $36 = ?$ $\frac{1}{6}$ of $36 = ?$ $\frac{1}{12}$ of $36 = ?$ $\frac{1}{9}$ of $36 = ?$ $\frac{1}{4}$ of $36 = ?$ $\frac{1}{2}$ of $36 = ?$

7. From $\frac{1}{4}$ take $\frac{1}{8}$. How much remains?

8. One third equals how many sixths?

9. One sixth equals how many twelfths?

10. From $\frac{1}{6}$ of 24 take $\frac{1}{8}$ of 24.

11. How much is $\frac{1}{8}$ of 48? $\frac{3}{8}$ of 48? $\frac{1}{6}$ of 48? $\frac{5}{6}$ of 48?

12. What part of 36 is 12? 9? 6? 4? 3?

13. How many times does 36 contain 3? 4? 6? 9? 12? 18?

REVIEW

1. In the regiment of Colonel White there were seven companies containing in all 665 men. What was the average number of men in each company?

2. At $\$2\frac{1}{2}$ a day how much would six men earn in six days?

3. In a girl's library there were 425 story books, 120 picture books, and 84 other books. How many books had she in all?

4. A man owed 982 dollars, and had 741 dollars with which to pay the debt. How much more did he need?

5. A school board bought 50 books for a class, paying $\$\frac{1}{5}$ for each book. What did the books cost in all?

6. $2\frac{1}{2}$ dozen tarts at $18\cent$ a dozen cost how much?

7. Alice gave a tea party to eight persons, including herself. Each one had $\frac{1}{4}$ pt. of ice cream. How many pints of ice cream did they have all together?

8. At $1\frac{1}{2}\cent$ a glass what is the cost of 6 glasses of milk?

9. Draw a clock face to show quarter of four o'clock.

10. Will was sent at 6.30 A.M. on an errand, and was told to be back in three quarters of an hour. At what time was he due to return?

11. What is the *volume* of a cube, 3 in. upon a side?

12. Make a drawing to show $\frac{1}{7}$ of $\frac{1}{2}$ of 28.

MULTIPLICATION TABLE 8

Counting by 8 to 100.

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
10	20	30	**40**	50	60	70	**80**	90	100

1. Read this table, emphasizing the numbers printed in **black face** figures.

8	8	8	8	8	8	8	8	8	8	8	8
	8	8	8	8	8	8	8	8	8	8	8
	16	8	8	8	8	8	8	8	8	8	8
		24	8	8	8	8	8	8	8	8	8
			32	8	8	8	8	8	8	8	8
				40	8	8	8	8	8	8	8
					48	8	8	8	8	8	8
						56	8	8	8	8	8
							64	8	8	8	8
								72	8	8	8
									80	8	8
										88	8
											96

2. Prove these sums.

3. What is 8×9?

4. What part of 88 is 11?

5. What is 8×12?

$8 \times 1 = 8$ $8 \times 5 = 40$ $8 \times 9 = 72$

$8 \times 2 = 16$ $8 \times 6 = 48$ $8 \times 10 = 80$

$8 \times 3 = 24$ $8 \times 7 = 56$ $8 \times 11 = 88$

$8 \times 4 = 32$ $8 \times 8 = 64$ $8 \times 12 = 96$

MULTIPLICATION TABLE 8

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8				
1	2	3	4	5	6	7					
1	2	3	4	5	6	7					
1	2	3	4	5	6						
1	2	3	4	5	6						
1	2	3	4	5							
1	2	3	4	5							
8	16	24	32								

Complete this table and find the sums.

1. 8)8 8)16 8)24 8)32 8)40 8)48

2. 8)56 8)64 8)72 8)80 8)88 8)96

3. Answer: $32 \div 4 = ?$ $64 \div 8 = ?$ $88 \div 11 = ?$ $48 \div 6 = ?$
$96 \div 12 = ?$ $80 \div 10 = ?$ $72 \div 9 = ?$ $56 \div 7 = ?$ $40 \div 5 = ?$

4. Multiply

10	11	12	4	7	8	8	8	8
8	8	8	8	8	8	6	5	9

5. $64 \div 8 \div 4 = ?$ $96 \div 12 \div 6 = ?$ $6 \times 2 \times 4 = ?$
$24 \div 3 \times 6 = ?$ $88 \div 11 \div 4 = ?$ $72 \div 8 \div 3 = ?$

6. What is the highest number that multiplied by 12 gives a number less than 100?

7. Complete this division table.

$8 \div 8 = 1$	$40 \div 8 =$		
$16 \div 8 = 2$	$48 \div$		
$24 \div 8 = 3$			
$32 \div 8 = 4$			

EIGHT AND EIGHTHS

1.

8)24	8)27	8)30	8)32	8)36	8)39	8)40
8)12	8)43	8)47	8)9	8)14	8)51	8)57
8)19	8)60	8)64	8)15	8)69	8)72	8)79
8)83	8)88	8)17	8)96	8)120	8)144	8)192

2.

$\frac{1}{8}$ of 80 = ?	$\frac{3}{8}$ of 80 = ?	$\frac{1}{8}$ of 56 = ?	$\frac{5}{8}$ of 56 = ?
$\frac{1}{8}$ of 32 = ?	$\frac{2}{8}$ of 32 = ?	$\frac{1}{8}$ of 88 = ?	$\frac{4}{8}$ of 88 = ?
$\frac{1}{8}$ of 8 = ?	$\frac{2}{8}$ of 8 = ?	$\frac{3}{8}$ of 8 = ?	$\frac{6}{8}$ of 8 = ?
$\frac{1}{8}$ of 24 = ?	$\frac{6}{8}$ of 24 = ?	$\frac{1}{8}$ of 16 = ?	$\frac{5}{8}$ of 16 = ?
$\frac{1}{8}$ of 72 = ?	$\frac{7}{8}$ of 72 = ?	$\frac{1}{8}$ of 64 = ?	$\frac{7}{8}$ of 64 = ?
$\frac{1}{8}$ of 96 = ?	$\frac{5}{8}$ of 96 = ?	$\frac{1}{8}$ of 48 = ?	$\frac{4}{8}$ of 48 = ?
$\frac{1}{8}$ of 40 = ?	$\frac{3}{8}$ of 40 = ?	$\frac{5}{8}$ of 24 = ?	$\frac{7}{8}$ of 40 = ?

3. Copy and answer:

$2 \times 8 = ?$	$7 \times 8 = ?$	$12 \times 8 = ?$	$72 \div 8 = ?$	$24 \div 8 = ?$
$9 \times 8 = ?$	$3 \times 8 = ?$	$8 \times 8 = ?$	$64 \div 8 = ?$	$96 \div 8 = ?$
$1 \times 8 = ?$	$5 \times 8 = ?$	$4 \times 8 = ?$	$32 \div 8 = ?$	$40 \div 8 = ?$
$6 \times 8 = ?$	$11 \times 8 = ?$	$10 \times 8 = ?$	$56 \div 8 = ?$	$88 \div 8 = ?$
$56 = ? \times 8$	$64 = ? \times 8$	$16 = ? \times 8$	$16 \div 8 = ?$	$88 = ? \times 8$
$32 = ? \times 8$	$72 = ? \times 8$	$96 = ? \times 8$	$48 \div 8 = ?$	$48 = ? \times 8$
$80 = ? \times 8$	$8 = ? \times 1$	$40 = ? \times 8$	$80 \div 8 = ?$	$24 = ? \times 8$

4. What part of 96 is: 6; 8; 12; 24; 32?

5. 96 is how many times: 6, 8, 12, 24, 32?

6. $\frac{1}{8}$ of 40 = ? $\frac{2}{8}$ of 40 = ? $\frac{1}{4}$ of 40 = ? $\frac{1}{4} = \frac{?}{8}$

EQUALITY OF FRACTIONS

1. $\frac{1}{12}$ of 24 = ? $\frac{2}{12}$ of 24 = ? $\frac{3}{12}$ of 24 = ? $\frac{5}{12}$ of 24 = ? $\frac{6}{12}$ of 24 = ? $\frac{1}{2}$ of 24 = ? Then $\frac{1}{2} = \frac{?}{12}$.

2. $\frac{8}{12}$ of 24 = ? $\frac{10}{12}$ of 24 = ? $\frac{12}{12}$ of 24 = ?

3. $\frac{1}{6}$ of 24 = ? $\frac{2}{6}$ of 24 = ? $\frac{3}{6}$ of 24 = ? $\frac{1}{2}$ of 24 = ? Then $\frac{1}{2} = \frac{?}{6}$

4. $\frac{4}{6}$ of 24 = ? $\frac{5}{6}$ of 24 = ? $\frac{6}{6}$ of 24 = ? $\frac{1}{3}$ of 24 = ? $\frac{2}{3}$ of 24 = ? $\frac{2}{3}$ of 24 = $\frac{?}{6}$

5. $\frac{1}{8}$ of 24 = ? $\frac{2}{8}$ of 24 = ? $\frac{1}{4}$ of 24 = ? Then $\frac{2}{8} = \frac{?}{4}$

6. $\frac{3}{8}$ of 24 = ? $\frac{4}{8}$ of 24 = ? $\frac{1}{2}$ of 24 = ? Then $\frac{4}{8} = \frac{?}{2}$

7. $\frac{5}{8}$ of 24 = ? $\frac{6}{8}$ of 24 = ? $\frac{3}{4}$ of 24 = ? Then $\frac{6}{8} = \frac{?}{4}$

8. $\frac{1}{2} = \frac{?}{4}$ $\frac{1}{2} = \frac{?}{6}$ $\frac{1}{2} = \frac{?}{8}$ $\frac{1}{8} = \frac{?}{12}$ $\frac{1}{2} = \frac{?}{20}$

In a fraction the number written below the line shows the number of equal parts into which the unit is divided, and is called the **denominator.**

The number written above the line shows the number of equal parts taken, and is called the **numerator.**

$\frac{1}{2}$ equals any other fraction of which the numerator is $\frac{1}{2}$ of the denominator. If there are ten equal parts, then $\frac{5}{10} = \frac{1}{2}$, since five of the ten equal parts is half of them.

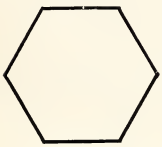
9. $\frac{1}{3} = \frac{?}{6}$ $\frac{1}{3} = \frac{?}{9}$ $\frac{1}{3} = \frac{?}{12}$ $\frac{1}{3} = \frac{?}{15}$ $\frac{1}{2} = \frac{?}{18}$

$\frac{1}{3}$ equals any other fraction of which the numerator is three times the denominator.

MANY-SIDED FIGURES

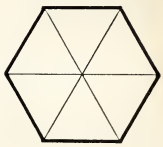
The bees always make their cells with six sides of equal length. A figure with six equal sides is called a hexagon. We can find its center by drawing lines to opposite angles. Where the lines cross is the center of the hexagon. These lines divide the hexagon into six equal parts.

Hexagon

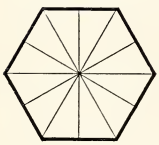


Each one of these equal parts is a triangle. If we divide each side of the hexagon into two equal parts, and draw a line inside of each triangle from the center of the hexagon to the middle point of each side, the hexagon will have twelve equal parts and twelve triangles.

Sixths



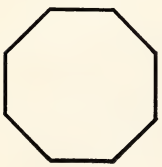
Twelfths



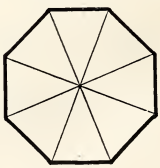
1. Point out $\frac{1}{6}$ of the hexagon; $\frac{2}{6}$; $\frac{3}{6}$.
2. Point out $\frac{1}{12}$ of the hexagon; $\frac{2}{12}$; $\frac{3}{12}$; $\frac{4}{12}$; $\frac{5}{12}$; $\frac{6}{12}$.
3. Show that $\frac{1}{2} = \frac{3}{6} = \frac{6}{12}$ of the hexagon.
4. Show that $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$ of the hexagon.
5. Draw hexagons on the blackboard.
6. Cut hexagons out of paper or cardboard and show these facts.

A figure with eight sides is called an

Octagon

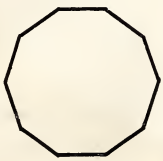


Eighths

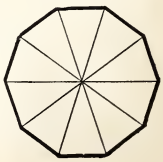


A figure with ten sides is called a

Decagon



Tenths



REVIEW

1. If there are a dozen buttons on a card, how many buttons are there on 9 cards? on 5 cards? on a dozen cards?

2. I paid 90¢ for 9 quarts of vinegar. What was the price of 1 quart? of 4 quarts? of 6 quarts? of 1 pint?

3. $56 was paid for 8 weeks' board. At that rate, how much money should be paid for 1 week's board? for 2 weeks' board? for 5 weeks' board?

4. How many more inches are there in $\frac{1}{2}$ of a foot than in $\frac{1}{4}$ of a foot? How many more in $\frac{1}{3}$ than in $\frac{1}{6}$ of a foot?

5. Which is cheaper, milk at 30¢ a gallon or at 8¢ a quart? Explain.

6. How many separate squares can you make with a dozen sticks? how many separate triangles?

7. One boy ran 100 yards in 12 seconds. Another boy ran 300 feet in 16 seconds. Which ran the faster?

8. A street car conductor collected in one trip one dollar in fares at a nickel each passenger. How many fares did he collect?

9. John's father needed 18 two-cent stamps for his letters to go to places in this country, and 2 five-cent stamps for letters to go to England. How much money should he give John to take to the post office to pay for letters?

10. Which is more, 2 dozen or $\frac{1}{4}$ of one hundred?

11. How many more sides has a decagon than an octagon? than a hexagon?

12. What is the ratio of $1 to 3 dimes? to 3 quarters?

DOLLARS AND CENTS

$ is the sign for dollars. $5 $8 $2

¢ is the sign for cents. 30¢ 25¢ 75¢

We do not write five dollars and thirty cents, using the signs for both dollars and cents, but the sign for dollars only and a sign . called the **decimal** point. $5.30, $8.25, $2.75.

The decimal point is always placed after the number of dollars and before the number of cents.

Twenty-one dollars forty cents	$21.40
Sixty-two dollars ten cents	62.10
Thirty-four dollars seventy cents . . .	34.70
	$118.20

Let us add these:

100¢ = $1. The cents here make all together 120¢.

120¢ = $1 + 20¢ over = $1.20.

	1.	2.	3.	4.	5.
Add	$3.25	$2.60	$ 3.10	$ 4.25	$13.22
	2.45	4.20	20.35	13.75	.51
	3.61	5.55	6.70	19.00	17.54

When we add dollars and cents together, we must be very careful to add the units of cents together and the tens of cents together, and the units of dollars together and the tens of dollars together.

We may call the units of dollars hundreds of cents, and tens of dollars thousands of cents. The figures of the result in addition will be the same.

200¢ = $? 300¢ = $? 1500¢ = $? 2800¢ = $?

6. Add $3.52, 51¢, and $7 together. Write in columns.

7. Add $1, $4.39, and $21.50 together. Write $1.00 for $1.

DOLLARS AND CENTS

1. Add $2.50, $1.35, and $2.45; to their sum add 70¢.

2. Add $1.20, $3.20, $2.05, and $3.

3.
$1.50
.05
.10
1.00

Add. Tell why we use each of the zeros in the four different items of dollars and cents.

4. From $2.40 take $1.30.

$2.40 — 0 equals 0. Set 0 in units' place.
1.30 — 3 and 1 is 4. Set 1 in tens' place.
$1.10 — 1 and 1 is 2. Set 1 in hundreds' place.

5.

From	$2.75	$3.85	$12.90	$8.35	$6.40
Take	1.45	1.85	9.85	7.25	.03

6. From $2.45 take $1.98.

$2.45
1.98
.47

8 is greater than 5, but 8 and 7 equals 15. Set 7 in units' place, and add 1 to 9, in tens' place of the subtrahend. 9 and 1 is 10. 10 is greater than 4, but 4 and 10 equals 14. Set 4 in tens' place and add 1 to 1, in hundreds' place of the subtrahend.

1 and 1 is 2. 2 equals 2. There is nothing to set in hundreds' place, in the difference.

7.

From	$3.60	$2.15	$10.20	$20.00	$32.15
Take	1.75	.90	3.50	8.75	10.00

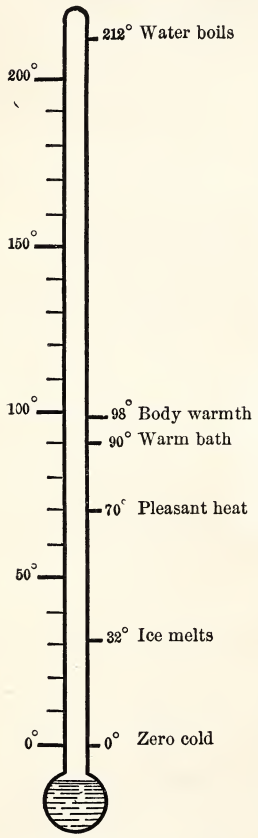
8. Mary had three dollars and seventy cents, and spent one dollar and a quarter for a beautiful doll. How much money had she left?

9. Sam had eight dollars, and spent six dollars and forty-five cents for a leather-covered football. How much money had he left?

10. Which is more, a thousand cents or eleven dollars?

TELLING HEAT AND COLD

In the winter, when we have no fire indoors, we feel the cold. In the summer we are often very warm. Sometimes in winter the fire is very hot, and our rooms are too warm. It is hot near bonfires or the fire in the blacksmith's shop. It is warmer in the sunshine than in the shade. We call the warmth or coldness of the air, the *temperature*.



Fahrenheit Thermometer. The spaces are called *degrees*. This means equal parts of space. The sign for degree is °.

We have *thermometers* to tell us how warm it is. Inside the glass of the thermometer is a liquid heavier than water. This is a metal called quicksilver or mercury. It looks like silver. Did you ever see little balls of quicksilver run across the surface of a flat table? This quicksilver expands and goes up the tube of the glass, when it is warm, but contracts and goes down in the glass when it is cold. When the glass is put in water with broken ice in it, the quicksilver goes to 32°. When we hold the bulb or thick end tight in one hand, the quicksilver goes nearly to 98°. In boiling water the quicksilver marks 212°. We call the weather hot when the air is as warm as our bodies, 98°.

We like to have the air in our rooms at 70°; but in winter, to make the air healthful at that temperature, we must have water

vapor in it. That is why we put water on our stoves or in our furnaces, or let steam out of the steampipes into our rooms. Cold air has only a little water vapor in it. When we warm the cold air, it needs more moisture to make it pleasant to breathe.

Dry warm or hot air does not feel as warm as does damp warm air. Dry cold air does not feel as cold as does damp cold air. The *hygrometer* tells us how damp the air is.

QUESTIONS

1. How many degrees are there between body warmth and boiling water?

2. How many degrees are there between melting ice and boiling water?

3. In the sun the temperature one summer's day was 140°, while it was 96° in the shade. What was the difference?

4. The water of the ocean was 57° while that near the beach was 68°. How many degrees of difference were there in each case between these temperatures and the warmth of a swimmer's body?

5. Two boys had been playing ball. One drank cold spring water at 55°, while the other drank ice-cold water. The latter was made very sick. How many degrees colder was the water drunk by the second boy than that drunk by the first? Compare also the differences between the water drunk and the body warmth.

6. Water at 50° or less tastes cold; at 60° cool; at 75° warm; at 105° hot. Explain these facts, telling the differences between these temperatures and that of the body.

WEIGHT MEASURE

2000 pounds = 1 ton. 2000 lbs. = 1 T.

1. A man can make a bicycle weighing 25 pounds go 12 miles in an hour. A horse can draw a ton of coal in a wagon weighing half a ton on a good road 6 miles in an hour. How many pounds is the horse pulling? How much faster does the man travel? How many times heavier is the load of the horse?

2. Can you find out the following facts? How many tons does a freight locomotive weigh? How many tons does a loaded freight car weigh? How many loaded cars can the locomotive draw on a level track? How many miles an hour can a freight locomotive travel, drawing a heavy train of cars?

3. Find and report facts about the weights of buggies, carriages, wagons, horses, cows, dogs, etc., etc.

4. Did you ever notice how large a pile a ton of coal makes? Do you know how much a hod of coal weighs?

16 ounces = 1 pound. 16 oz. = 1 lb.

5. Mrs. Eaton bought $\frac{1}{4}$ of a pound of tea and $\frac{1}{2}$ of a pound of coffee. How many ounces did she buy in all?

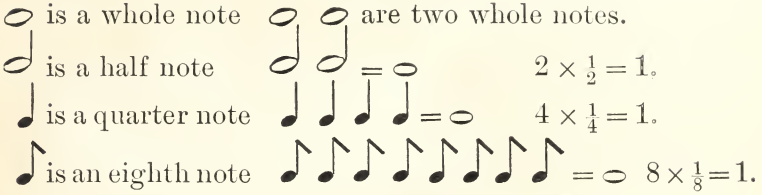
6. She ordered a half ton of coal at the coal dealer's. How many pounds did she order?

7. She paid for the tea at the rate of 40¢ per lb., and for the coffee at the rate of 30¢ per lb. How much in all did she pay the grocer?

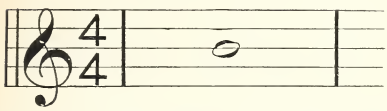
8. The coal she bought cost $5 per T. How many dollars did she pay for the coal?

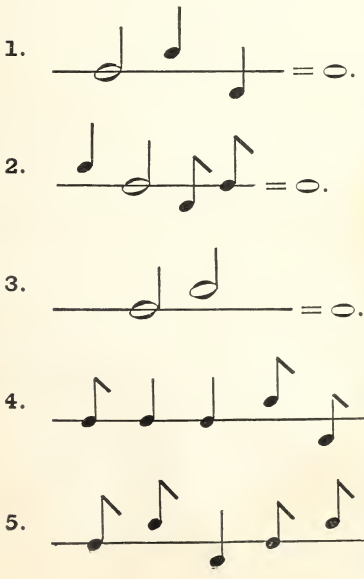
MUSIC FRACTIONS

In music we have equal parts or fractions of time. A whole note is the unit.



The space between the two vertical bars in this drawing is one measure. One whole note would take all the time in this measure. Two half notes would take all the time. Two quarter notes and one half note would also take all the time.





1. $\frac{1}{2} + \frac{1}{4} + \frac{1}{4} = 1.$
2. $\frac{1}{4} + \frac{1}{2} + \frac{1}{8} + \frac{1}{8} = 1.$
3. $\frac{1}{2} + \frac{1}{2} = 1.$
4. $\frac{1}{8} + \frac{1}{4} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 1.$
5. $\frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 1.$

GENERAL REVIEW

1. Subtract $\frac{1}{3}$ of 9 from $\frac{2}{3}$ of 12.

2. John needed 39 more apples in order to have twelve dozen. How many did he have?

3. Draw three oblongs 1 × 2 in. Divide the first into halves, the second into fourths, and the third into eighths.

4. How many times $\frac{1}{8}$ is $\frac{1}{2}$? What part of $\frac{1}{4}$ is $\frac{1}{8}$?

5. Draw a square with an area of 16 sq. in.

6. What is the volume in cubic inches of a cube 2 in. × 3 in. × 4 in.?

7. Mary sold $\frac{5}{6}$ of two dozen eggs for 40¢. What price did she receive for each egg?

8. Write in words these numbers:

110,452; 1,800,100; 207,907; 4,090,000; and 1010000.

9. Draw a hexagon and divide it into twelfths.

10. $\frac{3}{4} = \frac{?}{8}$ $\frac{2}{3} = \frac{?}{15}$ $\frac{1}{5} = \frac{?}{10}$ $\frac{4}{4} = \frac{?}{9}$

11. His father gave Tom $1.78 for a wagon. Tom already had $1.39. He then spent $3.10 for a football. How much money had he left?

12. Draw a music measure in $\frac{4}{4}$ time, and place two eighth notes, one half note, and as many quarter notes in it as are necessary all together to make one whole note of time in the measure.

13. What part of 7 apples is 1 apple? What part of 1000 soldiers is 500 soldiers?

14. Draw an acute, a right, and an obtuse angle.

MULTIPLICATION

Multiplication repeats one number as many times as there are units in another.

The number repeated, or multiplied, is the **multiplicand**.

The number showing how many times the multiplicand is repeated is the **multiplier.**

The result of the multiplication is the **product.**

The sign $\times$ is read **times** or **multiplied by.**

$7 \times 5 = 35$ is read **five times seven are thirty-five,** or, **seven multiplied by five are thirty-five.**

1. Find 5×17.

$17 = 7 + 10$

$5 \times 7 = 35$

$5 \times 10 = 50$

85

Thus: 17 multiplicand
5 multiplier
85 product

In multiplying, however, we find it better not to write the number of tens, but to remember them and add them to the result when we multiply the tens in the multiplicand.

2. Find 7×15.

15
7
$7 \times 5 = 35$
$7 \times 10 = 70$
105

Though we must understand multiplication in this way, we should learn to write the process in a simpler way.

15
7
105

3. Find 9×25.

$9 \times 5 = 45$

$25 = 5 + 20$

$9 \times 20 = 180$

45	25	multiplicand
180	9	multiplier
225	225	product

4. Multiply:

16	15	13	14	20	17	18
4	5	7	5	6	7	6

REVIEW

1. *a.* A newsboy bought 6 papers for 6¢ and sold them for 12¢. What was his gain? *b.* The next day he bought twice as many and sold them for twice as much. What was his gain? *c.* The third day he bought twice as many as on the second day and sold them for twice as much. What was his gain?

2. *a.* Mr. Malcolm bought 8 doz. eggs at 20¢ a dozen. What did he pay in all for them? *b.* He sold them at an average price of 2¢ each. What did he receive for them? *c.* What was his total gain?

3. William bought wood for scroll sawing at 6¢ per square foot. One piece was $1\frac{1}{2}$ ft. × (by) 4 ft. What was its cost?

4. Isabel was expected to practice her music lessons $\frac{1}{2}$ hr. every day. One week for six days she practiced only 50 minutes in all. How many minutes more was she expected to practice that week?

5. George read in ten days a book of 300 pages. How many pages was this on the average each day?

6. When 8 eggs weigh a pound, what is the average number of ounces each egg weighs?

7. When a class has 42 children and each child uses 4 sheets of paper each day, how many sheets are used daily by all the children?

8. A pad of paper costs $3\frac{1}{2}$¢ and contains 100 sheets. There are 25 children in the class, who use each day 2 sheets each. How much does a day's supply of paper cost?

QUESTIONS

MULTIPLICATION AND ADDITION

3 7 4 9 5 11 2 10 6 8 12

1. Multiply each of these numbers by:

4 6 2 10 5 8 3 9 7 11 12

2. *Multiply* the numbers by:

a	*b*	*c*
4 and add 2	6 and add 2	11 and add 4
d	*e*	*f*
6 and add 1	12 and add 5	10 and add 5
g	*h*	*i*
8 and add 4	11 and add 5	10 and add 10
j	*k*	*l*
9 and add 3	12 and add 2	5 and add 6
m	*n*	*o*
7 and add 4	10 and add 7	8 and add 4
p	*q*	*r*
10 and add 9	12 and add 6	6 and add 3
s	*t*	*u*
2 and add 6	10 and add 8	9 and add 8
v	*w*	*x*
4 and add 5	5 and add 4	11 and add 3
y	*z*	*aa*
7 and add 9	8 and add 6	5 and add 12

3. For 6 days Willie made 12¢ a day selling papers. How many cents in all did he make? His mother gave him 11¢ more. How much money did he then have?

MULTIPLICATION

1. Multiply 249 by 7.

249	multiplicand
7	multiplier
1743	product

Seven times 9 units are 63 units, equal to 6 tens and 3 units. We write 3 in units' place in the product and carry 6 tens.

Seven times 4 tens are 28 tens. Adding the 6 tens, we have 34 tens, equal to 3 hundreds and 4 tens. We write 4 in tens' place and carry 3 hundreds.

Seven times 2 hundreds are 14 hundreds. Adding the 3 hundreds, we have 17 hundreds, equal to 1 thousand and 7 hundreds. We write 7 in hundreds' place and 1 in thousands' place.

Proof:

249
249
249
249
249
249
249
1743

2. Multiply 4 by 370.

370	multiplicand
4	multiplier
1480	product

Proof: Add 4 times 370.

370
370
370
370
1480

3. Multiply 21 by 5 and the product by 3.

21
5
105
3
315

Proof:

21	105
21	105
21	105
21	315
21	
105	

4. Multiply these numbers:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
312	425	234	117	123	432	171	302	140
2	3	2	6	3	3	3	4	4

DOLLARS AND CENTS

1. Four boys had $2.40 each. How much money had they in all? We can find this by

MULTIPLICATION

$2.40
4
$9.60

We multiply just as in ordinary multiplication: $4 \times 0 = 0$. $4 \times 4 = 16$. $4 \times 2 = 8$. $8 + 1 = 9$. The period . or *decimal* point we place before the 6 to show that the 9 is $ and the 60 represents ¢. The boys had each 40¢, but $40¢ \times 4 = 160¢$; and $160¢ = \$1 + 60¢$.

In multiplying money we set the decimal point as many places to the left as it stood to the left in the multiplicand.

2. Multiply:

$1.75	$2.25	$4.13	$8.15	$3.98
3	6	9	12	10

3. The price of each of 7 books was one dollar and twenty-five cents. Mary's mother bought the whole set for her. What change should she receive from a ten-dollar bill?

4. Add:

$8.32	$1.42	$8.14	$10.00	$14.03
9.41	3.27	1.90	8.00	.10
.06	8.29	3.06	9.00	.90
2.33	.50	2.10	.25	15.00
8.21	10.00	8.25	1.75	.69

5. Subtract:

$15.50	$3.33	$5.25	$5.50	$22.50
8.69	2.98	1.49	3.38	16.75

DOLLARS AND CENTS

Sometimes when we multiply money, we do not have a multiplicand as large as the multiplier. The true multiplicand is always the quantity multiplied. Where the multiplier is larger than the multiplicand, for convenience we multiply by the figure or figures of the smaller number.

1. A boy sold 65 newspapers at 2¢ each. How much money did he receive?

Here the multiplicand is 2¢ and the multiplier is 65. How much is $65 \times 2¢$.

$$\begin{array}{r} 65 \\ 2¢ \\ \hline 130¢ \end{array}$$

$130¢ = 100¢ + 30¢$

$100¢ = \$1.$ $\quad 30¢ = \$.30$

$130¢ = \$1.30$

All the figures to the left of the *decimal* point, when the sign $ is used, stand for dollars, and the two figures to the right stand for cents.

We may write fifty cents either 50¢ or $.50.

$10¢ = \$.10.$ $\quad 25¢ = \$.25.$ $\quad 6¢ = \$.06.$ $\quad 2¢ = \$.02.$

2. A boy sold 91 fresh eggs at 5¢ each. How much money did he receive?

$$\begin{array}{r} 91 \\ \$.05 \\ \hline \$4.55 \end{array}$$

We write the multiplicand in the place of the multiplier and multiply by the smaller number.

3. Multiply 8¢ by 55, 105, 132, 69, 48, and 74.

4. Multiply $.07 by 25, 84, 125, 210, 305, and 76.

5. Write with the dollar sign these amounts:

40¢, 38¢, 97¢, 49¢, 86¢, 75¢. Add them.

6. Multiply each amount in **5** by these numbers:

4 8 6 12 11 7 9

MULTIPLICATION

1. Multiply 5317 by 8.

5317	multiplicand
8	multiplier
42,536	product

2. Multiply 532,005 by 7.

532,005	multiplicand
7	multiplier
3,724,035	product

Multiply these numbers, and prove, by either method, the answers to the first five problems.

3.	**4.**	**5.**	**6.**	**7.**
6342	5024	8153	3254	2150
3	4	5	6	7

8.	**9.**	**10.**	**11.**	**12.**
5346	7135	2648	6174	1342
4	5	6	7	8

13.	**14.**	**15.**	**16.**
42,307	18,243	72,845	16,537
5	6	7	8

17.	**18.**	**19.**	**20.**
71,465	32,618	47,438	19,684
4	6	7	8

21.	**22.**	**23.**	**24.**
43,019	27,420	426,815	371,648
3	5	7	8

1st proof:

5317
5317
5317
5317
5317
5317
5317
5317
42,536

2d proof:

$8 \times 7 = 56$. Write 6. Carry 50.

$8 \times 10 = 80$

$80 + 50 = 130$.

Write 30. Carry 100.

$8 \times 300 = 2400$

$2400 + 100 = 2500$.

Write 500. Carry 2000.

$8 \times 5{,}000 = 40{,}000$

$40{,}000 + 2{,}000 = 42{,}000$.

6
30
500
2000
40,000
42,536

LENGTH MEASURE

3 feet = 1 yard. 3 ft. = 1 yd.
1760 yards = 1 mile = 5280 feet.

1. A bicycle rider traveled 10 miles in one hour and 8 miles in the next hour. How many yards did he travel each hour?

2. A horse and carriage went six miles while a bicyclist went ten miles. How many feet farther in the same time did the bicyclist travel?

3. How far is it from your house to the post office? to the baseball field? to the high school?

4. How many miles can you walk in an hour? run? skate? ride on a bicycle? drive a horse? go on an electric car? on the steam railway train?

12 inches = 1 foot. 12 in. = 1 ft.

5. In a hop, step, and jump Albert cleared 23 ft. 7 in. In the hop he cleared 72 in. and in the step 84 in. How long was the jump?

RECITE

REVIEW

6. John and Tom had a dozen and a half trout which they caught in a brook. Each trout weighed a half pound. How many pounds did all the trout weigh?

7. $\frac{1}{3}$ of the trout were John's. He sold them at 10¢ each. How much money did he receive?

8. The rest were Tom's. He sold his for 8¢ each. How much money did he receive? Which had the larger amount of money? How much more had he?

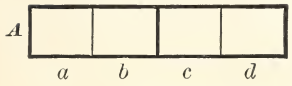
9. Make a drawing to show that $\frac{1}{3}$ of anything equals $\frac{2}{6}$ of it.

10. Multiply

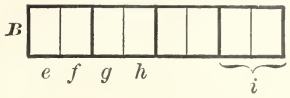
15	20	31	64	28	71	52	31	23	25
6	7	5	4	3	7	9	12	11	8

COMPARISONS AND RELATIONS

Halves and Fourths



Fourths and Eighths



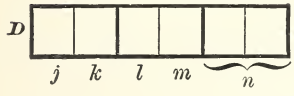
1. What part of A is a? $a + b$? $a + b + c$?

2. Does $\frac{1}{2}$ of A equal $\frac{2}{4}$ of A?

3. Into how many parts is B divided? What part of B is e? i? $e + i$?

4. Does $\frac{1}{2}$ of B equal $\frac{4}{8}$ of B?

Thirds and Sixths



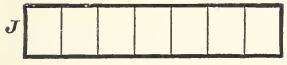
Fifths and Tenths

Read = equal

5. Does $\frac{2}{3}$ of $D = \frac{4}{6}$ of D? $\frac{4}{5}$ of $G = \frac{8}{10}$ of G?

6. Compare $j + k$ with $l + m + n$.

Sevenths



Twelfths

7. Is $\frac{3}{7}$ more or less than $\frac{1}{2}$? Measure.

8. Show that $\frac{3}{12} = \frac{1}{4}$; $\frac{2}{12} = \frac{1}{6}$; $\frac{4}{12} = \frac{1}{3}$; $\frac{6}{12} = \frac{1}{2}$.

9. Point out $\frac{1}{2}$ of K; $\frac{1}{3}$; $\frac{1}{4}$; $\frac{1}{6}$.

10. Point out $\frac{1}{3} + \frac{1}{4}$ of K. How many twelfths equal $\frac{1}{3} + \frac{1}{4}$? How many equal $\frac{1}{2} + \frac{1}{6}$?

FRACTIONS AND MULTIPLES

1. How many times 1¢ is 9¢? What part of 9¢ is 1¢?

2. What part of 6¢ is 1¢? of 6¢ is 3¢? of 4¢ is 2¢?

3. What part of 50 is 5? of 500 is 5?

4. What is $\frac{1}{12}$ of a dozen?

5. How many times 1 is 12? What part of 12 is 1?

6. If a dozen apples cost 12¢, how much would 2 apples cost? 3 doz.? 7 doz.?

7. If 7 oranges cost 14¢, how many cents would 1 orange cost? What is the ratio of 14 to 7? of 7 to 14?

8. Philip had a dime and 2¢. He paid $\frac{1}{12}$ of his money for an apple. What did the apple cost? Tell the cost of 2 apples.

9. Henry had 10 marbles. He lost 2. What part of his marbles did he lose?

10. $\frac{2}{5}$ of 10 marbles = ? $\frac{3}{5}$ of 10 marbles = ?

11. How many times 2 is 10? What part of 10 is 2?

12. A basket contained 14 eggs. The cook took out $\frac{1}{7}$ of them. How many eggs did she take out?

13. How many times 2 eggs is 14 eggs?

14. George had 15 pears. He gave away 3. What part did he give away?

15. How many times 3 is 15? What part of 15 is 3?

16. What is $\frac{1}{5}$ of 15? What are $\frac{2}{5}$ of 15?

17. Eddie had 16 cherries. He gave $\frac{1}{8}$ of them to James and $\frac{1}{8}$ to Arthur. How many eighths did he keep? How many cherries did he give to James? to Arthur? to both boys?

FRACTIONS

1. Which is greater, 2×1 or $2 \times \frac{1}{2}$?

2. What is $\frac{1}{4}$ of 16? $16 \div ? = 4$.

3. $\frac{3}{4}$ of $16 = ?$ $\frac{6}{8}$ of $16 = ?$ $\frac{5}{8}$ of $16 = ?$ $\frac{3}{8}$ of $16 = ?$

4. A butcher had 18 chickens. He sold $\frac{1}{6}$ of them to 1 man and $\frac{1}{6}$ to another man. How many chickens did he sell to both men?

5. What is the ratio of 6 to 18? of 18 to 6?

6. I had 18¢ and lost $\frac{1}{3}$ of my money. How many cents did I lose?

7. $\frac{1}{6}$ of $18 = ?$ $\frac{2}{6}$ of $18 = ?$ Then $\frac{2}{6} = \frac{?}{3}$.

8. $\frac{3}{6}$ of $18 =$ ——. $\frac{4}{6}$ of $18 =$ ——. $\frac{5}{6}$ of $18 =$ ——.

9. There were 20 books on a table. 4 of them were taken away. How many were left? What part was taken away? What part was left?

10. $\frac{2}{5}$ of 20¢ are how many cents?

11. $\frac{3}{5}$ of 15 figs are how many figs?

12. $\frac{4}{5}$ of \$10 are how many dollars?

13. $\frac{1}{7}$ of 14 pounds are how many pounds? $\frac{2}{7}$? $\frac{3}{7}$? $\frac{4}{7}$? $\frac{5}{7}$? $\frac{6}{7}$? $\frac{7}{7}$?

14. Which is greatest and which is least, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$?

15. Point out $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{12}$ of this oblong.

16. What is $\frac{1}{4}$ of 24? $\frac{1}{6}$? $\frac{1}{8}$?

17. Mary gave to John $\frac{3}{8}$ of 24 apples, and John gave $\frac{1}{3}$ of his apples to Walter. How many apples did Walter receive?

DIVISION

Division finds how many times one number is contained in another.

The number to be divided is called the **dividend.**

The number we divide by is called the **divisor.**

The result obtained by division is called the **quotient.** It shows how many times the divisor is contained in the dividend.

When the dividend does not contain the divisor an exact number of times, the part of the dividend left undivided is called the **remainder.** It is always less than the divisor.

The sign of division, $\div$, shows that the number before it is to be divided by the number. Thus, $10 \div 5 = 2$. Ten contains five twice. Or, 10 divided by 5 is 2.

Division is also indicated by writing the dividend above a line and the divisor below it; thus, $\frac{10}{5} = 2$.

The sign) is also used to indicate division. Thus 5)10(2 shows that 10 divided by 5 equals 2. We sometimes indicate division by this form, $8\overline{)64}$.

Proof. Multiply the quotient by the divisor and add the remainder, if any. If the result equals the dividend, the work is correct.

8)64	$8 \times 8 = 64$	8)216	27	quotient
8		27	8	divisor
			216	dividend

Do as is indicated by the forms given.

1. $3\overline{)429}$	**2.** $\frac{81}{9} = ?$	**3.** $96 \div 12 = ?$	**4.** $11\overline{)132}$
5. $6\overline{)737}$	**6.** $\frac{48}{8} = ?$	**7.** $108 \div 9 = ?$	**8.** $11\overline{)165}$

DIVISION

1. Divide 486 by 2.

2 is contained in 4 hundreds 2 (hundred) times. We write 2 in hundreds' place in the quotient. 2 is contained in 8 tens 4 (tens) times. We write 4 in tens' place in the quotient. 2 is contained in 6 units 3 (units) times. We write the 3 in units' place in the quotient.

$$\begin{array}{r} 2)\overline{486} \\ \underline{243} \end{array}$$

Proof:

$$\begin{array}{r} 243 \text{ quotient} \\ \times\ 2 \text{ divisor} \\ \hline 486 \text{ dividend} \end{array}$$

To prove the result of division, multiply the quotient by the divisor. This gives the dividend.

Second proof:

$$\begin{array}{rl} 400 \div 2 = & 200 \\ 80 \div 2 = & 40 \\ 6 \div 2 = & 3 \\ \hline 486 \div 2 = & 243 \end{array}$$

2. Divide 1842 by 3.

1 cannot be divided by 2, except with a fraction as the result, but 1 thousand equals 10 hundreds. We add the 10 hundreds to the 8 hundreds and divide the 18 hundreds by 3. We write the quotient figure 6 in hundreds' place. 3 is contained in 4 tens 1 (ten) time and 1 ten over. We write 1 in tens' place in the quotient. 1 ten and 2 units are 12 units. 3 is contained in 12 units 4 (unit) times. We write 4 in the quotient.

$$\begin{array}{r} 3)\overline{1842} \\ \underline{} \\ 614 \end{array}$$

Proof:

$$\begin{array}{r} 614 \text{ quotient} \\ 3 \text{ divisor} \\ \hline 1842 \text{ dividend} \end{array}$$

3. Divide 4940 by 2, 3, 4, 5, 6, and 7.

4. Divide 7264 by 3, 6, 8, 2, 4, and 7.

MULTIPLICATION TABLE, 9

1	11	21	31	41	51	61	71	**81**	91	101	111	121
2	12	22	32	42	52	62	**72**	82	92	102	112	122
3	13	23	33	43	53	**63**	73	83	93	103	113	123
4	14	24	34	44	**54**	64	74	84	94	104	114	124
5	15	25	35	**45**	55	65	75	85	95	105	115	125
6	16	26	**36**	46	56	66	76	86	96	106	116	**126**
7	17	**27**	37	47	57	67	77	87	97	107	**117**	127
8	**18**	28	38	48	58	68	78	88	98	**108**	118	128
9	19	29	39	49	59	69	79	89	**99**	109	119	129
10	20	30	40	50	60	70	80	**90**	100	110	120	130

Notice that the multiples of 9 in this *number table* in columns of ten present the appearance of steps, in lines like stairs.

A **multiple** is the product resulting from multiplying one number by another.

9	9	9	9	9	9	9	9	9	9	9	9
	9	9	9	9	9	9	9	9	9	9	9
	18	9	9	9	9	9	9	9	9	9	9
		27	9	9	9	9	9	9	9	9	9
			36	9	9	9	9	9	9	9	9
				45	9	9	9	9	9	9	9
					54	9	9	9	9	9	9
						63	9	9	9	9	9
							72	9	9	9	9
								81	9	9	9
									90	9	9
										99	9
											108

1. Prove these sums.
2. What is 9×7?
3. What is 9×8?
4. What of 108 is 9?

MULTIPLICATION TABLE, 9

Add 1 and 8; 2 and 7; 3 and 6; 1 and 1 and 7; 1 and 2 and 6. Notice that the sum of the figures in any multiple of 9 is always 9, or another multiple of 9, *e.g.* 9 + 9.

$9 \times 1 = 9$	$9 \times 5 = 45$	$9 \times 9 = 81$
$9 \times 2 = 18$	$9 \times 6 = 54$	$9 \times 10 = 90$
$9 \times 3 = 27$	$9 \times 7 = 63$	$9 \times 11 = 99$
$9 \times 4 = 36$	$9 \times 8 = 72$	$9 \times 12 = 108$

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	
1	2	3	4	5	6	7					
1	2	3	4	5	6						
1	2	3	4	5	6						
1	2	3	4	5							
1	2	3	4	5							
1	2	3	4								
1	2	3	4								
9	18	27									

Complete these columns and add them.

Complete this division table.

$9 \div 9 = 1$	$45 \div 9 =$		
$18 \div 9 = 2$	$54 \div$		
$27 \div 9 = 3$			
$36 \div 9 = 4$			

Answer: 3)9 $18 \div 9 = ?$ $18 \div 6 = ?$ $18 \div 2 = ?$ $18 \div 3 \div 3 = ?$ 3)27 $36 \div 9 = ?$ $36 \div 12 = ?$ $36 \div 6 = ?$ 5)45 9)54 7)63 8)72 9)81 10)90 11)99 9)108

MULTIPLICATION TABLE, 7

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
10	20	30	40	50	60	**70**	80	90	100

7	7	7	7	7	7	7	7	7	7	7	7
	7	7	7	7	7	7	7	7	7	7	7
	14	7	7	7	7	7	7	7	7	7	7
		21	7	7	7	7	7	7	7	7	7
			28	7	7	7	7	7	7	7	7
				35	7	7	7	7	7	7	7
					42	7	7	7	7	7	7
						49	7	7	7	7	7
							56	7	7	7	7
								63	7	7	7
									70	7	7
										77	7
											84

1. Prove the totals.
2. What is 7×6?
3. What is 9×9?
4. What part of 84 is 7?

$7 \times 1 = 7$	$7 \times 5 = 35$	$7 \times 9 = 63$
$7 \times 2 = 14$	$7 \times 6 = 42$	$7 \times 10 = 70$
$7 \times 3 = 21$	$7 \times 7 = 49$	$7 \times 11 = 77$
$7 \times 4 = 28$	$7 \times 8 = 56$	$7 \times 12 = 84$

MULTIPLICATION TABLE, 7

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9			
1	2	3	4	5	6	7	8	9			
1	2	3	4	5	6	7	8				
1	2	3	4	5	6	7	8				
1	2	3	4	5	6	7					
1	2	3	4	5	6		Complete these columns				
7	14	21	28	35			and add them.				

1. Answer: $49 \div 7 =$ $77 \div 11 =$ $84 \div 12 =$ $35 \div 7 = ?$
$56 \div 7 =$ $63 \div 9 =$ $28 \div 7 =$ $70 \div 7 =$ $42 \div 6 = ?$

2. Multiply: 8×7 12×7 11×7 6×7 9×7 10×7 4×7 5×7

Complete this division table:

$7 \div 7 = 1$	$35 \div 7 = 5$		
$14 \div 7 = 2$	$42 \div 7$		
$21 \div 7 = 3$	49		
$28 \div 7 = 4$			

1. How many fours are there in 28?

2. $(7 \times 8) - (6 \times 9) = ?$ 3. $(108 \div 12) - (84 \div 7) = ?$

Every multiple of two different numbers, each of which is less than twelve, occurs in at least two multiplication tables.

4. In what tables do we find: 63, 48, 36, 72, 35, 42, 24, 18, 20, 32, 30, 54, 56?

Draw the plan of a class-room, conveniently seated with 42 desks.

SEVEN AND SEVENTHS

1. 7)21 7)23 7)26 7)35 7)39 7)44 7)48
7)55 7)60 7)66 7)69 7)72 7)78 7)80 7)83

2. How many 7's are there in :

35? 42? 84? 49? 14? 21? 56? 7? 28? 63? 77? 70?

3.

$\frac{1}{7}$ of 14 = ?	$\frac{2}{7}$ of 14 = ?	$\frac{3}{7}$ of 14 = ?	$\frac{4}{7}$ of 14 = ?
$\frac{5}{7}$ of 14 = ?	$\frac{6}{7}$ of 14 = ?	$\frac{7}{7}$ of 14 = ?	$\frac{1}{7}$ of 7 = ?
$\frac{4}{7}$ of 7 = ?	$\frac{1}{7}$ of 77 = ?	$\frac{3}{7}$ of 77 = ?	$\frac{1}{7}$ of 42 = ?
$\frac{6}{7}$ of 42 = ?	$\frac{1}{7}$ of 49 = ?	$\frac{5}{7}$ of 49 = ?	$\frac{1}{7}$ of 28 = ?
$\frac{3}{7}$ of 28 = ?	$\frac{1}{7}$ of 84 = ?	$\frac{4}{7}$ of 84 = ?	$\frac{1}{7}$ of 35 = ?
$\frac{7}{7}$ of 35 = ?	$\frac{1}{7}$ of 21 = ?	$\frac{6}{7}$ of 21 = ?	$\frac{1}{7}$ of 70 = ?
$\frac{4}{7}$ of 70 = ?	$\frac{1}{7}$ of 63 = ?	$\frac{5}{7}$ of 63 = ?	$\frac{1}{7}$ of 56 = ?
$\frac{3}{7}$ of 56 = ?	$\frac{6}{7}$ of 14 = ?	$\frac{1}{7}$ of 84 = ?	$\frac{2}{7}$ of 42 = ?
$\frac{4}{7}$ of 21 = ?	$\frac{3}{7}$ of 28 = ?	$\frac{2}{7}$ of 70 = ?	$\frac{4}{7}$ of 35 = ?
$\frac{4}{7}$ of 28 = ?	$\frac{2}{7}$ of 56 = ?	$\frac{5}{7}$ of 49 = ?	$\frac{3}{7}$ of 21 = ?

4. What part of 49 is 7 ? of 77 is 7 ? of 84 is 7 ?

5. 7 is $\frac{1}{8}$ of —? $\frac{1}{2}$ of —?

6. 7 is $\frac{1}{12}$ of —? $\frac{1}{9}$ of —?

7. 28 is 4 × —? $\frac{1}{2}$ of —?

8. 84 is 12 × —? 2 × —?

FRACTIONS AND MULTIPLES

1. How many 7's are there in 14? in 7? in 8? in 10? in 11? in 13? in 15? in 17? in 20?

2. $\frac{1}{7}$ of 14 = ? $\frac{2}{7}$ of 14 = ?

3. At 2¢ apiece, what will be the cost of 7 oranges?

4. If there are 14 boys in a class, how many boys are there in $\frac{1}{7}$ of the class?

5. Divide 14 oranges equally among 7 boys. How many oranges will each boy have?

6. What part of 16 is 8? of 18 is 6? $10 \div 8 = ?$ $12 \div 8 = ?$ $15 \div 8 = ?$ $19 \div 8 = ?$

7. 8)9 8)11 8)13 8)14 8)17 8)20

8. If 8 cakes cost 16¢, what will be the cost of 1 cake? of 2 cakes? of 4 cakes? of 7 cakes?

9. If apples are 2¢ apiece, how many can one buy for 16¢?

10. Arthur had 16 marbles. He gave $\frac{1}{8}$ of them to Willie. How many marbles did Willie get?

11. How many times 9 is 18? What part of 18 is 9?

12. $\frac{1}{9}$ of 18 = ? $\frac{1}{2}$ of 18 = ?

13. $12 \div 9 = ?$ $14 \div 9 = ?$ $17 \div 9 = ?$ $20 \div 9 = ?$

14. 9)11 9)13 9)15 9)19 9)16 9)18

15. Edith had 18 pinks. She gave $\frac{1}{9}$ of them to Louise. How many pinks did Louise get?

16. I bought 9 pencils at 2¢ each. How many cents did I spend?

17. Arthur paid 2¢ for a banana, 6¢ for oranges, and 10¢ for apples. How many cents did he spend?

18. What is $\frac{2}{9}$ of 18¢? $\frac{3}{9}$ of 18¢ = ? $\frac{5}{9}$ of 18¢ = ?

MULTIPLICATION TABLE, 11

The number 11 gives us the easiest multiplication table.

The figures for units and tens in all multiples of 11, less than 100, are the same and are the figure of the unit multiplied by 11. $11 \times 2 = 22$. $11 \times 6 = 66$.

Above 100 the figures for units and hundreds of the multiples when added together give the figure for tens. $121 = 11 \times 11$. $1 + 1 = 2$.

1	**11**	21	31	41	51	61	71	81	91	101	111	**121**	131	141
2	12	**22**	32	42	52	62	72	82	92	102	112	122	**132**	142
3	13	23	**33**	43	53	63	73	83	93	103	113	123	133	**143**
4	14	24	34	**44**	54	64	74	84	94	104	114	124	134	144
5	15	25	35	45	**55**	65	75	85	95	105	115	125	135	145
6	16	26	36	46	56	**66**	76	86	96	106	116	126	136	146
7	17	27	37	47	57	67	**77**	87	97	107	117	127	137	147
8	18	28	38	48	58	68	78	**88**	98	108	118	128	138	148
9	19	29	39	49	59	69	79	89	**99**	109	119	129	139	149
10	20	30	40	50	60	70	80	90	100	**110**	120	130	140	150

In a *number-table* arranged in columns of ten, the multiples of 11 in black face figures, like the multiples of 9, make a line of stairs.

$11 \times 1 = 11$	$11 \times 5 = 55$	$11 \times 9 = 99$
$11 \times 2 = 22$	$11 \times 6 = 66$	$11 \times 10 = 110$
$11 \times 3 = 33$	$11 \times 7 = 77$	$11 \times 11 = 121$
$11 \times 4 = 44$	$11 \times 8 = 88$	$11 \times 12 = 132$

MULTIPLICATION TABLE, 11

11	11	11	11	11	11	11	11	11	11	11	11
	11	11	11	11	11	11	11	11	11	11	11
	22	11	11	11	11	11	11	11	11	11	11
		33	11	11	11	11	11	11	11	11	11
			44	11	11	11	11	11	11	11	11
				55	11	11	11	11	11	11	11
					66	11	11	11	11	11	11
						77	11	11	11	11	11
							88	11	11	11	11
								99	11	11	11
									110	11	11
										121	11
											132

1. Prove these totals.
2. Complete the division table for 11.

$11 \div 11 = 1$	$55 \div$
$22 \div 11 = 2$	
$33 \div 11 =$	
$44 \div 11 =$	

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4								
1	2	3	4								
1	2	3	4								
1	2	3									
1	2	3									
1	2	3									
1	2	3									
1	2										
1	2										
1	2										
11	22										

Complete these columns and add them.

Answer: $2 \times 2 \times 11 = ?$ $8)\underline{88}$ $7 \times 11 = ?$ $11 \times 5 = ?$ $132 \div 11 = ?$ $11 \times 11 = ?$ $3 \times 3 \times 11 = ?$ $3 \times 2 \times 11 = ?$ $11)\underline{99}$ $3 \times 2 \times 2 \times 11 = ?$ $11 \times 3 = ?$ $11)\underline{110}$ $12)\underline{132}$

MULTIPLICATION TABLE, 12

The number 12 is the last and largest number whose multiples we study very carefully. We do not need to use the multiples of still larger numbers very often. If we learn accurately the multiples of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, we can multiply larger numbers rapidly when necessary.

1	11	21	31	41	51	61	71	81	91	101	111	121	131	141
2	**12**	22	32	42	52	62	**72**	82	92	102	112	122	**132**	142
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143
4	14	**24**	34	44	54	64	74	**84**	94	104	114	124	134	**144**
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
6	16	26	**36**	46	56	66	76	86	**96**	106	116	126	136	146
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147
8	18	28	38	**48**	58	68	78	88	98	**108**	118	128	138	148
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149
10	20	30	40	50	**60**	70	80	90	100	110	**120**	130	140	150

1. Why is every multiple of 12 a multiple also of 2, of 3, of 4, and of 6? Try every number in black face type in this *number table* by division, and see if this is true; divide each black face number by 2, 3, 4, and 6.

2. Learn this table:

$12 \times 1 = 12$	$12 \times 5 = 60$	$12 \times 9 = 108$
$12 \times 2 = 24$	$12 \times 6 = 72$	$12 \times 10 = 120$
$12 \times 3 = 36$	$12 \times 7 = 84$	$12 \times 11 = 132$
$12 \times 4 = 48$	$12 \times 8 = 96$	$12 \times 12 = 144$

3. Notice that we have studied the multiplication tables in this order: 2, then 4; 5, then 10; 3, then 6; next 8; next 9; then 7 and 11; and last 12. $4 = ? \times 2$. $10 = ? \times 5$. $6 = ? \times 3$. $8 = ? \times 4$. $9 = ? \times 3$. $12 = 2 \times 2 \times 3$. $7 \times 12 = ?$ $11 \times 12 = ?$ $12 \times 12 = ?$

MULTIPLICATION TABLE, 12

1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12

Add these columns:

12	12	12	12	12	12	12	12	12	12	12	12
	12	12	12	12	12	12	12	12	12		
	24	12	12	12	12						
		36	12	12	12						
			48	12	12						
				60	12						

Complete these columns and add them.

1. How much is a dozen times a dozen?

2. How much is half a dozen times a dozen?

3. What part of 12×12 is 6×6?

4. What part of 120 is 60?

A gross is a dozen dozen.

5. Divide a gross of pens equally among 48 boys and girls.

6. Divide a gross of lead pencils equally among 36 pupils.

ROMAN NOTATION

I=1 V=5 X=10 L=50 C=100 D=500 M=1000

Roman notation uses seven capital letters I, V, X, L, C, D, M.

On the clock we found Roman figures or numerals. Our more common figures came from Arabia and India, lands even farther away than Rome in Italy.

Rome is a great city in Italy, a land five thousand miles away across the great Atlantic Ocean. It was built by very brave, hard-working people more than two thousand seven hundred years ago.

I = one	= 1	XX	= twenty	=	20
II = two	= 2	XXI	= twenty-one	=	21
III = three	= 3	XXX	= thirty	=	30
IV = four	= 4	L	= fifty	=	50
V = five	= 5	XL	= forty	=	40
VI = six	= 6	LX	= sixty	=	60
VII = seven	= 7	C	= one hundred	=	100
VIII = eight	= 8	XC	= ninety	=	90
IX = nine	= 9	CX	= one hundred ten	=	110
X = ten	= 10	CC	= two hundred	=	200
XI = eleven	= 11	D	= five hundred	=	500
XIX = nineteen	= 19	M	= one thousand	=	1000

On the clock we find IIII instead of IV for four.

1. Write in Roman numerals 45, 70, 225, 800.

2. What part of C is L? of D is C? of XVIII is IX? of XVI is XII? of XL is XX? of M is D?

PRINCIPLES

Repeating a letter repeats its value:

III, 3; XXX, 30; CC, 200; CCCXXII, 322.

When a letter is placed before one of greater value, the value of the less number is subtracted from the value of the greater; as IV = 5 − 1 = 4; XL = 50 − 10 = 40.

XIX = 10 + 10 − 1 = 19; XXIV = 10 + 10 + 5 − 1 = 24.

When a letter is placed after one of greater value, the value of the less is added to the value of the greater; as

VI = 5 + 1 = 6; MC = 1000 + 100 = 1100.

COMPARISONS

Some numbers are more simply written in Roman than in Arabic notation, but for most the latter is simpler.

Simpler in Roman	Simpler in Arabic
D = 500	14 = xiv
CD = 400	18 = xviii
M = 1000	19 = xix
MD = 1500	33 = xxxiii

1. Write all the numbers from 1 to 100 in Roman notation.

2. Write all the years from 1776 to 1905 in Roman notation.

3. Write these years in Roman notation: 1492, 1607, 1620, 1682, 1732, 1775, 1789, 1812, 1861, 1899.

EXERCISES

IV=?	DXI=?	LXXI=?
XXIII=?	MDXXI=?	XLIX=?
XIX=?	MCDXCII=?	XXVIII=?
LIV=?	MV=?	MIX=?
XXXV=?	DXIV=?	MDXI=?
D=?	CDLXX=?	L=?
DLV=?	CMX=?	LXXXIV=?
DC=?	CCCI=?	MDCCC=?
DCCC=?	XCIX=?	MDCCCLXI=?
MMM=?	MMCC=?	MDCCCXCIX=?
LXXIV=?	VM=?	MCM=?
XVIII=?	CCXCV=?	MCMII=?
XCIX=?	MCD=?	MCMIX=?
CCXX=?	DXI=?	MCMXXX=?
XLVII=?	MDC=?	MM=?

19=?	42=?	200=?	1200=?	75=?
31=?	99=?	304=?	1419=?	175=?
49=?	54=?	520=?	1641=?	1750=?
75=?	71=?	411=?	1861=?	555=?
38=?	86=?	900=?	1900=?	1776=?

Roman notation is used very little now except for the prefaces of books, upon clocks, and sometimes to date the building of churches, libraries, school-houses and halls.

GENERAL REVIEW

1. Colonel Alden divided a regiment of 702 men into 9 companies of —— men each.

2. Draw a figure to represent a cube 3 in. on a side. Divide each side into —— 1 in. squares.

3. The public library in the town of Estabrook was built in the year MDCCCLXXII. Write this in figures and words.

4. A is —— of B.

5. 64 is —— × 16.

6. Mr. Olmstead, a farmer, had twice as many sheep as he had cows, and twice as many cows as horses. He had 8 horses, —— cows, and —— sheep.

7. There were 731 children on the average in each of 9 schools. There were —— children in all.

Prove the answer by addition.

8. There are —— inches in 4 yards.

9. Alfred jumped 100 inches and Arthur $\frac{9}{10}$ as far. Alfred's jump was —— inches longer than Arthur's.

10. Alfred jumped —— ft. —— in. Arthur jumped —— ft. —— in.

11. Mary had 20 dolls and gave $\frac{1}{2}$ to Susan and $\frac{1}{4}$ to Alice. She had left —— dolls.

12. 48 marbles are —— less than 64 marbles.

GENERAL REVIEW

1. Give the multiplication tables.

2. Give the tables of weights and measures.

3. Explain eighth, quarter, half, and whole notes in music.

4. What is an octagon?

5. Give two fractions that equal three ninths.

6. Count to one hundred by each number from two to twelve beginning at 1: at 2: at 3.

7. What is 15×3? 18×2? 8×11? 35×2? 20×3? 50×2? 25×4? 3×33? 12×6? 200×5?

8. Mary gave \$3.20 to her sister, who had \$1.50 before. How much money did her sister then have?

9. When Annie put the water on the stove it was 52° warm. In 4 minutes it was boiling. How many degrees did the water rise in temperature each minute? Do you think the fire was very hot or not?

10. John's father borrowed \$100 and agreed to pay the money back in 100 days. How many months was that?

11. Tell the exact number of days in each month.

12. Willie's house is number 850 on Lake Street, but Charlie's is 225. How many numbers are they apart? If Willie lives on the east side of the street, on which side do you think Charlie lives?

13. What part of a ton of coal is four hods of coal that weigh twenty-five pounds each?

14. What part of 3 yd. is 2 ft.? What part of 12 ft. is 3 yd.?

15. Multiply by 10: 3, 7, 9, 10, 15, 20, 50, 75, 90, 100.

16. Susan bought a dozen eggs at $2\frac{1}{2}$¢ each. What was the cost? Explain the way to get the answer.

DOLLARS AND CENTS

1. Six boys had in all $3.30. They divided the money equally. How much had each? We find this by

DIVISION

$$6)\$3.30 \quad \$.55$$

6 is found in 3 (hundreds) 0 times.
6 is found in 33 (tens) 5 times and 3 tens over.
6 is found in 30 (units) 5 times.

2. Eight girls had in all $3.60. They went to a store and saw there some dolls at 50¢ each. The clerk told them that he could sell eight dolls at a little lower price each, and gave them the dolls for their money. What price did they pay for each doll?

$$8)\$3.60 \quad \$.45$$

8 is found in 3 (hundreds) 0 times.
8 is found in 36 (tens) 4 times and 4 tens over.
8 is found in 40 units 5 times.

Tell number stories, using the following facts:

3. $6. and 5 boys buying books : or — : or —.

4. $2.40 and 12 girls selling violets : or — : or —.

5. $7)\underline{\$4.27}$ **6.** $9)\underline{\$5.49}$ **7.** $11)\underline{\$13.20}$ **8.** $9)\underline{\$3.96}$

REVIEW WRITE

9. Add 30¢, $4., $1.25, $10., 47¢, and a half dollar.

10. How many inches are there in $7\frac{1}{2}$ ft.?

11. John sold four dozen eggs at 2¢ each egg. What amount did he receive?

12. Mr. Clark's horse weighed $\frac{1}{2}$ ton. How many pounds did he weigh?

13. It is April 1. Mary's baby sister is 1 mo. and 8 days old. What day was the baby's birthday?

MONEY

1. If a cake cost 8¢, then $\frac{1}{4}$ of it will cost — cents.

2. Half a dollar and a quarter of a dollar make — quarters of a dollar.

3. If I pay 16¢ for 8 apples, half that number of apples will cost — cents.

4. 5¢ is $\frac{1}{2}$ of — cents. 3¢ is $\frac{1}{2}$ of — cents.

5. 2¢ is $\frac{1}{4}$ of — cents. 1¢ is $\frac{1}{4}$ of — cents.

6. If 6 yards of silk cost $18, 1 yard will cost $—.

7. If 9 yards of silk cost $18, $\frac{1}{2}$ yard will cost $—.

8. At 12¢ a qt. what will be the cost of 8 qt. of berries?

9. If a tub of butter costs $11, how many tubs can be bought for $77?

10. Willie had 6 dimes and 2 nickels. How many cents did he have?

11. If berries were 8¢ a quart, how many quarts could you buy with half a dollar? After paying for the berries, how many cents would you have left?

12. Arthur had 3 cents, 2 nickels, and a quarter of a dollar. After paying for 6 five-cent car fares, how many cents did he have left?

13. In 1 day a milkman sold 50 gallons of milk at 20¢ a gallon and 10 gallons of cream at $1. a gallon. How much money in all did he receive?

14. In **13** what price per quart did the milkman receive for his milk? What price per quart for his cream? What prices would you expect to pay where you live?

15. Bertha picked 47 quarts of plums, and her brother Thomas picked 18 more than 5 times as many. At 10¢ a quart, how much money were all the plums worth?

UNITED STATES MONEY

5 cents (¢) make 1 nickel
10 cents make one dime
25 cents make a quarter dollar
10 dimes make 1 dollar ($)
50 cents make a half dollar
100 cents make 1 dollar

1. How many cents make half a dime?
2. What part of a dollar is a dime?
3. 6 dimes make what part of a dollar?
4. What is the name of the smallest coin we use?
5. How many cents are there in 3 dimes and a nickel?
6. What will six pictures cost at $12 each?
7. If a quart of chestnuts is worth 10¢, what will a peck cost?
8. $\frac{1}{5}$ of my money is 4¢. How many cents have I?
9. Louis made 19¢ by selling papers. He spent 7¢. How many cents did he have left?
10. I paid for an overcoat with three 10-dollar bills; and received 8 1-dollar bills as change. What was the price of the overcoat?
11. If 3 qt. of vinegar cost 33¢, what is the price of 1 qt.? What will 7 qt. cost at the same price?
12. Louise bought 10 yards of braid at 7¢ a yard, and gave the clerk a fifty-cent piece and a quarter. What change should the clerk give her?
13. If 7 dozen apples cost 84¢, what will 2 dozen cost?
14. William had one dollar with which to buy 4 lb. of sugar at 5¢ a lb., 2 doz. eggs at 1¢ each, a 3¢ top, a ball of twine at 7¢, and a quarter of a dollar's worth of beef to boil. How much money did he bring home?

REVIEW

1. With a thermometer take the temperature out of doors at 8.30 A.M., at 12 M., and at 3 P.M. Tell the differences. Do this for five school days.

2. Take the temperature in the schoolroom every hour all day.

3. Draw pictures of thermometers showing the quicksilver at 98°, at 32°, at zero, at 212°, at 70°, at 90°, at 100°.

4. Draw pictures of thermometers, telling when ice melts, when water boils, when the heat is pleasant, how warm the body is when one is well, when one has a fever, when one has a chill, how warm a bath should be, and how low the mercury is when it is very, very cold, below zero.

5. Draw a picture of the clock face to show the time when school begins in the morning; in the afternoon; when school closes in the morning; in the afternoon.

6. Draw a flag showing thirteen stripes and forty-five stars.

 or  or 

7. Write in words all the numbers from one to thirty; all from thirty to sixty; all from sixty to a hundred.

8. George made a checkerboard 8 inches by 8 inches, and marked on it —— inch squares. Draw the board on the blackboard and count the squares.

9. Fold a piece of strong paper into a box (rectangular prism), six inches long, two inches wide, and two inches high. Roll another piece of strong paper into a cylinder, six inches long, two inches in diameter. With dry sand find whether the box or the cylinder is the larger. See pages 205 and 219.

TIME MEASURE

60 seconds make 1 minute

1 min. = 60 secs.

60 minutes make 1 hour

1 hr. = 60 min.

24 hours (hr.) make 1 day

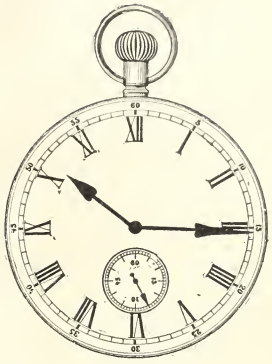
1 day = 24 hrs.

7 days make 1 week (wk.)

1 wk. = 7 days

12 months (mo.) make 1 year (yr.)

1 yr. = 12 mo.



1. What day of the week is to-day?
2. Name the days of the week in their order.
3. Read the time on this watch face in hours, minutes, and seconds.
4. At what hour does school begin in the morning?
5. How many hours do we spend in school in the afternoon? in the forenoon? during the day?
6. What time is it at noon? Where are the clock hands then? What time is it at midnight?
7. How many months are there in 2 years?
8. How many seconds are there in an hour?
9. Give the months in their order.
10. How many months are there in a quarter of a year?
11. How many months of vacation from school do we have every year?
12. Name the school vacation months.
13. What other school vacations do we have?

TIME MEASURE

30 days are counted as 1 month.

1 mo. = 30 days.

365 days are counted as 1 year.

1 yr. = 365 days.

There are $52\frac{1}{7}$ weeks in 1 year.

1. How many days are there in 3 yr.? in 2 yr. 3 mo.?

2. How many minutes are there in 4 hr.? in 2 hr. and a half?

3. How many seconds are there in 3 min.? in 8 min.?

4. How many days are there in 4 wk.? in 8 wk.?

5. How many seconds are there in half an hour?

6. George went on a visit to his cousin Charles, and stayed six weeks. How many days did he stay? If he ate three meals every day, how many meals did he eat while there?

7. Charles could run a mile in eight minutes, and George a thousand yards in the same time. Which could run faster?

8. If Mary reads ten pages every day, how many pages does she read in a month? in a year?

9. If a book has 400 pages in it, and you read 10 pages every day, in how many days can you read the book?

10. John read 12 books in one year. At that rate how many books can he read in 104 weeks?

11. In 100 days are how many months? how many weeks?

TIME

1. What is the date of New Year's day?

2. What is the date of Washington's Birthday?

3. What is the date of your birthday?

4. Lincoln's Birthday comes the —— day of the month of ——.

5. This year Memorial Day comes the —— day of the month of ——.

6. Independence Day is ——.

7. Thanksgiving Day is usually the last Thursday in ——.

8. Christmas Day is the —— of ——.

9. A man built a stone fence in 48 days. How many weeks did it take him to build the fence? Six working days are usually counted as one week.

10. 4 bricklayers laid the bricks for a house in 36 days. What part of the brick work did they do in 1 week? in 2 weeks? in 3 weeks?

11. A boy picked 3 pk. of cherries in one day. At that rate how long would it have taken him to pick 3 bu.?

12. Do you have Labor Day or Fast Day in your State? When? Do you celebrate Arbor Day?

13. If January 1 comes on Sunday, how many Sundays will there be in the year? In a year are how many weeks and days?

14. If in one year Sunday comes January 1, the next year what week-day will be January 1?

15. What part of 98 days is a fortnight?

FRACTIONS AND RELATIONS

1. How many 9's are there in 108?

2. How many 12's are there in 108?

3. $\frac{1}{9}$ of 108 = ? $\frac{1}{12}$ of 108 = ? $\frac{2}{9}$ of 108 = ?
$\frac{4}{9}$ of 108 = ? $\frac{6}{9}$ of 108 = ? $\frac{2}{12}$ of 108 = ?
$\frac{3}{12}$ of 108 = ? $\frac{5}{12}$ of 108 = ? $\frac{7}{21}$ of 108 = ?

4. $11 \times 8 = ?$ $8 \times 11 = ?$ $11 \times 9 = ?$ $9 \times 11 = ?$
$99 \div 11 = ?$

5. How many 11's are there in 99? $\frac{1}{11}$ of 99 = ? $\frac{2}{11}$ of 99 = ? $\frac{4}{11}$ of 99 = ?

6. $10 \times 7 = ?$ $10 \times 9 = ?$ $10 \times 10 = ?$ $10 \times 11 = ?$
$10 \times 12 = ?$ $9 \times 10 = ?$ $11 \times 10 = ?$ $12 \times 10 = ?$

7. $\frac{1}{10}$ of 110 = ? $\frac{1}{11}$ of 110 = ? $\frac{1}{10}$ of 120 = ?
$\frac{1}{12}$ of 120 = ? $\frac{2}{10}$ of 120 = ? $\frac{2}{11}$ of 110 = ?
$\frac{2}{12}$ of 120 = ? $\frac{7}{12}$ of 120 = ? $\frac{3}{20}$ of 120 = ?

8. How many 10's are there in 110? What is the ratio of 110 to 10? of 10 to 110?

9. How many 11's are there in 110? What is the ratio of 110 to 11? of 11 to 110?

10. How many 12's are there in 120? What is the ratio of 120 to 12? of 12 to 120?

11. How many 10's are there in 120? What is the ratio of 120 to 10? of 10 to 120?

12. What part of a dollar is a dime?

13. What part of a dozen is one?

REVIEW QUESTIONS

1. Harry attended school on 17 days in January, and had to walk 3 miles each day to do so. How many miles did he walk to attend school that January?

2. Annie walked a mile to school every school day and a mile home again. How many miles did she thus walk in a week of 5 school days?

3. A railway train ran for 4 hours at the rate of 27 miles an hour? What distance did it run?

4. George takes 2350 steps to a mile. How many steps will he take in walking 3 miles?

5. There are 38 children in Will's class. Each has 9 school books. How many have all?

6. A spider has 8 legs and a fly has 6. How many legs have 6 spiders and 8 flies?

7. A mail-carrier drove every working day from A to B, 4 miles; from B to C, 3 miles; from C to D, 5 miles; and from D back to A, 5 miles. How many miles did he drive every week?

8. James walked 8 miles a day on 25 days in January, on 23 days in February, and on 26 days in March. How many miles in all did he walk in the three months?

9. How many feet are there in 5 yards? in 7 yards? in 9 yards? in 12 yards? in 20 yards? in 387 yards?

10. If a man walks 22 miles in a day, how many miles will he walk in 10 days? in 20 days?

11. If a horse eats 6 pecks of oats in a week, how many pecks will he eat in 7 weeks? in 12 weeks?

12. If a yard of cloth cost $6, how much will 8 yards cost? 10 yards?

REVIEW QUESTIONS

1. 5 men build a wall in 8 days. How many men can build it in one day?

2. Measure accurately in feet and inches the size of the floor of your classroom.

3. A train moves 8 times as fast as a man who walks 7 feet a second; how many feet does the train pass over in a second?

4. How many inches are there in 7 feet? in 8 feet? in 10 feet? in 12 feet? in 100 feet?

5. Five pipes, all the same in size, empty a cistern in 10 minutes. In how many minutes will one such pipe empty it?

6. A ton is two thousand pounds. A furnace burns a hundred pounds of coal daily. How many days does a ton last?

7. Draw a music staff and on it represent three eighth notes, two quarter notes, and an eighth note.

8. If a man works 7 hours a day, how many hours does he work in 32 days?

9. James is 9 years old, and his father is four times as old, lacking a year. How old is his father?

10. In a certain schoolhouse there are 29 windows; in each window there are 4 rows of panes with 3 panes in each row. How many panes are there in all the windows?

11. In a field of corn there were 67 rows with 70 hills in each row. If the hills yielded, on an average, 7 ears to a hill, how many ears did the field produce?

12. Find the number of men in an army consisting of 7 regiments averaging 873 men each.

SUBTRACTION REVIEW

1. From 145 subtract 129.

$$\begin{array}{r} 245 \\ 129 \\ \hline 116 \end{array}$$

9 is greater than 5. Add 10 to 5. $9 + 6 = 15$. Set 6 in units' place. Since we added 10 to the minuend, we must add it also to the subtrahend. 2 (tens) $+ 1$ (ten) $= 3$ (tens). Briefly we say $2 + 1 = 3$. $3 + 1 = 4$. Set 1 in tens' place. In hundreds' place $1 + 1 = 2$. Set 1 in hundreds' place in the difference. 116 = difference. See page 213.

2. From 174 take 137. Explain each step.

3. A farmer had 184 sheep and lambs all together. There were 135 lambs. How many sheep had he?

4. A boy had 138 marbles. Of these, 119 marbles were new and perfect in shape. How many of his marbles were old?

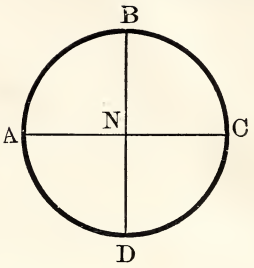
5. Find the remainders:

142	155	252	163	198	284	367	285	195	188	179
127	129	236	138	175	252	254	138	136	69	119
185	291	382	473	257	632	441	554	266	397	186
138	272	381	314	148	513	229	339	146	258	127

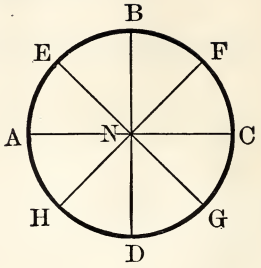
6. Make up questions like **3** and **4**, using the numbers in **5**, and answer the questions orally.

7. A man who earned $4 every day when he worked was unable to work 175 days, including Sundays and holidays, one year. How many days did he work? How much money did he earn?

TELLING ANGLES



A circle with 4 quarters and 4 right angles

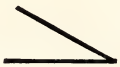


A circle with 8 eighths and many different angles

AC is a diameter. It divides the circle into halves because it is a straight line through the center of the circle and is extended on both sides to the circumference.

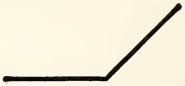
BD is a diameter. It divides each of the circle's halves into two equal parts: $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{4}$.

These are angles:



Acute

Right



Obtuse

Angles are formed by the meeting of lines. *ANB* is an angle. Trace it.

Two diameters crossing each other so as to divide a circle into quarters make right angles with each other.

We say that *BN* is perpendicular to *AN* because it forms the right angle *ANB*.

We call angles smaller than right angles *acute* angles.

We call angles larger than right angles *obtuse* angles.

We call this a *horizontal* line: ———.

And this we call a *vertical* line: |.

ABCD is the *perimeter* or *circumference* of the circle.

SUBTRACTION

1. From 2456 take 1587.

2456
1587
869

7 is greater than 6. $10+6=16$. $7+9=16$. Set 9 in units' place for the difference. $8+1=9$. 9 is greater than 5. $10+5=15$. $9+6=15$. Set 6 in tens' place. $5+1=6$. 6 is greater than 4. $10+4=14$. $6+8=14$. Set 8 in hundreds' place. $1+1=2$. $2=2$. Nothing remains. 869 = difference.

	2.	3.	4.	5.	6.	7.
From	142	253	111	194	185	643
take	92	96	22	95	106	554

	8.	9.	10.	11.	12.	13.
From	1894	1847	1853	5236	4116	3822
take	1886	1739	967	4348	3208	3759

14. From 308 take 209.

308
209
99

9 is greater than 8. $10+8=18$. $9+9=18$. Set 9 in units' place. $0+1=1$. 1 is greater than 0. $10+0=10$. $1+9=10$. Set 9 in tens' place. $2+1=3$, $3=3$. Nothing remains. 99 is the difference.

15. Subtract 1605 from 2503; 3406 from 4401; 1989 from 5000.

16. A regiment entered a battle with 942 men. 106 men were killed, 203 were disabled by wounds, and 47 were missing at nightfall. How many men were present to answer the roll-call?

SUBTRACTION

	A	B	C	D	E	F	G	H	I	J
1.	25	44	76	93	58	426	748	269	371	914
	13	31	25	71	24	104	126	147	240	813
2.	320	506	953	758	460	309	865	271	750	618
	141	208	670	270	107	256	93	148	391	88
3.	140	700	648	310	200	705	918	444	100	208
	54	107	97	78	199	507	819	155	17	198

	A	B	C	D	E	F	G	H
4.	2760	4705	7004	1280	2047	3042	8910	4760
	819	3250	1252	417	1919	2024	3204	1076
5.	6374	3003	6856	4004	3626	9271	6119	7208
	4485	303	1269	440	1836	790	5911	2975

ADDITION

K	L	M	N	O	P	Q	R	S	T
423	865	721	233	654	329	103	406	598	207
351	642	342	912	317	485	62	9	147	609
486	317	809	341	862	17	708	470	594	423
510	423	417	190	194	934	390	58	46	48
136	186	153	617	706	460	47	103	810	276

6. Mary had three dollars sixty-five cents. Then her aunt gave her two dollars fifty cents, and her father one dollar. How much money did she then have in all?

DIVISION

1. Divide 7212 by 7, exactly.

$$7\overline{)7212}$$
$$1030\tfrac{2}{7}$$

Proof:	1030	Quotient
	× 7	Divisor
	7210	
	+ 2	Remainder
	7212	Dividend

7 is contained in 7 thousands 1 (thousand) times. We write 1 in thousands' place in the quotient. 7 is not contained in 2 (hundreds). We write zero in hundreds' place, and add the 2 hundreds, which equal 20 tens, to the 1 ten. 7 is contained in 21 tens, 3 tens times. We write 3 in tens' place. 7 is not contained in 2 units. We write zero in units' place. 2 is written over the divisor, 7, with a line between the two figures, to show that the 2 is still to be divided by 7.

2. Divide 5232 by 12.

$$12\overline{)5232}$$
$$436$$

Proof:	436	
	× 12	
	5232	

12 is contained in 52 4 times ($12 \times 4 = 48$) with 4 over. The 52 is the sign not of 52 units, but of 52 hundreds. The 4 over stands for 4 hundreds. 12 is contained in 43 3 times ($12 \times 3 = 36$) with 7 over. The 43 is for 43 tens, and the 7 over is for 7 tens. 12 is contained in 72 6 times ($12 \times 6 = 72$).

3. Divide 6336 by 11, 3, 8, 4, 6, and 12.

4. Divide 5084 by 9, 12, 3, 4, 8, and 6.

5. Divide 4679 by 2, 4, 8, 3, 6, and 12.

6. Divide 9214 by 4, 5, 11, 9, 7, and 10.

MULTIPLICATION

Multiply each multiplicand by each multiplier.
Why will there be 100 products?
Copy these numbers, using commas to set off thousands.

Multiplicands		Multiplicands	
I 36723	(*a*) 2	VI 60389	(*f*) 7
II 14576	(*b*) 3	VII 70895	(*g*) 8
III 100835	(*c*) 4	VIII 63809	(*h*) 9
IV 73809	(*d*) 5	IX 909009	(*i*) 11
V 356724	(*e*) 6	X 87632	(*j*) 12

Multipliers		Multipliers	
(*a*) 2		(*f*) 7	
(*b*) 3		(*g*) 8	
(*c*) 4		(*h*) 9	
(*d*) 5		(*i*) 11	
(*e*) 6		(*j*) 12	

DIVISION

Divide each dividend by each divisor.
Copy these numbers, using commas to set off thousands.

Dividends		Dividends	
A 355680	(*k*) 6	*F* 316169	(*p*) 5
B 39521	(*l*) 3	*G* 695201	(*q*) 7
C 118566	(*m*) 4	*H* 10824	(*r*) 8
D 711369	(*n*) 2	*I* 129888	(*s*) 11
E 750889	(*o*) 9	*J* 119064	(*t*) 12

Divisors		Divisors	
(*k*) 6		(*p*) 5	
(*l*) 3		(*q*) 7	
(*m*) 4		(*r*) 8	
(*n*) 2		(*s*) 11	
(*o*) 9		(*t*) 12	

1. What part of one million is one hundred thousand?

2. One city had 153629 people; another city had 9 times as many. How many had the second city?

3. A family used 49 lb. of coal a day. How many did they use in 7 days? From 1 T. how many pounds were left after 40 days?

MULTIPLICATION

1. Multiply 73 by 45.

	73	multiplicand
	45	multiplier
$5 \times 73 =$	365	first partial product
$40 \times 73 =$	292	second partial product
	3285	total product

Multiplying 73 units by 5 gives as a product, 365 units. Multiplying 73 by 4 tens gives as a product, 292 tens = 2920 units. 292 tens, or 2920 units, plus 365 units = 3285 units. The right-hand figure of the product, 365, is placed under the 5 of the multiplier. The product, 292, obtained by multiplying by 4 (tens), is so placed that its right-hand figure, 2, comes under the 6 of the multiplier. To show that we are adding units, tens, hundreds, thousands, together, we write them in the same columns, as in addition.

2. Multiply 175 by 24, and 2763 by 58.

	175		2763	multiplicand
	24		58	multiplier
$4 \times 175 =$	700	$8 \times 2763 =$	22104	partial product
$20 \times 175 =$	350	$50 \times 2763 =$	13815	partial product
$24 \times 175 =$	4200	$58 \times 2763 =$	160254	total product

To multiply by 10, annex a zero to the multiplicand; to multiply by 100, annex two zeros; to multiply by 1000, annex three ciphers.

3. $3{,}685 \times 10 = 36{,}850$ $\quad 7{,}000 \times 10 = 70{,}000$

4. $46{,}373 \times 100 = 4{,}637{,}300$ $\quad 7{,}000 \times 100 = 700{,}000$

5. $9 \times 1000 = 9{,}000$ $\quad 642 \times 1000 = 642{,}000$

MULTIPLICATION

Multiplicands	Multipliers
I 8509	(*a*) 45
II 7004	(*b*) 17
III 8020	(*c*) 63
IV 9867	(*d*) 98
V 7118	(*e*) 87

Multiply each of the multiplicands by each of the multipliers. Why will there be 25 different products?

1. Albert takes 2460 steps to a mile. How many steps will he take in walking 3 miles?

2. An acre of land contains 4840 square yards. How many square yards are there in 10 acres? in 27 acres? in 50 acres?

3. Find the cost of 27 tons of steel at $39 a ton.

4. At 27 bushels of wheat to an acre, how many bushels would 36 acres yield?

5. A drover bought 37 head of cattle at $48 each. How much did he pay for them all?

6. How much money would be required to pay $500 each to 798 men?

7. How many days' work will 36 men do in 27 days?

8. Emma bought a doll for 25¢ and a doll's carriage for five times as much. How much did both doll and carriage cost?

9. A merchant bought 768 pounds of cheese at 7¢ a pound, 287 pounds of butter at 19¢ a pound, and 178 dozen eggs at 13¢ a dozen. Find the total cost.

10. A man had a chest of tea, which at first contained 87 pounds, but 29 pounds were taken out of it. How much was the rest of the tea worth at 63¢ a pound?

11. A man bought two farms, one containing 167 acres at $73 an acre, the other containing 79 acres at $87 an acre. How much did both farms cost him?

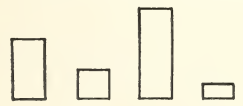
Arithmetic

School No 7 Louise Warnick
Room 9. Dec. 15. 1903.

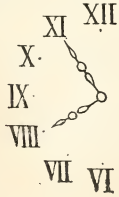
1. 283
194
618
537
1632 Answer 1632

2 431 6-1=5
6
5|2586 Answer
517+1 517+1 remainder

3. $4\times2\frac{1}{2}¢=4\times2¢+4\times\frac{1}{2}¢$
$4\times2¢=8¢$ $4\times\frac{1}{2}¢=2$
$8¢+2¢=10¢$ Answer 10¢

4 
2 1 3 $\frac{1}{2}$

5. 164
123
41 Answer 41

5 

7.55 o'clock
The clock says,
Five minutes of eight.

GENERAL MULTIPLICATION TABLE

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8								
3	6	9	12								
4	8	12	16								
5					30			45			
6				30							72
7							56				
8						56	64				
9			36						90		
10								90			
11										121	
12					72						144

1. On a sheet of paper mark off 144 half-inch squares. Copy very accurately the numbers here. Fill in each blank square by the multiple of the numbers at the head of the column and at the left end of the row. $4 \times 2 = 8$ and $2 \times 4 = 8$. $11 \times 11 = 121$ and $12 \times 12 = 144$.

2. Compare your results with the multiplication tables in this book.

3. On the blackboard make 144 two-inch squares and proceed as in 1.

4. Why are the numbers larger, the nearer they are to the lower right hand corner of the *table?*

GENERAL REVIEW

Addition:

1.	2.	3.
80476	34567	723
9007	8000	674
986147	691	1674
91067	470000	19006
486	109687	1916
4071	48001	936936
937	290	97979

Subtraction:

4.	5.
a. 1135 − 780	*h.* 5367 − 5269
b. 4232 − 3121	*i.* 8700 − 199
c. 9256 − 135	*j.* 7505 − 6469
d. 1202 − 1158	*k.* 1811 − 799
e. 8634 − 7402	*l.* 9707 − 8609
f. 7672 − 7589	*m.* 4627 − 1565
g. 8738 − 7394	*n.* 2444 − 566

Multiplication:

6.	7.	8.	9.	10.	11.	12.
1423	512	615	10342	735	45346	2682
45	216	135	96	99	67	234

Division:

13.	14.	15.	16.	17.
5)6895	6)96108	4)72604	8)7589328	12)980424

ANSWER AND PROVE THE ANSWERS

18. From three thousand four hundred nine take one thousand six hundred fifteen.

19. From two thousand seventy-eight take eight hundred nineteen.

20. From six thousand two hundred ninety-eight take three thousand eight hundred nine.

21. From eight thousand two hundred seventy-four take two thousand six hundred five.

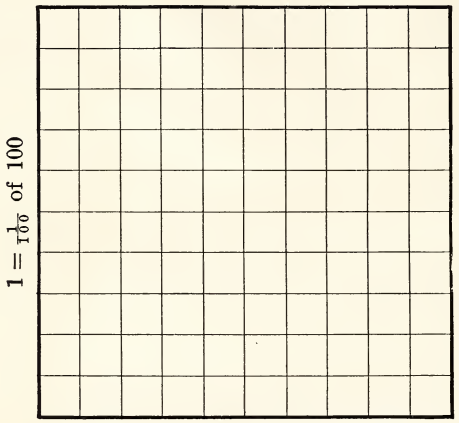
22. From three thousand eight hundred twenty take two thousand six hundred five.

HUNDRED AND HUNDREDTHS

We saw that $\frac{1}{2}$ of 2 things is 1, that $\frac{1}{5}$ of 5 things is 1, and that $\frac{1}{10}$ of 10 things is 1.

Every whole number suggests a fraction like it in name.

The number one hundred suggests a hundredth as a fraction.



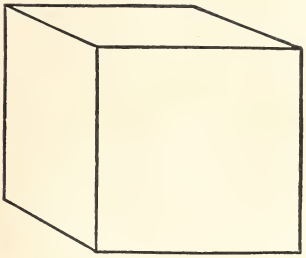
1. Point out $\frac{1}{100}$, $\frac{1}{10}$, $\frac{3}{100}$, $\frac{3}{10}$, $\frac{25}{100}$, $\frac{33}{100}$, $\frac{50}{100}$.

2. Draw three squares like this and divide each of them into 100 squares.

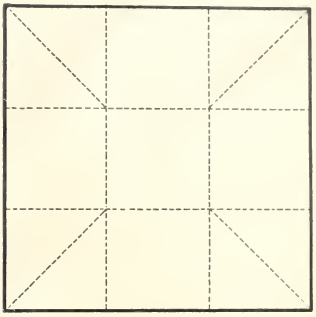
a. Mark on one of them one half of the squares blue or red or black. How many are one half of one hundred?

b. On another square mark one fourth blue, another fourth red, and another fourth black. How many are one fourth of one hundred?

c. On the last square mark one third blue and another third red. How many are left white? If $3 \times 33 = 99$, then $\frac{1}{3}$ of $100 = ?$ Mark the last hundredth into thirds. What does this show? $33\frac{1}{3} \times 3 = ?$ See page 211.



Cubic inch



$1\frac{1}{2}$ in. × $1\frac{1}{2}$ in.

MEASURES OF CAPACITY

A cubic inch may be represented in cardboard or heavy paper. Fold at the lines dotted. This will hold water, but dry sand may be used. The cardboard should be 3 in. × 3 in. in size. Read ×, *by*.

4 gills make 1 pint.

1. Take a liquid gill measure and find how many cubic inches it contains.

2. Make a box of paper 3 in. × 3 in. × 3 in.

3. Find the number of cubic inches in a dry quart.

4. Find the contents in cubic inches of a drinking glass. Compare this with a pint.

5. Find the number of cubic inches in a liquid quart. Is this more or less than the number in a dry quart? By how much?

6. How many cubic inches are there in a box measuring 7 in. × 9 in. × 12 in.?

7. A cardboard box 3 in. × 7 in. × 11 in. will be found to contain almost exactly 1 gallon. What is its volume in cubic inches?

AREAS

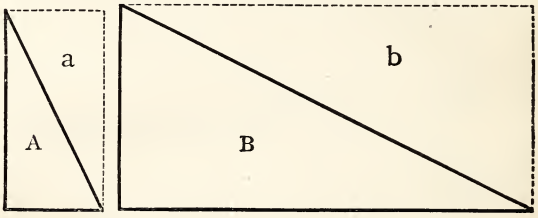
We find the **areas** of rectangles in square measure by multiplying together the numbers representing the lengths of the adjoining sides.

1. If the sides of this rectangle were 2 inches and 3 inches, its area would be 3 sq. in. × 2 = 6 square inches = 6 sq. in.

2. If a mirror is 3 ft. by $4\frac{1}{2}$ ft. in size, its area is $13\frac{1}{2}$ sq. ft.

We find the areas of right-angled triangles by multiplying together the numbers representing the lengths of the sides which make the right angle and dividing the product by two.

The dotted lines show the rectangle which the multiplication of the lengths of the two sides gives us.



3. Find the area of these triangles, A and B.

A. 1 sq. in. × $\frac{1}{2}$ = $\frac{1}{2}$ sq. in.
$\frac{1}{2}$ sq. in. = area of $A + a$.
$A = \frac{1}{2}$ $(A \times a)$.
$\frac{1}{2}$ of $\frac{1}{2}$ sq. in. = $\frac{1}{4}$ sq. in.

B. 2 sq. in. × 1 = 2 sq. in.
2 sq. in. = area of $B + b$.
$B = \frac{1}{2}$ $(B + b)$.
$\frac{1}{2}$ of 2 sq. in. = 1 sq. in.

Point out $\frac{1}{2}$ of $\frac{1}{2}$.

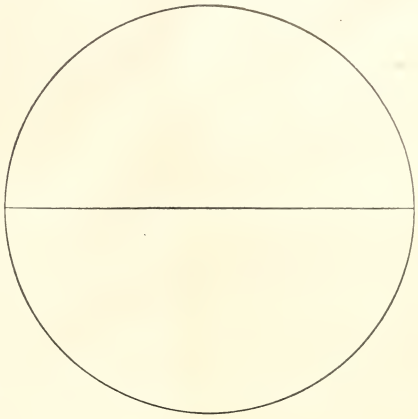
Find the area of these triangles:

4. 2 miles by $6\frac{1}{2}$ miles.

5. 3 yds. by $9\frac{1}{3}$ yds.

CIRCUMFERENCES

A circle may be drawn on the blackboard by making a loose knot in a string and setting the knot around the crayon. Then if one holds the free end of the string against the blackboard with one finger of the left hand, and stretches it tight, a circle of any desired diameter may be made. The finger marks the center. With a pin, a pencil, and a piece of cardboard with holes in it for the pin and pencil, circles may be drawn on paper. Circles may also be drawn with dividers or compasses.



The diameter of a circle is twice its radius. A radius is any straight line from the center to the circumference. The string makes the length of the radius of the circle drawn on the blackboard.

The circumference of any circle equals almost exactly three and a seventh times the diameter. We can prove this by drawing circles and comparing their diameters and circumferences.

1. Find the circumference of a circle 2 in. in diameter.

$2 \text{ in.} \times 3\frac{1}{7} = 6\frac{2}{7} \text{ in.}$ Read $\times$, *multiplied by*.

2. Find the circumference of a circle 4 yd. in diameter.

$4 \text{ yd.} \times 3\frac{1}{7} = 12\frac{4}{7} \text{ yd.}$ See page 211.

3. Draw circles of various diameters and find their circumferences.

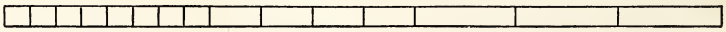
In these questions we always need to know how to multiply a whole number and a fraction.

Measures

pint

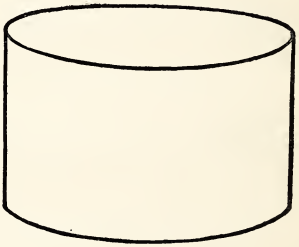
quart

gallon

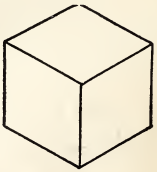


$\frac{1}{8}$ in $\frac{1}{4}$ in. $\frac{1}{2}$ in.

$3\frac{1}{2}$ inches



quart peck bushel



ounce pound cubic inch cubic foot

MEASURE OF SURFACE

144 sq. in. = 1 sq. ft. 43560 sq. ft. = 1 acre
9 sq. ft. = 1 sq. yd. 640 acres = 1 sq. mi.

Square . . . sq.	Inch . . . in.	Yard . . . yd.
Acre . . . . A.	Foot . . . ft.	Mile . . . mi.

1. The lot on which Mary's house stands is 60 ft. by 150 ft. What is its area?

2. The lot on which the school stands is 90 ft. by 484 ft. How many acres is the area?

3. There are 1170 sq. ft. in the carpet at the music hall. How many square yards are there in it? If it cost $260, what was the price per yard?

4. A lot of land, in the form of a right-angled triangle, was 105 ft. on one side of the right angle and 255 ft. on the other side. What was the area of the triangle?

5. In 8 acres are how many sq. ft.?

6. A township contains 12 sq. mi. How many acres of land has it?

7. Mr. Lincoln's home has 50,000 sq. ft. of land. How many sq. ft. more or less than an acre is that?

8. A marble table has a rectangular top $2\frac{1}{4}$ ft. $\times$ $3\frac{1}{2}$ ft. How many sq. ft. is that?

9. Draw to any scale on paper or on blackboard a plan to show a house-lot 48 ft. $\times$ 200 ft., with a rectangular house upon it 34 ft. $\times$ 40 ft.

10. A page of a certain picture-book is 6 in. $\times$ 8 in. How many square inches are in its surface?

MEASURE OF VOLUME

Volume

1728 cu. in. = 1 cu. ft.
27 cu. ft. = 1 cu. yd.

Capacity

$31\frac{1}{2}$ gal. = 1 bbl.
A liquid quart = $57\frac{3}{4}$ cu. in.
A dry quart = $67\frac{1}{5}$ cu. in.
A bushel = $1\frac{1}{4}$ cu. ft.

Cubic . . . cu. Gallon . . . gal. Barrel . . . bbl.

1. An iron box contains 3000 cu. in. One side is 10 in. and another is 30 in. What is the length of the third side?

2. Is 3000 cu. in. more or less than 2 cu. ft.? By how much?

3. A contractor dug a cellar 40 ft. wide, 90 ft. long, and 4 ft. deep. How many cu. ft. was that?

4. In 12 bbl. are how many gal.?

5. How many bbl. may be filled by 63 gal.? by 126 gal.?

6. How many cu. in. are there in a gal.?

7. How many cu. in. are there in a peck?

8. A bin of wheat contains 50 cu. ft. How many bushels does it contain?

Notice that 5 cu. ft. contain 4 bu.

REVIEW QUESTIONS

1. One train travels 50 miles an hour and another train 30 miles an hour. They start together at the same time in the same direction. How far apart will they be at the end of an hour?

2. What number is that from which if I take away the sum of 5, 3, and 8, there will be 4 left?

3. After having had 1260 men killed and wounded and 7200 taken prisoners by the Boers, the British South African army numbered 196,800. Before these losses how many men were in the British army in South Africa?

4. The difference between two numbers is 118, and the greater number is 1801. Find the smaller number.

5. There are 140 pages in a Reader and 120 in an Arithmetic. How many more pages are there in the Reader than in the Arithmetic?

6. The Old Testament contains 23,145 verses, and the New Testament 7957 verses. How many verses are there in the whole Bible? How many more verses are there in the Old Testament than in the New?

7. Annie bought a Third Reader for 36¢, a Geography for 60¢, and a Speller for 17¢. She gave a two-dollar bill to the clerk. What change should she get?

8. A man borrowed $2790 and promised to pay $285 for the loan. He repaid $764 at one time, $847 at another, and $793 at another. What did he then owe?

9. Willie attended school 15 days in January, 17 in February, 16 in March, 16 in April, 21 in May, and 18 in June. If there were 120 school days in the six months, how many less days did he go to school than Johnnie, who was not absent even one day?

REVIEW QUESTIONS

1. A farmer had 120 acres of land, and bought 87 acres more. He afterwards sold 68 acres. How many acres had he then?

2. In the first car of a railway train there were, on starting, 29 passengers; in the second, 27; and in the third, 15. At the first stopping place 19 passengers got out and 7 others got on board. How many passengers were there on the train then?

3. A man had to put 73 head of cattle into four cars. He put 18 into the first car and 19 into the second car and 19 into the third car. How many head were left to go into the fourth car?

4. A man bought a horse for $97 and another one for $85. He sold the two horses for $163. How much did he lose on them?

5. I sold goods for $1225, gaining thereby $248. How much did the goods cost me?

6. A man having $10,000 in business made $2741 one year and lost $713 the next year. How much was he then worth?

7. A man's salary is $1420 a year, and he has a property that brings him in $225 a year. If his expenses are $975 a year, how much money can he save in one year?

8. A man bought 100 acres of land for $5750. He paid $1235 in cash, and borrowed the rest of the purchase price. What was the amount that he borrowed?

9. Mr. Jones owed Mr. Smith $163; in payment he gave a horse and $49 in cash. At what was the horse valued?

COUNTING MEASURE

20 sheets = a score
24 sheets = a quire
20 quires = a ream
480 sheets = a ream

This is chiefly used to measure paper.

1. How many quires are there in 5 reams? 8? 20?

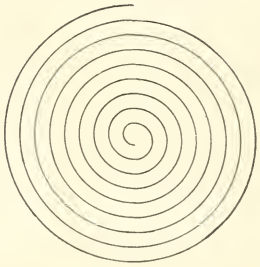
2. Mrs. Thompson paid 48¢ for 2 quires of paper. How much per sheet was this?

3. Mary asked for 5 quires of paper, but received only 5 score of sheets. What was the difference?

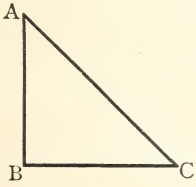
LENGTHS

Not all things to be measured are in straight lines.

A clock spring 18 inches long would be coiled up like this. Coil up 3 yards of thread or string, and see how it looks.



SAVING CORNERS



If we wish to cross a street and to save time and distance, we cut corners. If we wish to go to C from A, we may go from A to B and from B to C. Make drawings of triangles and measure A to C.

4. If it is 2 in. from A to B and 3 in. from B to C, how long is the space from A to C? What is saved?

5. A to B 3 in. and B to C 2. $2 + 3 = 5$. Measure the distance A to C. $5 - A$ to $C = ?$

6. $AB = 4$ in. $BC = 5$ in. $AC = ?$

DECIMALS

We found that we could write five dollars and twenty-eight cents \$5.28. We called the period or point between 5 and 2 the **decimal point.** Decimal means ten or tenth.

We can extend decimals to the fractions, tenth and hundredth, by the use of the decimal point.

Hundreds	Tens	Units	Decimal Point	Tenths	Hundredths
6	3	9	.	4	2

39.4 is read thirty-nine and four tenths. $39.4 = 39\frac{4}{10}$.

39.42 is read thirty-nine and forty-two hundredths.

The whole number may be written $639\frac{42}{100}$.

1. Write in decimals $756\frac{84}{100}$; \$$15\frac{65}{100}$; $56\frac{1}{10}$ yd.

2. Read 15.3%; 2.7 hr.; 9.3 mo.

3. I bought 7.4 oz. of a very expensive kind of tea especially imported from China. I paid 10¢ an ounce. What was the cost?

Multiplying decimals by tens or hundreds is very easy.

$7.4¢ \times 10 = [7 \times 10]$ and $[\frac{4}{10}¢ \times 10] = 70¢ + 4¢ = 74¢$.

We can multiply a decimal by ten simply by moving the decimal point one place to the right, as you see.

4. If I had paid 20¢, what would have been the cost?

$20¢ = 10¢ \times 2$. $7.4¢ \times 10 = 74¢$. $74¢ \times 2 = 148¢$. $148¢ = \$1.48$. Read $\times$, *multiplied by.*

Do you see that we can change cents to dollars by moving the decimal point 2 places to the left?

$100¢ = \$1.$ $148¢ = \$1.48.$

BILLS

When we buy things at stores we often get bills.

This is a bill of goods sold to Mr. Thomas Davenport :

3	yd. calico	@ 6¢	.18
5	yd. flannel	@ 30¢	1.50
1	pr. shoes	@ 2.75	2.75
8	handkerchiefs	@ 15¢	1.20
			$5.63

Draw up other bills. Are the various items and the total of this bill correct?

RELATIONS OF MEASURES RECITE

1. What part of $1 is 10¢? How many times 25¢ is $2?

2. What part of 3 yd. is 2 ft.? How many times 2 ft. is 4 yd.?

3. What part of 2 gal. is 3 pt.? of 3 pt. is 1 gal.?

4. What fraction of 1 hr. is 2 min.? 5 min.?

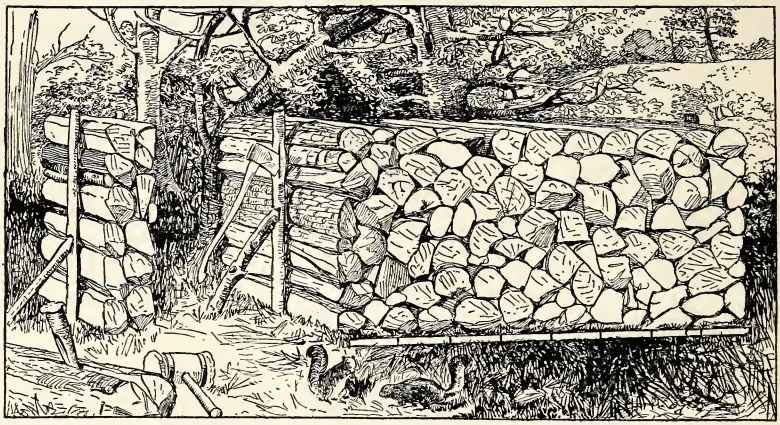
5. How many times larger is a bushel than a quart?

6. What part of a ton is five hundred pounds?

7. John ran 1320 ft. What part of a mile was that?

8. What part of a ream is 5 quires?

CORD WOOD



Cord foot Cord

A cord of wood is as much wood as is contained in a pile measuring 4 ft. × 4 ft. × 8 ft.

A cord = 128 cu. ft. in space.

The wood is piled as it comes, and the space not actually taken by wood counts just as much as the solid wood.

A cord foot is 4 ft. × 4 ft. × 1 ft.

A cord foot = 16 cu. ft. of space.

1. How many cord feet are there in a cord?

2. Will's father bought 20 cords of wood. If this was piled 4 ft. wide and 4 ft. high, how long would the pile be?

3. What part of a cord is 2 cord feet? 3 cord feet?

4. A pile of wood 4 ft. × 12 ft. × 12 ft. was offered to John Douglas at $5 a cord. He found the amount of the bill in this way:

$4 \times 12 \times 12 = 4 \times 3 \times 4 \times 3 \times 4 = 4 \times 4 \times 4 \times 3 \times 3 =$ $\frac{1}{2}$ cord $\times 9 = \frac{9}{2}$ cords $= 4\frac{1}{2}$ cd. $\$5 \times 4\frac{1}{2} = \$20\frac{1}{2} = \$20.50$.

Can you follow these steps?

PER CENTS

The fraction, a hundredth, is so important that we have another name for it, a **per cent.** This means *by the hundred.* 5 per cent is $\frac{5}{100}$. 10 per cent is $\frac{10}{100}$. $33\frac{1}{3}$ per cent is thirty-three and one third hundredths. Just as we have ¢ as the sign for cent and $ as the sign for dollar or 100¢, so also we have a sign for hundredths or per cents. This sign for hundredths is %, called **per cent.**

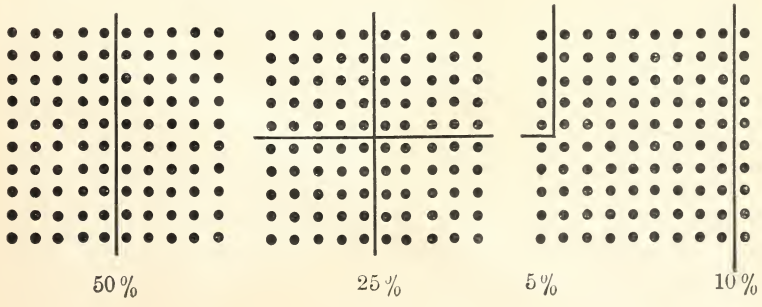
6% of \$1 is $\frac{6}{100}$ of 100¢, or 6¢

50% of \$1 is $\frac{50}{100}$ of 100¢, or 50¢

Per cents are especially used in dealing with money; for when one lends money to another, the lender usually asks the borrower not only to give him back after a time all his money, but also to pay him so many per cent for the use of the money. This payment is called **interest.** Also we pay the governments of our town or city and of our State every year so many per cent of the money value of our property. This payment is called a **tax.** It supports the police and schools and takes care of the streets or roads.

4% of \$1000 is $\frac{4}{100}$ of \$1000 $\quad \$\frac{1000}{100} = \$10 \quad \$10 \times 4 = \$40$

2% of \$5000 is $\frac{2}{100}$ of \$5000 $\quad \$\frac{5000}{100} = \$50 \quad \$50 \times 2 = \$100$



ADDITION SUMS AND PROBLEMS

1. 93	2. 6702	3. 417	4. 4	5. 300
618	564	64	85	761
4192	83	8163	307	95
1216	1709	350	6890	8
904	341	19	42	604
6. 6819	7. 17	8. 7621	9. 38	10. 3042
1706	420	874	2719	817
324	1608	19	450	96
8270	9743	3240	8063	2403
11. 7268	12. 2763	13. 8006	14. 6543	15. 6207
3917	9208	3952	9876	8392
8068	593	7688	5678	6749
765	8637	2765	2345	9370

16. The railroad route from Albany to New York is 144 miles in length; from New York to Philadelphia it is 96 miles; from Philadelphia to Washington it is 136 miles. How many miles long is the distance from Albany to Washington?

17. A man spent $174 a year on clothing for his family, $369 for food, $168 for interest, $69 for fuel, $27 for light, $77 for furniture, $84 for labor, and $67 for life insurance; he also paid $18 to a doctor and $24 in taxes. How much a year did he spend in all?

18. A merchant's sales amounted to $395 on Monday; $278 on Tuesday; $647 on Wednesday; $594 on Thursday; $295 on Friday, and $947 on Saturday. What was the total value of his week's sales?

PROOFS

1. *To prove addition:*

(*a*) 136
642
258
1036

Add up and then down.

(*b*) $6482.96
1329.37
$7812.33
6483.96

From the sum of two numbers subtract one addend: the difference is the other addend.

2. *To prove subtraction:*

846
298
548
846

To the difference add the subtrahend: the sum is the minuend.

3. *To prove multiplication:*

469
54
1876
2345
25326

54)25326(469
216
372
324
486
486

Divide the product by the multiplier: the quotient is the multiplicand.

4. *To prove division:*

Multiply the quotient by the divisor: the product is the dividend.

5. *To prove division when the divisor is a multiple of whole numbers (factors):*

$54 = 6 \times 9$

6)25326
9) 4221
469

Divide by each factor.

All products in the multiplication tables are multiples of whole numbers.

MULTIPLES AND FACTORS

$4 = 2 \times 2$ $\quad$ $6 = 2 \times 3$ $\quad$ $8 \begin{cases} = 2 \times 4 \\ = 2 \times 2 \times 2 \end{cases}$

$9 = 3 \times 3$ $\quad$ $10 = 2 \times 5$ $\quad$ $12 \begin{cases} = 2 \times 6 \\ = 3 \times 4 \\ = 2 \times 2 \times 3 \end{cases}$

$14 = 2 \times 7$ $\quad$ $15 = 3 \times 5$ $\quad$ $16 \begin{cases} = 4 \times 4 \\ = 2 \times 8 \\ = 2 \times 2 \times 4 \\ = 2 \times 2 \times 2 \times 2 \end{cases}$

$18 \begin{cases} = 2 \times 9 \\ = 2 \times 3 \times 3 \end{cases}$ $\quad$ $20 \begin{cases} = 4 \times 5 \\ = 2 \times 2 \times 5 \end{cases}$ $\quad$ $21 = 3 \times 7$

$22 = 2 \times 11$ $\quad$ $24 \begin{cases} = 2 \times 12 \\ = 3 \times 8 \\ = 2 \times 2 \times 6 \\ = 2 \times 4 \times 3 \\ = 2 \times 2 \times 2 \times 3 \end{cases}$ $\quad$ $25 = 5 \times 5$

After studying the facts of the multiplications that produce numbers under 100, a class may be interested in analyzing the multiples into their factors. This analysis must be done very simply.

RATIO

In the scientific treatises upon arithmetic, ratio is usually considered as the relation of one number to another, not necessarily reduced to a value. 7 : 2 is the ratio. It means the same thing as 2 : 7. It is the fashion nowadays in some quarters to call 2 the ratio of 4 tc 2, and $\frac{1}{2}$ the ratio of 2 to 4. By too greatly simplifying the matter this fashion renders proportion needlessly difficult. Further, *ratio* itself is a word both not familiar to a child's vocabulary and also too difficult easily to be understood.

GENERAL MULTIPLICATION TABLE

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

1. Read the multiplication table of each number, beginning $2 \times 1 = 2$, $2 \times 2 = 4$, $2 \times 3 = 6$, and so through 2's; then $3 \times 1 = 3$, and so on through all numbers.

2. Read the division facts in this way, beginning $4 \div 2 = 2$, $6 \div 2 = 3$, $8 \div 2 = 4$, and so through the first column; then $6 \div 3 = 2$, $9 \div 3 = 3$, $12 \div 3 = 4$; and so on through all the numbers.

3. Read the columns down, 2, 4, 6, 8, and so on; 3, 6, 9, 12, and so on, telling in what multiplication table we find these numbers.

4. What numbers multiplied together give 144, 132, 121, 120, 110, 108, 100, 99, and so on through all these numbers?

HOUSE NUMBERS

In towns and cities the streets are named, and the houses and lots on the streets are numbered. One side of the street has odd numbers, and the other side has even numbers. If there is room between houses for more houses, then these lots, sometimes called vacant lots, are numbered.

Has your house a number, and your street a name?

If you live in the open country where there is plenty of room, and people do not need names for their roads and numbers for their houses, probably you know where some townspeople have their houses or stores.

The name of the street and the number of the house are part of the **address.** Mr. William Jones, 165 Main Street.

Sometimes when there are very many streets, the streets have numbers for names. When we wish to write a letter to a person living in a different place from our own town or city, we tell the post-office clerks what the place is where we wish the letter to go.

Master Charles Marshall,
149 Sixth Street,
Atlanta,
Georgia.

If houses were not numbered in large towns and cities, it would take a great deal of time to find people in them.

1. Write your house address or that of some friend.

2. Exchange your paper with its address for that of the boy or girl in front of or behind you. Read that, and copy it. Exchange across the aisle.

3. Has your schoolhouse any address?

4. Where is your town or city hall? Your post office?

QUESTIONS

1. The odd numbers of houses are on one side of the street, while the even numbers of houses are on the other side. Eva lives at No. 98, and Charlotte at No. 126. How many house lots are there between them?

No. is the abbreviation for Number.

In towns and cities the house lots rather than the houses are numbered.

House lots are from 16 ft. to 40 ft. wide, more or less.

2. How many house-lots separate Tom, who lives at No. 87, and Will, who lives at No. 145?

3. Draw on the blackboard a rectangle to represent a house lot 200 feet long by 40 feet wide. How many times as long must the drawing be as it is wide?

4. Plot a rectangular piece of ground of good size in lots both single and double.

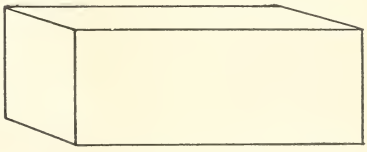
PRISMS DRAW

1. Draw on the blackboard a figure representing a rectangular prism 3 in. by 4 in. by 6 in.

2. Draw a figure, representing another prism 3 in. × 3 in. × 4 in.

Read ×, by.

3. Draw another figure, representing a prism 2 in. × 3 in. × 3 in.



Rectangular Prism

4. Draw still another figure, representing a prism 1 in. × 3 in. × 6 in.

Fold out of stiff paper or cardboard prisms of the above sizes, and with dry sand find their comparative volumes.

MULTIPLICATION

Products not over 100.

8×12 12×8 3×32 32×3 } $= ?$	5×9 9×5 3×15 15×3 } $= ?$	5×6 3×10 6×5 10×3 } $= ?$	8×4 2×16 4×8 16×2 } $= ?$
9×8 6×12 8×9 12×6 } $= ?$	4×12 6×8 12×4 8×6 } $= ?$	3×6 2×9 6×3 9×2 } $= ?$	2×6 3×4 6×2 4×3 } $= ?$
9×11 11×9 3×33 33×3 } $= ?$	8×10 4×20 10×8 20×4 } $= ?$	2×10 5×4 10×2 4×5 } $= ?$	7×10 10×7 2×35 35×2 } $= ?$
9×6 6×9 2×27 27×2 } $= ?$	6×10 5×12 10×6 12×5 } $= ?$	6×7 7×6 2×21 21×2 } $= ?$	5×10 2×25 10×5 25×2 } $= ?$
4×4 8×2 2×8 } $= ?$	7×5 5×7 } $= ?$	7×3 3×7 } $= ?$	11×8 8×11 } $= ?$
	7×8 8×7 } $= ?$	2×7 7×2 } $= ?$	3×9 9×3 } $= ?$
3×12 6×6 12×3 4×9 2×18 9×4 18×2 } $= ?$	8×3 6×4 3×8 2×12 4×6 12×2 } $= ?$	4×10 8×5 10×4 5×8 2×20 20×2 } $= ?$	10×10 2×50 50×2 4×25 25×4 9×9 } $= ?$

APPENDIX

PAGE 74. How far to carry concrete illustrative work is not always easy to determine. Upon page 216 there is presented a comparison of the numbers ten to twenty that may prove helpful to classes that find difficulty in the "teens." The method may be greatly extended.

In general, imaginative children need little or no concrete illustrative work beyond twelve. The reason why they enjoy problems about birds, dolls, flowers, fruit, is extrinsic from arithmetic. They enjoy any subject that refers to the bright and attractive things of life. It often happens that children are delayed in their progress in arithmetic by too much paper-folding, block-building, and blackboard drawing.

PAGE 100. In using the calendar let the children mark off the days as they pass, making, if they choose, comments on the weather. Measuring time has been said frequently to be the greatest service of arithmetic to mankind.

PAGE 102. An interesting story may serve to help the child learn how to tell time. The hour hand may be called the little boy who walks slowly while his big brother goes fast. Or, the hour hand may be called an old man and the minute a vigorous young man. Or, again, the hour hand may be called a tortoise and the minute hand a hare.

Explain also that:

When the minute hand points to more than 30, we usually read the number of minutes before the next hour.

6 o'clock and 35 minutes we usually call 25 minutes before 7. 60 minutes less 35 minutes are 25 minutes.

Railroads read this time 6 hours 35 minutes.

VIII means in hours 8, but in minutes it means 40.

6 hours 40 minutes are 20 minutes before 7 hours.

ILLUSTRATIVE TESTS OF SUCCESS

I is to be copied and completed: partly "busy work."

II illustrates abstract work in number-computation: "figuring."

III is concrete work: chiefly "busy work."

IV is especially difficult because it involves both reasoning and imaging.

I

1. There are —— pecks in a bushel (or, pk. in 1 bu.).
2. There are —— minutes in an hour (or, min. in 1 hr.
3. 92° is —— degrees above freezing (or, —° above 32°).
4. A gallon of water weighs —— pounds (or, 1 gal. of water = — lb.).
5. —— cents make one dime (or, —¢ = 1 dime).
6. A square has —— sides and —— angles.
7. 50¢ make —— of a dollar (or, 50¢ = — of $1).
8. Twenty less one dozen is ——.
9. A fraction is one or more of the —— parts of something.
10. There are —— pints in a gallon (or, pt. in 1 gal.).

II

1. Add: 50, 100, 200, 50.
2. From 78 take 49.
3. Divide 84 by 12.
4. Multiply 19 by 4.
5. $12 + 16 + 19 + 23 + 31 = ?$
6. $66 \div 3 = ?$
7. $1000 - 700 = ?$
8. $8 \div 4 + 3 \div 5 - 1 = ?$
9. $1 less 45¢ = ?
10. 3 qt. − 5 pt. = ?

III

1. Draw a rectangle measuring 3 in. by 2 in.
2. Write a number table from 1 to 100, marking plainly the numbers that are products of 9.
3. Draw a clock face to show 11.45 o'clock.
4. Draw a thermometer to show 96°.
5. Draw a square divided into sixteen equal squares.
6. Show by drawings that $\frac{1}{3} = \frac{2}{6} = \frac{3}{9}$.
7. Design a disk to use in teaching the products of 11.
8. Draw a hexagon divided into eighths.
9. Make a Division Table of Twelves.
10. Draw chairs or anything else to represent the difference between a dozen and a half and two thirds of a dozen.

IV

1. 8.45 A.M. + 3 hr. 30 min. = what time A.M. or P.M.?
2. Draw any square and take from it $\frac{3}{8}$ of itself.
3. Mr. Somers had $1000. He gave a tenth to his son and two tenths to his wife. How much was left?
4. How much more is $\frac{1}{4}$ of 100 than $\frac{1}{3}$ of 60?
5. Draw a rectangle equal to five squares.
6. $75 + $35 ÷ 5 = how many dollars?
7. $5\frac{1}{2}$ ft. − $1\frac{1}{2}$ yd. = how many inches?
8. George walks a mile in 20 min. What time does he need to go $3\frac{1}{2}$ miles?
9. One year two pairs of robins raised in the spring six little robins. How many pairs of robins were there then? Next year each pair of robins raised three little robins more. If all lived, how many robins were there then?
10. Each year it costs $3 a child to buy books, paper, tools, and other things for the schools in the city of B——. What does it cost for a school of 2000 children?

READING SIGNS

The signs $+$, $-$, $\times$, and $\div$, are called by various names and are read in various ways; but each has only one meaning.

$+$, **plus** or **and**, means that we are to add.

$-$, **minus** or **less**, means that we are to subtract.

$\times$, **times** or **multiplied by**, means that we are to multiply.

$\div$, **into** or **divided by**, means that we are to divide.

1. $10 + 6$ is read, Ten and six, or Ten plus six.

2. $15 - 9$ is read, Fifteen less nine, or Fifteen minus nine.

3. 5×6 is read, Five times six, or Five multiplied by six.

4. $24 \div 4$ is read, Four into twenty-four, or Twenty-four divided by four.

Or we may read:

1. Add 10 and 6.
2. Subtract 15 and 9.
3. Multiply 5 and 6.
4. Divide 24 by 4.

In writing questions like these it is important to notice that in multiplication we multiply the larger number by the smaller; hence we write the larger number first when we mean to read the sign $\times$ **multiplied by**, but second when we mean to read it **times**.

Similarly in division, we write the dividend first when we are to read $\div$ **divided by**, but second when we are to read it **is contained in** or **into**. This last name **into** is a correct idiom, but is not the best English.

MULTIPLIER AND MULTIPLICAND

It is customary to write the multiplication tables:

$1 \times 5 = 5$	and to read them:
$2 \times 5 = 10$	One *times* five is five,
$3 \times 5 = 15$	Two *times* five is ten, etc.

Among business men the use of the expression *times* is more common than that of the expression *multiplied by*. It would be impossible to secure in all the schools of the nation the reading of the multiplication tables, Five *multiplied by* one is five, etc. *Times* is an English idiom. *Multiplied by* is an explanation of the process.

In the problem, Sixteen boys bought a score of base balls at $1 each, we may write the solution either (*a*) $\$1 \times 20 \times 16 = \$320$ or (*b*) $20 \times 16 \times \$1 = \$320$. (*a*) is read, One dollar multiplied by twenty multiplied by sixteen. (*b*) is read, Twenty times sixteen times one dollar.

DIVISOR AND DIVIDEND

For the sake of uniformity it might be well to secure the use of *and* always for *plus;*

of *less*	for *minus;*
of *times*	for *multiplied by:* and
of *into*	for *divided by:* or vice versa.

But such uniformity we are not likely to secure.

It is an accepted mathematical principle that $\div$ follows the dividend and precedes the divisor. $15 \div 5 = 3$ is read more easily, Fifteen divided by five equals three, than, Five into fifteen gives three. This principle is not true of $\times$, for $\times$ tells factors, and it is a matter of indifference in the result which factor is multiplier and which multiplicand.

ILLUSTRATIVE WRITTEN LESSON

See Page 183

1. Add: Two hundred eighty-three, one hundred ninety-four, six hundred eighteen, five hundred thirty-seven.

2. A town had six schools with an average of 431 pupils each. One school was closed, and the children were then equally divided among the remaining schools. How many pupils did each have on the average?

3. Tom sold 4 eggs at $2\frac{1}{2}$ ¢ each. What did he receive?

4. Draw figures in the relation of 2, 1, 3, $\frac{1}{2}$, to each other.

5. From 164 apples take 123. How many remain?

6. Make a clock face and tell what time it says.

THE FUNDAMENTAL OPERATIONS

Beside the method in the main text another method of subtraction is presented upon the page opposite. The advantages of the text method are: that one is not required later to lay it aside and to forget it, for it is the method used in actual business; and that it follows the principles of addition.

Still another method of subtracting is that of adding to the subtrahend the "taken" unit, or ten, or hundred.

$$\begin{array}{r} 37 \\ \underline{18} \\ 19 \end{array} \qquad 17 - 8 = 9 \qquad 1 + 1 = 2 \qquad 3 - 2 = 1$$

There are various other methods.

See the author's Elementary School Mathematics: *Theory of Method*, for a discussion of the subject of the fundamental operations. It is there argued that the fundamental operations are two: counting and measuring.

SUBTRACTION METHODS

A familiar subtraction method much used in schools, less frequently in business, involves "taking" from the next higher figure of the minuend when the figure of the subtrahend exceeds the corresponding figure of the minuend.

From 234 take 89.

234
89
145

4 is less than 9. From 3 (tens) take 1 (ten). 1 ten plus 4 units equal 14. 14 less 9 equal 5. Set 5 in units' place of the difference. 3 (tens) less 1 (ten) equal 2 (tens). 2 is less than 8. From 2 (hundreds) take 1 (hundred). 2 (tens) plus 1 (hundred) equal 12 (tens). 12 (tens) less 8 (tens) equal 4 tens. 2 (hundreds) less 1 (hundred) equal 1 (hundred). As there is nothing in the subtrahend to subtract, set 1 in hundreds' place.

Compare this process with that in the main text; which gives us 9 and 5 (difference) equal 14; set down 5. 8 and 1 (taken and added to 4) equal 9. 9 and 4 (difference) equal 13; set down 4. 1 and 1 equal 2; set down 1.

In actual operations it is best to omit calling the order of the digits, whether tens, hundreds, etc., or not.

6239	$9 - 5 = \mathit{4}$	$13 - 7 = \mathit{6}$	School
4875	$11 - 8 = \mathit{3}$	$5 - 4 = \mathit{1}$	method.
1364			
3784	$5 + \mathit{9} = 14$	$10 + \mathit{8} = 18$	Business
2195	$2 + \mathit{5} = 7$	$2 + \mathit{1} = 3$	method.
1589			

The *italics* indicate the digits in the difference.

In the case of the fundamental operations it is well to teach several methods. Experts work rapidly because they know all methods. Like experts children often seem to "see" answers.

THE DIVISION DEVICE

The advantage in writing the processes of short and long division thus,

$$5\overline{)24} = 4 + 4 \text{ remainder} \qquad \text{and} \qquad 19\overline{)486} = 25 + 11 \text{ remainder}$$

is that the quotient is placed in the same location by each device. The child does not learn two different devices. The disadvantages are: that business men do not use the device; that it is extremely inconvenient in cases where several processes are involved; and that it does not follow the English system of writing downward or rightward.

ILLUSTRATION: How much is $24 \times 7 + 13 \div 12 - 10$?

$$\begin{array}{r} 24 \\ \times\ 7 \\ \hline 168 \\ +\ 13 \\ \hline 181 \end{array}$$

$$12\overline{)181} = 15\tfrac{1}{12}$$

$$\begin{array}{r} 15\tfrac{1}{12} \\ -\ 10 \\ \hline 5\tfrac{1}{12} \end{array}$$

Answer $5\tfrac{1}{12}$

$$\begin{array}{r} 24 \\ \times\ 7 \\ \hline 168 \\ +\ 13 \\ \hline 12\overline{)181} \\ 15\tfrac{1}{12} \\ -\ 10 \\ \hline 5\tfrac{1}{12} \end{array}$$

Answer $5\tfrac{1}{12}$

See also page 34, Example 2.

The second device saves time and space, and lessens the liability to error, since there is no copying of intermediate results.

DAYS OF THE WEEK

There are seven days in one week. After seven days we begin the names of the days over again. The names of the days are: Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday.

Each day is one seventh of a week. 7 days = 1 week.

At midnight we change the name of the day.

Many, many years ago, when our forefathers lived on the other side of the great Atlantic Ocean, most of them thought that the earth was ruled by beings who live in the sky. So they named each day for some one of these beings. We use their names for the days.

Sunday is named for the Sun in the sky.
Monday is named for the Moon in the sky.
Tuesday is named for Tyr, who leads in battle.
Wednesday is named for Woden, the wise father of all.
Thursday is named for Thor, the thunder.
Friday is named for Freya, the loving wife and mother.
Saturday is named for Saturn, who began the world with time.

ABBREVIATIONS

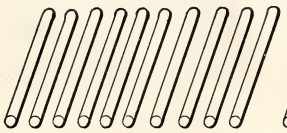
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.

Yesterday was the day before this day.
To-day is this day in which we are now living.
To-morrow will be the day after this day.
Day before yesterday was two days ago.
Day after to-morrow will be two days after this.
A fortnight is two weeks, or fourteen nights or days.

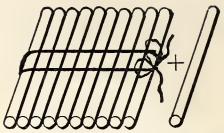
1. What day will be ten days from to-day? What day was ten days ago?

2. Name the days when we go to school.

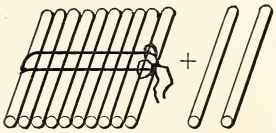
REVIEW OF NUMBERS 10 TO 20



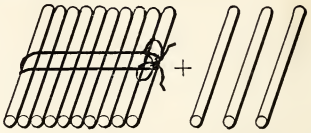
Ten 1's are 10



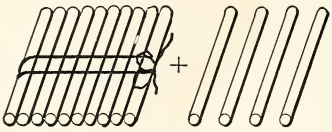
10 + 1 = 11



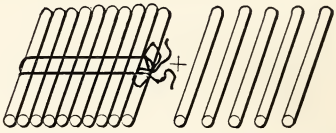
10 + 2 = 12



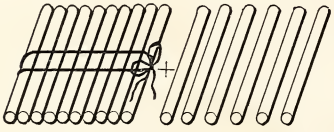
10 + 3 = 13



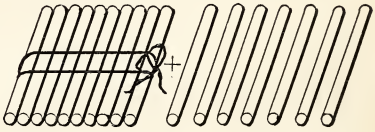
10 + 4 = 14



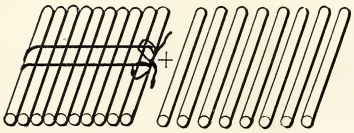
10 + 5 = 15



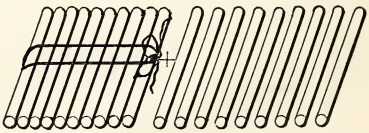
10 + 6 = 16



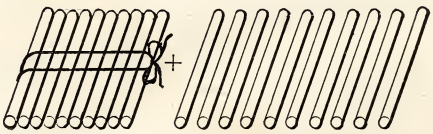
10 + 7 = 17



10 + 8 = 18



10 + 9 = 19

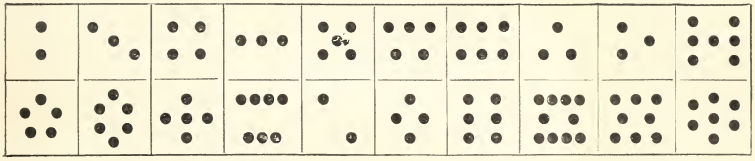


10 + 10 = 20

SIGHT-COUNTING, 1–20

The teacher may make sight number cards, using ordinary paper or, better, drawing paper, 4 × 5 in. or 4 × 6 in. size. The figures should be as large as those on page 10 for blackboard writing. They may be drawn with brush and diluted ink, or with blue pencil. The children may make sets for themselves, either as large as the teacher's set, or much smaller, 2 × 3 in., with figures as large as those on page 11. These sets of sight cards should review all the number facts as high as 20, and drill the pupil in quick recognition of number groups as high as 7 or even 10. The teacher with a set of cards in her hand may call for answers in various ways. The answers are to be remembered instantly and with certainty.

For a set of sight-counting cards :

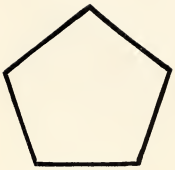


Cards involving 10 may be written like these :

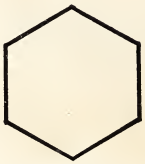
10+1=	10+2=	10+3=	10+4=	10+5=	10+6=	10+7=	10+8=	10+9=	10+10=
10×2=	$\frac{1}{2}$ 0 =	2)10	5)10	10÷2=	10−1=	10−2=	10−3=	10−4=	10− 5=
10−6=	10−7=	10−8=	10−9=	10)10	5+5=	5×2=	2×5=	9+1=	8+ 2=
7+3=	6+4=	18−8=	19−9=	17−7=	16−6=	15−5=	14−4=	13−3=	12− 2=

The variety of possible ways to use the numbers to 20 in combinations producing not more than 20 and using no partition facts or fractions over $\frac{1}{2}$ is too great to permit of complete illustration. Not all the combinations or forms of signs to indicate operations involving 10 are indicated even in these forty spaces.

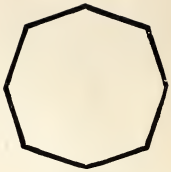
GEOMETRIC FIGURES



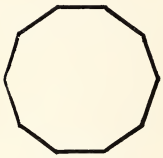
Pentagon



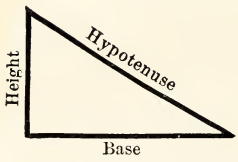
Hexagon



Octagon

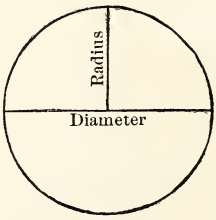


Decagon



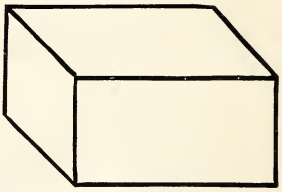
Right-angle triangle

Equilateral triangle
Equiangular triangle



Circle

Parallelopiped



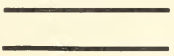
Prism

Rectangle

Square

Parallelogram

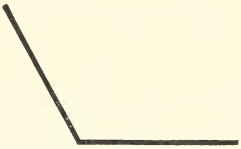
GEOMETRIC FIGURES



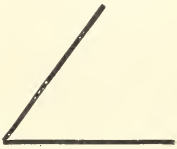
Parallel horizontal lines

Parallel vertical lines

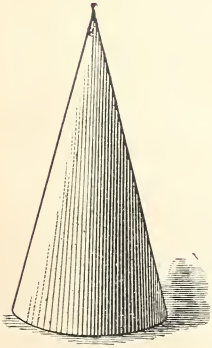
Right angle



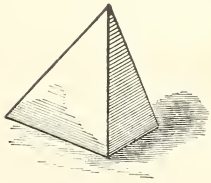
Obtuse angle



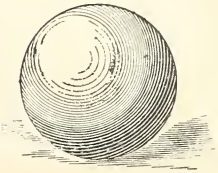
Acute angle



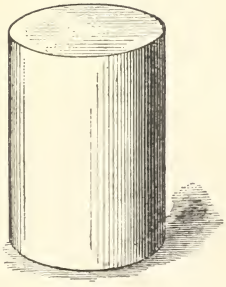
Cone



Pyramid



Sphere



Cylinder

REVIEWS OF NUMBER TABLES

Counting by 3's.

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
51	52	53	**54**	55	56	**57**	58	59	**60**
61	62	**63**	64	65	**66**	67	68	**69**	70
71	**72**	73	74	**75**	76	77	**78**	79	80
81	82	83	**84**	85	86	**87**	88	89	**90**
91	92	**93**	94	95	**96**	97	98	**99**	100

Counting by 6's.

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
51	52	53	**54**	55	56	57	58	59	**60**
61	62	63	64	65	**66**	67	68	69	70
71	**72**	73	74	75	76	77	**78**	79	80
81	82	83	**84**	85	86	87	88	89	**90**
91	92	93	94	95	**96**	97	98	99	100

Counting by 4's.

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
51	**52**	53	54	55	**56**	57	58	59	**60**
61	62	63	**64**	65	66	67	**68**	69	70
71	**72**	73	74	75	**76**	77	78	79	**80**
81	82	83	**84**	85	86	87	**88**	89	90
91	**92**	93	94	95	**96**	97	98	99	**100**

Counting by 7's.

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
51	52	53	54	55	**56**	57	58	59	60
61	62	**63**	64	65	66	67	68	69	**70**
71	72	73	74	75	76	**77**	78	79	80
81	82	83	**84**	85	86	87	88	89	90
91	92	93	94	95	96	97	**98**	99	100

Counting by 5's.

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**
51	52	53	54	**55**	56	57	58	59	**60**
61	62	63	64	**65**	66	67	68	69	**70**
71	72	73	74	**75**	76	77	78	79	**80**
81	82	83	84	**85**	86	87	88	89	**90**
91	92	93	94	**95**	96	97	98	99	**100**

Counting by 8's.

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
51	52	53	54	55	**56**	57	58	59	60
61	62	63	**64**	65	66	67	68	69	70
71	**72**	73	74	75	76	77	78	79	**80**
81	82	83	84	85	86	87	**88**	89	90
91	92	93	94	95	**96**	97	98	99	100

The 10's are always at the ends of the rows.

NUMBER TABLES 1 TO 144

Counting by 9's.

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	51	52	53	**54**	55	56	57	58	59	60
61	62	**63**	64	65	66	67	68	69	70	71	**72**
73	74	75	76	77	78	79	80	**81**	82	83	84
85	86	87	88	89	**90**	91	92	93	94	95	96
97	98	**99**	100	101	102	103	104	105	106	107	**108**
109	110	111	112	113	114	115	116	**117**	118	119	120
121	122	123	124	125	**126**	127	128	129	130	131	132
133	134	**135**	136	137	138	139	140	141	142	143	**144**

Notice that the 2 figures in each number which contains 9 always add together 9, except 99. $9 + 9 = 18$, $1 + 8 = 9$. Notice also that the unit figure of each larger multiple of 9 is always 1 less: 18, 27, 36, and so on.

Counting by 11's.

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	51	52	53	54	**55**	56	57	58	59	60
61	62	63	64	65	**66**	67	68	69	70	71	72
73	74	75	76	**77**	78	79	80	81	82	83	84
85	86	87	**88**	89	90	91	92	93	94	95	96
97	98	**99**	100	101	102	103	104	105	106	107	108
109	**110**	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	**132**
133	134	135	136	137	138	139	140	141	142	**143**	144

Notice that from 1 to 100 the 2 figures in each multiple of 11 are always the same, and that above 100 the number of tens always increases 1, 110, 121, and so on, and the number of units always increases 1, 121, 132, 143.

1. Copy these Number Tables in red and blue pencil on paper, or in red and blue chalk on the blackboard.

2. Read these Tables in class, explaining them.

TABLES

Dry Measure

2 pints	= 1 quart	2 pt.	= 1 qt.
8 quarts	= 1 peck	8 qt.	= 1 pk.
4 pecks	= 1 bushel	4 pk.	= 1 bu.

Liquid Measure

4 gills	= 1 pint	4 gi.	= 1 pt.
2 pints	= 1 quart	2 pt.	= 1 qt.
4 quarts	= 1 gallon	4 qt.	= 1 gal.

Time Measure

60 seconds	= 1 minute	60 sec.	= 1 min.
60 minutes	= 1 hour	60 min.	= 1 hr.
24 hours	= 1 day	24 hr.	= 1 da.
7 days	= 1 week	7 da.	= 1 wk.
12 months	= 1 year	12 mo.	= 1 yr.
30 days count usually as 1 month		30 da.	= 1 mo.
365 days count usually as 1 year		365 da.	= 1 yr.

Length Measure

12 inches	= 1 foot	12 in.	= 1 ft.
3 feet	= 1 yard	3 ft.	= 1 yd.
5280 feet	= 1 mile	5280 ft.	= 1 mile
1760 yards	= 1 mile	1760 yd.	= 1 mile

Weight Measure

16 ounces	= 1 pound	16 oz.	= 1 lb.
2000 pounds	= 1 ton	2000 lb.	= 1 T.

U. S. Money

5 cents	= 1 nickel	5 ¢	
10 cents	= 1 dime	10 ¢	
100 cents	= 1 dollar	100 ¢	= $1

GENERAL REVIEW

1. Write division tables for 6, 7, 8, and 9.

2. Write in decimal fractions, $34\frac{28}{100}$, $56\frac{37}{100}$, $89\frac{6}{100}$.

3. Make a bill to show the following purchases: 2 pr. of shoes at \$2 per pair, 9 yd. of silk at \$2.50 per yd., and 2 doz. handkerchiefs at \$1.75 per doz.

4. Mary bought 4 quires of paper at 24¢ a quire. How much did all the paper cost? What was the cost per sheet?

5. Add: 275, 386, 4293, 1874, 1253.

6. From 3394 take 1875.

7. How much is $15 \times 24 \div 8$?

8. How many cu. ft. are in a tank 3 ft. $\times$ 5 ft. $\times$ 8 ft.?

9. What is the area of a right triangular plot of ground that is 96 ft. on one side and 200 ft. on the other?

10. A circular pond is 500 yd. in diameter. What is the length of its circumference?

11. How much is $10 \times 10 \times 10 \times 10 \times 10$? Write the answer in figures and in words.

12. Write all the multiplication tables in which occur these multiples: 48, 54, 56.

13. Draw accurately a rectangle $2\frac{1}{2}$ in. by $3\frac{3}{4}$ in.

14. A freight locomotive weighs 144 tons and draws a load of 100 15-ton freight cars. Another locomotive weighs 90 tons and draws 50 cars. What is the difference in the weights of the locomotives? in the loads they can draw?

TESTS

1. Beginning at 1, count by 11 to 144.

2. What is a thermometer? What does it measure?

3. What is the *multiplicand*, the *multiplier*, and the *product* in multiplication?

4. Which is the larger, one eighth or one twelfth of anything? one tenth or one fiftieth? Why? What part of $\frac{1}{8}$ is $\frac{1}{16}$? of $\frac{1}{10}$ is $\frac{1}{50}$?

5. What are the *dividend*, the *divisor*, and the *quotient* in division?

6. Tell the Roman notation for the present year.

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7. Add \$13.25, \$26.14, \$168.90, and \$1000.

8. Write the heading of a letter with date and addresses of yourself and of the person to whom you write.

9. I bought 4 pair of shoes @ \$2.60 each. What was their cost?

10. The principal of a school received 2864 cents from a school entertainment as a picture fund, and divided the money equally among eight class rooms. How many dollars did each room receive?

11. Show by drawings these fractions: $\frac{4}{9}$, $\frac{3}{8}$, $\frac{5}{7}$, $\frac{3}{10}$, $\frac{2}{15}$.

12. Mary gave $\frac{1}{3}$ of $\frac{1}{6}$ of 36 apples to each girl in her class, and had none left. How many girls were there in the class?

13. Subtract $2130\frac{1}{2}$ acres from $4360\frac{3}{4}$ acres.

14. What per cent of \$2.00 is 66¢?