GRADED ARITHMETICS

BOOK TWO-GRADE III

CHANCELLOR

CHILDREN'S ARITHMETICS BY GRADES

GLOBE SERIES

SECOND BOOK

THIRD YEAR

FUNDAMENTAL OPERATIONS

BY

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"The proper use of the printed page is the greatest of all arts taught in the school. How to get out of printed words and sentences the original thought and observation recorded there — how to verify these and critically go over the steps of the author's mind — this is the method of discovery, and leads to the only real progress."

W. T. HARRIS, LL.D.,
United States Commissioner of Education.

— From Address before the National Educational Association, 1896.

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PREFACE

This book is intended for boys and girls who know the numbers from one to thirty thoroughly, who can count to one thousand, who know something of the multiplication tables of two, three, four, five, six, ten, and twelve, and who understand the simplest facts about ratio and fractions. For such boys and girls there is here about a year's work.

How should boys and girls study numbers? The interrelations of number-facts and of number-principles are such as to make progress very slow and very difficult through their intricate maze. Is there any Ariadne's thread to follow through the labyrinth of numbers?

Is number ratio or counting? Is it comparison, or magnitude, or multitude? Is it a logic of thought, which can be analyzed after the topical style, — addition, subtraction, multiplication, division, rule of three, and so forth, — of which we may complete one part before beginning the next? Shall we learn every discoverable fact about twenty before taking up twenty-one, or every conceivable fact about $\frac{1}{3}$ of $\frac{6}{7}$ of $\frac{2}{9}$ of $\frac{12}{10}$ before taking up liquid measure?

This book is both "topical" and "spiral" in plan. Its substance is both ratio and counting. Its purpose is to conform numbers in their facts and principles to the usual processes and powers and interests of children's minds. The graded reader has opened the way for the graded arithmetic. Grading all books is part and parcel of the new education, which means to discover and to obey the facts of the child-mind, its methods, nascent periods, and order of growth.

The core of the concentric theory is recognition of the value of finding something that is known even in the mass of the unknown. Let us not hesitate in schoolbooks as we do not hesitate in life to branch out into the new and to return again to the old. Because ratio is the root and numbering is the top, let us not forget reasoning, which is the main trunk of arithmetic. The child's knowledge of arithmetic should grow as evenly in all directions as the most careful and the most open-minded education can secure.

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 rather for reading and study than for the setting of many exercises in writing figures. It calls for oral expression far more than for written work; but it is meant to call most for the quiet, studious effort of the child to think through the number-processes for himself in the light of the instruction of the teacher and of these pages. Many minds, of adults as well as of children, cannot at once comprehend principles and facts explained orally. We often need to see the printed words, and slowly and patiently to think out their truth and meaning for ourselves. We remember with more than twofold certainty what we have verified for ourselves after hearing from others.

We cannot advance far in mathematics without giving ourselves to symbols wholly. No one can add 50 and 40 with the picture of 90 real objects in his imagination. In this book we are at the stage where we can properly think of 15 as a symbol only; hence we begin to use the singular verb in the English sentences, — 15 is what part of 50? and, 15 is 50 less?. Yet while this treating of numbers abstractly is essential to progress in arithmetic, considered either as the science of numbers or as the art of computation, we must remember that we study arithmetic not only for culture, but also for utility. In our teaching we must frequently correlate numbers with real facts. This is especially necessary in our dealings with arithmetic as ratio. Our boys and girls must know quarts, yards, pounds, coins, square feet, as actual measures. To encourage interest in arithmetic as truth about real things, pictures and illustrations, tending to stimulate the activity of the imagination which gives men seeing eyes, have been introduced.

Arithmetic is the chief instrument of science and the essence of certainty. It is concrete logic. In a world of flux and change and doubt it is of elemental importance for our boys and girls to know a kind of truth that is as positive as the very reason and the very mind of our humanity.

Author and publishers desire to acknowledge the valuable suggestions of Principal W. B. Gunnison, Ph.D., of Erasmus Hall High School, Brooklyn, N.Y., in reviewing these pages.

W. E. C.

Bloomfield, N.J.,
June 14, 1901.

CONTENTS

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.

3. Do not hesitate to use in advance of the order in the book facts which appear later in these pages.

4. While the purpose of number-study is to learn numbers, oral expression needs to be encouraged. 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. See that the children do study this book, but do not ask them 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. Take great care not to drill upon things not essential.

7. This book is only a collection of suggestions; it is not an encyclopedia of devices. 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. Every child has peculiar interests. Find them. For number-stories use facts which interest the various children. Remember that children have their "good" and their "bad" days. On their good days children sometimes learn an amazing amount of new matter.

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 we should not forget that 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.

INTRODUCTORY REVIEW

1. Add and subtract these numbers:

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

2. Read and answer:

$27 - 5 - 2 - 2 - 2 = ?$ $19 + 1 + 7 - 6 - 1 = ?$

$25 - 4 - 1 - 10 = ?$ $23 - 10 - 3 - 5 + 1 = ?$

$20 - 9 - 1 + 2 = ?$ $18 - 8 + 10 - 8 + 6 = ?$

3. Measure the length and width of this page.

4. Measure the length and width of your desk top.

5. How high is the front edge of your desk from the floor?

6. Cut a string twelve inches long. Cut off a piece four inches long. Compare the parts.

7. Cut a strip of paper 6 inches long. Cut another strip 3 inches long. Mark off both into inches.

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

The sign − means that the number after it is to be taken from the number before it. We may read **2** *k*. — From 118 take, or subtract, 14.

Read the other problems in **2**, using the word "subtract."

	1	2	3	4	5	6	7	8	9	10
3.	21	34	42	50	111	93	61	222	1000	2000
	×4	×2	×5	×5	×3	×2	×5	×4	×5	×3

The sign × means that the number before it is to be multiplied by the number after it. We may read **3** 1. — 21 multiplied by 4 are how many? Or, — Multiply 21 by 4.

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 × 3 = ? 23 taken 3 times are how many? Or, 23 multiplied by 3 are how many? Or, 3 times 23 is how much?

Read: 25 × 4 = ? 50 × 2 = ? 100 × 3 = ? 33 × 3 = ?

7. 44 ÷ 2 = ? Read: 44 divided by 2 are how many?

Read: 66 ÷ 3 = ? 36 ÷ 4 = ? 48 ÷ 4 = ? 100 ÷ 10 = ?

ADDITION

Add: 21, 17, 49.

$$\begin{array}{r} 21 \\ 17 \\ 49 \\ \hline 87 \end{array}$$

$9 + 7 = 16$, $16 + 1 = 17$; that is, 1 ten and 7 units. We write the 7 in units' place below the line and add the 1 ten to the other tens. The sum of the tens is 8. We write the 8 in tens' place below the line.

Prove by adding the columns from the top down.

$$1 + 7 = 8 \qquad 8 + 9 = 17$$

1 ten over + 2 tens = 3 tens. 3 tens + 1 ten = 4 tens. 4 tens + 4 tens = 8 tens.

Add: WRITE

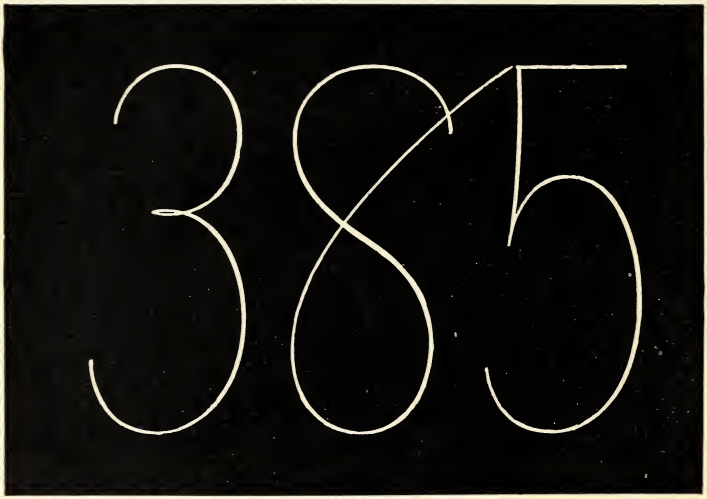
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
48	73	21	38	17	28	41	62	22	81	25	35
93	54	14	71	72	73	35	86	33	54	24	36
62	62	93	19	65	46	19	94	14	37	23	37
74	85	76	50	91	59	62	33	58	46	22	38
15	40	50	72	18	10	7	52	11	39	21	39

13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.
1	5	1	3	2	1	2	4	5	1	6	5	7	8	5
2	1	2	1	5	3	2	2	1	2	4	2	1	3	6
1	2	3	2	1	2	1	1	4	3	2	3	3	2	9
3	1	2	1	3	1	3	2	3	5	5	1	2	1	2
2	3	1	2	1	2	2	3	2	4	1	1	1	4	1
1	2	4	1	2	1	2	1	4	2	3	2	2	3	4
3	1	2	3	1	2	2	4	3	1	2	4	5	6	3
2	3	4	3	2	1	2	3	1	3	1	2	1	7	2
1	2	1	2	1	2	2	3	2	1	3	3	3	2	1

28. Add columns **13** to **27** orally also.

BLACKBOARD

With thumb and fingers, hold the chalk crayon partly under the palm of the hand, and use free arm movements only. It is hard to see figures on the blackboard unless they are at least two inches high, and are written very clear and white.



Write on the blackboard these numbers and add by columns and rows:

1.	1246	9223	6114	4645	8706	3139
2.	2105	4456	8000	9879	5371	2429
3.	4308	2798	7657	2986	1324	4869
4.	6756	7963	2786	4324	7542	2471

5. Write the multiplication tables.

6. Write 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

7. Write 0, 9, 8, 7, 6, 5, 4, 3, 2, 1.

8. Write and add 123, 456, 789, 143, 476, 719, 153, 486, 729, 163, 496, 739, 173, 406, 183, 416.

PAPER

Write with a soft lead pencil or with pen and ink. If 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.

Most children, if asked to try, soon make figures both clear and beautiful.

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

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

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

4. 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 to 1000; by elevens to 1100; and by twelves to 1200.

Spelling of Number Names

5. 1, one. 2, two. 3, three. 4, four. 5, five. 6, six.
7, seven. 8, eight. 9, nine. 10, ten. 0, zero.
11, eleven. 12, twelve. 13, thirteen. 14, fourteen.
15, fifteen. 16, sixteen. 17, seventeen. 18, eighteen.
19, nineteen. 20, twenty. 30, thirty. 40, forty.
50, fifty. 60, sixty. 70, seventy. 80, eighty.
90, ninety. 100, one hundred. 1000, one thousand.
Spell orally as well as in writing.

6. Write in words all the numbers in questions **1**, **2**, **3**, and **4** on page 10. Spell the words carefully.

SUBTRACTION

NUMBERS 1 TO 20 IN REVIEW

1. $10-?=3$ $9-?=4$ $8-?=2$ $7-?=6$ $6-?=4$
2. $5-?=2$ $4-?=3$ $3-?=2$ $2-?=1$ $10-?=4$
3. $9-?=5$ $8-?=3$ $10-?=4$ $7-?=5$ $6-?=5$
4. $5-?=3$ $4-?=2$ $3-?=1$ $10-?=5$ $9-?=6$
5. $8-?=4$ $7-?=4$ $6-?=3$ $5-?=4$ $4-?=1$

Subtract:

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

12. Make questions, using these numbers.

SUBTRACTION

Subtraction finds the difference between two numbers.

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** or **remainder**.

From 35 subtract 14.

35	5 less 4 = 1	35 minuend
14	30 less 10 = 20	14 subtrahend
		21 remainder

Proof. Add the remainder to the subtrahend, and if the sum equals the minuend, the work is correct.

14
21
35

Only numbers of like things can be subtracted.

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 84 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.

ADDITION AND SUBTRACTION

Add 51 and 17.

$$\begin{array}{r} 51 \\ 17 \\ \hline 68 \end{array}$$

The sum of the units, 7 and 1, is 8 units. We write 8 in units' column.

The sum of the tens is 6 tens. We write 6 in tens' column.

Add:

1.	7	14	26	92	22	14	70	33	58	62	20	25
	8	11	13	17	46	53	28	45	31	27	40	51
2.	2	11	12	11	71	54	43	25	10	41	41	22
	61	27	41	14	16	22	21	12	31	21	2	21
	35	60	33	42	10	11	35	51	47	2	21	41
3.	10	2	12	30	41	14	2	13	21	71	30	2	3
	7	4	44	16	3	11	12	14	20	3	13	14	2
	6	1	11	11	2	21	44	21	23	2	11	10	4
	2	2	12	21	20	32	1	31	24	20	12	61	10

Subtract 15 from 77.

$$\begin{array}{r} 77 \\ 15 \\ \hline 62 \end{array}$$

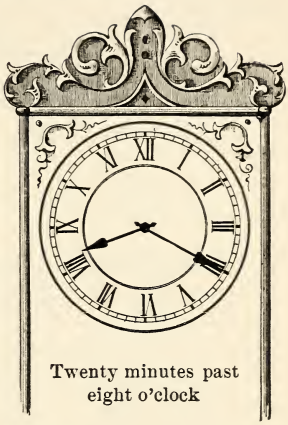
$7 - 5 = 2$. We write 2 in units' place. 7 tens less 1 ten are 6 tens. We write 6 in tens' place.

Subtract:

4.	12	21	45	79	87	72	45	54	66	31	77	97
	11	11	23	18	16	41	14	23	33	30	45	82
5.	38	29	14	73	88	81	25	19	20	46	79	87
	15	18	14	53	17	41	5	9	10	45	19	15

TELLING TIME

There are 24 hours in every day. The first hour begins halfway between sunset and sunrise, when the night is darkest. We call the end of one day and the beginning of the next day *midnight*. Then we count 12 hours, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. When it is twelve o'clock in the daytime in March and September, it is halfway between sunrise and sunset. Then we begin again, and count 1, 2, 3, to 12, midnight.



Twenty minutes past eight o'clock

Noon means 12 o'clock in the daytime.

Midnight means 12 o'clock in the night.

On the clock face we find Roman figures.

Key to clock face

1	one	I	7	seven	VII
2	two	II	8	eight	VIII
3	three	III	9	nine	IX
4	four	IIII	10	ten	X
5	five	V	11	eleven	XI
6	six	VI	12	twelve	XII

I = 1; V = 5; X = 10. I after V means V + I. I before X means X − I.

On the clock face we do not find any figures to tell us about the minutes.

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.

MULTIPLICATION TABLES, 2 AND 4

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

1. Learn this table, saying "Two ones are two, Two twos are four."

2. Count by twos to one hundred.

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

3. Learn this table, saying "Four ones are four," and so on to the end.

4. Count by fours to one hundred.

5. Answer: $8 \div 2 = ?$ $8 \times 4 = ?$ $12 \div 2 = ?$ $12 \times 4 = ?$
$6 \div 2 = ?$ $6 \times 4 = ?$ $9 \times 4 = ?$ $10 \div 2 = ?$ $10 \times 4 = ?$
$14 \div 2 = ?$ $7 \times 4 = ?$ $44 \div 11 = ?$ $5 \times 4 = ?$ $20 \div 2 = ?$
$16 \div 2 = ?$ $4 \times 4 = ?$ $12 \div 4 = ?$ $22 \div 11 = ?$ $9 \times 2 = ?$

6. Multiply:

11	12	8	7	7	11	12	5	9
4	2	4	2	4	2	4	4	2

7. Answer: $9)\underline{36}$ $4)\underline{12}$ $4)\underline{44}$ $2)\underline{22}$ $4)\underline{20}$ $2)\underline{18}$

8. $2 \times 2 \times 11 = ?$ $2 \times 2 \times 10 = ?$ $2 \times 2 \times 12 = ?$

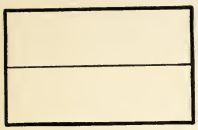
9. $2 \times 2 \times 7 = ?$ $2 \times 2 \times 9 = ?$ $2 \times 2 \times 5 = ?$

10. $44 \div 2 \div 2 = ?$ $48 \div 2 \div 2 \div 2 \div 2 = ?$

11. $10 \times 4 \div 2 = ?$ $20 \div 2 \times 4 = ?$ $48 \div 4 \times 2 = ?$

12. $36 \div 9 \div 2 = ?$ $40 \div 4 \div 2 = ?$ $32 \div 8 \div 2 = ?$

HALVES



Rectangle in halves

Circle in halves

Triangle in halves

Square in halves

When anything is divided into two equal parts, the parts are called halves.

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

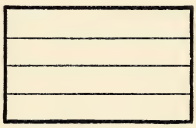
Draw a square. Divide it into halves.

FOURTHS OR QUARTERS

When anything is divided into four parts, each part is called a fourth or a quarter. Four fourths or four quarters make one whole. $4 \times \frac{1}{4} = 1$. $\frac{4}{4} = 1$.

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.

How much is $\frac{1}{2}$ of $\frac{1}{2}$?

How much is $\frac{1}{2}$ and $\frac{1}{4}$?

MULTIPLICATION TABLES, 5 AND 10

$5 \times 1 = 5$	$5 \times 5 = 25$	$5 \times 9 = 45$
$5 \times 2 = 10$	$5 \times 6 = 30$	$5 \times 10 = 50$
$5 \times 3 = 15$	$5 \times 7 = 35$	$5 \times 11 = 55$
$5 \times 4 = 20$	$5 \times 8 = 40$	$5 \times 12 = 60$

Count by fives to one hundred.

$10 \times 1 = 10$	$10 \times 5 = 50$	$10 \times 9 = 90$
$10 \times 2 = 20$	$10 \times 6 = 60$	$10 \times 10 = 100$
$10 \times 3 = 30$	$10 \times 7 = 70$	$10 \times 11 = 110$
$10 \times 4 = 40$	$10 \times 8 = 80$	$10 \times 12 = 120$

1. Answer: $40 \div 5 = ?$ $55 \div 11 = ?$ $120 \div 12 = ?$ $60 \div 6 = ?$
$7 \times 10 = ?$ $9 \times 5 = ?$ $10 \times 8 = ?$ $5 \times 7 = ?$ $10 \times 3 = ?$
$20 \div 4 = ?$ $6 \times 5 = ?$ $50 \div 5 = ?$ $12 \times 5 = ?$ $90 \div 9 = ?$
$10 \times 4 = ?$ $100 \div 10 = ?$ $11 \times 10 = ?$ $25 \div 5 = ?$ $5 \times 3 = ?$

2. Multiply:

12	11	10	11	12	9	8	7	9
5	10	5	5	10	5	5	5	10

3. Answer: $5)\underline{55}$ $9)\underline{45}$ $8)\underline{80}$ $7)\underline{35}$ $9)\underline{90}$ $4)\underline{40}$
4. Answer: $12)\underline{120}$ $11)\underline{110}$ $10)\underline{100}$ $100 \div 10 \div 5 = ?$
5. $120 \div 10 \div 4 = ?$ $60 \div 5 \div 4 = ?$ $80 \div 10 \div 4 = ?$
6. $50 \div 5 \div 2 = ?$ $30 \div 5 \div 2 = ?$ $20 \div 5 \div 2 = ?$
7. $2 \times 2 \times 5 = ?$ $10 \times 1 \times 5 = ?$ $3 \times 2 \times 2 \times 10 = ?$
8. $5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 5 \times ?$
9. $10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 = 10 \times ?$
10. If there are ten tens in one hundred, how many tens are there in five hundred? in one thousand?

FIFTHS AND TENTHS

When anything is divided into five equal parts, we call each part one fifth. Five fifths make one whole.

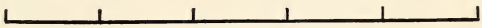

Circle


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.

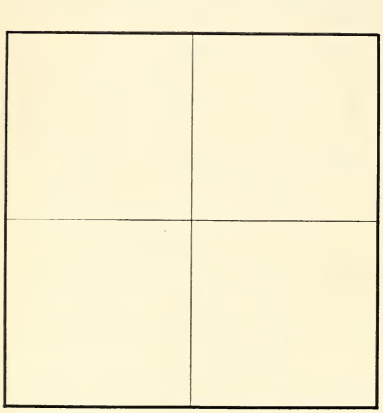
When anything is divided into tenths, it has ten equal parts. Ten tenths make one whole.

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.

SQUARE MEASURE

How long is each side of this figure? How many squares do you see here? How many square inches are there?



If we multiply together the lengths in inches, or feet, or yards, or miles, of each of two sides of a square, we get the size of the square in square inches or square feet or square yards or square miles.

2 in. × 2 in. = 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 square inches.

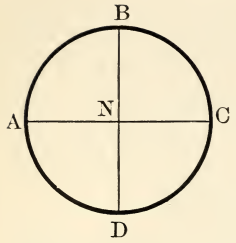
3. Find the area of an oblong 4 feet × 6 feet.

4. Find the area of an oblong 10 yards × 12 yards.

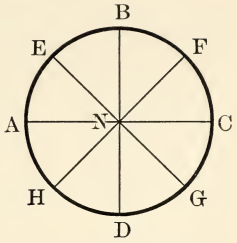
5. Find the area of a township 4 miles × 5 miles.

6. Tell the area of a picture 10 inches × 14 inches.

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, for it is a straight line through the center of the circle.

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 meetings 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. *ANE* is an acute angle. Point out other acute angles.

We call angles larger than right angles *obtuse* angles. *ANF* is an obtuse angle. Point it out.

We call this a *horizontal* line: ———.

And this we call a *vertical* line: |.

ABCD is the *perimeter* or *circumference* of the circle.

MULTIPLICATION TABLES, 3 AND 6

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

Count by threes to one hundred twenty.

$6 \times 1 = 6$	$6 \times 5 = 30$	$6 \times 9 = 54$
$6 \times 2 = 12$	$6 \times 6 = 36$	$6 \times 10 = 60$
$6 \times 3 = 18$	$6 \times 7 = 42$	$6 \times 11 = 66$
$6 \times 4 = 24$	$6 \times 8 = 48$	$6 \times 12 = 72$

Count by sixes to one hundred twenty.

1. Answer: $12 \div 2 = ?$ $48 \div 8 = ?$ $36 \div 6 = ?$ $42 \div 7 = ?$
$8 \times 3 = ?$ $21 \div 7 = ?$ $66 \div 11 = ?$ $4 \times 6 = ?$ $54 \div 9 = ?$
$18 \div 6 = ?$ $36 \div 12 = ?$ $60 \div 10 = ?$ $10 \times 3 = ?$ $11 \times 3 = ?$
$15 \div 5 = ?$ $27 \div 9 = ?$ $72 \div 12 = ?$ $5 \times 6 = ?$ $3 \times 3 = ?$

2. Multiply:

12	10	11	9	9	10	12	8	8
6	3	6	3	6	6	3	3	6

3. Answer: $9)\underline{54}$ $7)\underline{42}$ $8)\underline{24}$ $9)\underline{27}$ $5)\underline{30}$ $8)\underline{48}$
4. $2 \times 5 \times 3 = ?$ $2 \times 3 \times 12 = ?$ $2 \times 2 \times 3 \times 6 = ?$
5. $72 \div 12 \div 2 = ?$ $60 \div 10 \div 3 = ?$ $60 \div 6 \div 5 \div 2 = ?$
6. $54 \div 9 \div 6 = ?$ $48 \div 6 \div 4 = ?$ $36 \div 6 \div 3 \div 2 = ?$
7. $10 \div 2 \times 6 = ?$ $10 \times 6 \div 10 = ?$ $8 \times 2 \div 4 \times 6 = ?$
8. $12 \div 6 \times 3 = ?$ $11 \times 3 = ?$ $11 \times 6 = ?$ $3 \times 2 \times 9 = ?$

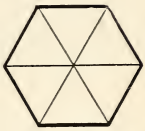
9. Does multiplying one quantity by another increase or reduce it? Is this true of dividing it?

SIXTHS AND TWELFTHS

When anything is divided into six equal parts, we call the parts sixths. Six sixths make one whole.

Circle

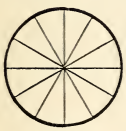
Rectangle



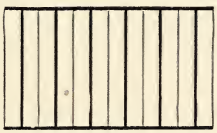
Hexagon

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.

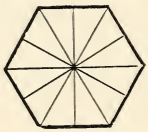
When anything is divided into twelve equal parts, we call the parts twelfths. Twelve twelfths make one whole.



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 $\frac{4}{12}$?

EQUAL PARTS OR FRACTIONS

A *number* is always a number of *ones* of the same kind.

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

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

Each is of a different size from the others.

A is divided into five parts. *B* is divided into four parts.

C is divided into two parts. *D* is not divided.

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

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

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

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

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

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

We call equal parts fractions.

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

Each part of *A* is one fifth part of *A*. 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 *A*.

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

Each part of *B* is one fourth of *B*. 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 *B*.

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

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

ONE-HALF AND TWO

1. $\frac{1}{2}$ of $6 = ?$ $\frac{1}{2}$ of $18 = ?$ $\frac{1}{2}$ of $12 = ?$ $\frac{1}{2}$ of $2 = ?$
$\frac{1}{2}$ of $20 = ?$ $\frac{1}{2}$ of $10 = ?$ $\frac{1}{2}$ of $8 = ?$ $\frac{1}{2}$ of $14 = ?$

2. How many 2's are there in 6? Or, 6 contains how many 2's? Or, 6 divided by 2 is how much? What is the ratio of 2 to 6? of 6 to 2?

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.

$$(5 \times 2) + 1 = ? \quad 2\overline{)11}$$
$$5 + 1$$

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

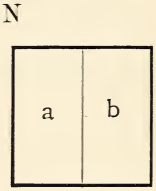
7. If a is $\frac{1}{2}$ of S, and if $b = \frac{1}{2}$ of S,

then $a + b = 2 \times \frac{1}{2}$ of S.

But $a + b = S$.

Then $S = 2 \times \frac{1}{2} = \frac{2}{2} = 1$.

Two halves make one whole.



S

SQUARE

MULTIPLYING A WHOLE NUMBER AND FRACTION

8. $2 \times 1\frac{1}{2} = ?$ $2 \times 1 = 2$ $2 \times \frac{1}{2} = 1$ $2 \times 1\frac{1}{2} = 2 + 1 = 3$.

9. $2 \times 2\frac{1}{2} = ?$ $2 \times 3\frac{1}{2} = ?$ $2 \times 4\frac{1}{2} = ?$ $2 \div 5\frac{1}{2} = ?$

10. John had seven apples. He gave one half of them to his sister. How many apples did she receive?

PARTS

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

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

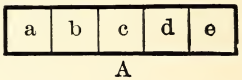
The square is one half as large as the rectangle.

Cut the square into two equal parts, 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.



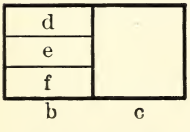
$a + b = 2$ fractions of $A = \frac{2}{5}$ of A.

$a + b + c = 3$ fractions of $A = \frac{3}{5}$ of A.

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

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

But as there are only 5 parts in A, $\frac{5}{5}$ of A = all of A = 1 A.



This form-picture is divided into two parts, $b + c$. $b = \frac{1}{2}$ of A. $c = \frac{1}{2}$ of A.

The picture of 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 parts, then A will have 6 parts.

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

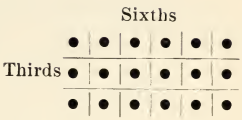
$d = \frac{1}{3}$ of $\frac{1}{2}$ of A, because d is $\frac{1}{3}$ of b, which is $\frac{1}{2}$ of A.

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

RATIOS, 3, $\frac{1}{3}$, 4, $\frac{1}{4}$, 5, $\frac{1}{5}$

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 = ?
   What is the ratio of 3 to 18? of 18 to 3?



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 = ?
   What is the ratio of 3 to 12? of 12 to 3? of 12 to 4? of 4 to 12?

3. How many 5's are there in 15? $\frac{1}{3}$ of 15 = ? $\frac{1}{5}$ of 15 = ?
   What is the ratio of 5 to 15? of 15 to 5? of 3 to 15? of 15 to 3?
   How many 3's are there in 12? What is the ratio of 4 to 12? of 12 to 4?

4. When we ask, What is the ratio of 3 to 12? we mean, What part of 12 is 3.

O OBLONG

$3 \times ? = 12$. $\frac{1}{4}$ of 12 = ?

Into how many parts is the oblong divided?

What part of *O* is 1? How many times IV is *O*?

5. When we ask, What is the ratio of 12 to 3? we mean, How many times does 12 contain 3?
   Ratio compares one thing with another.
   Ratio measures one thing by another.
   When anything is divided into equal parts, we may call the parts **fractions**.

6. There were 80 marbles to divide among 10 boys equally. What is the ratio of 80 to 10?

MULTIPLYING 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?

$1\frac{1}{2}¢ = \frac{2}{2}¢ + \frac{1}{2}¢ = \frac{3}{2}¢$. $10 \times \frac{3}{2}¢ = \frac{30}{2}¢ = 15¢$.

$10 \times 2¢ = 20¢$. $20¢ - 15¢ = 5¢$.

Or, $2¢ - 1\frac{1}{2}¢ = \frac{1}{2}¢$. $\frac{1}{2}¢ \times 10 = \frac{10}{2}¢$.

$\frac{10}{2}¢ = 5¢$.

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? $4\frac{1}{4}$ yr. $\times 2 = ?$ yr.

$4\frac{1}{4}$ yr. $= \frac{16}{4}$ yr. $+ \frac{1}{4}$ yr. $= \frac{17}{4}$ yr. $2 \times \frac{17}{4}$ yr. $= \frac{34}{4}$ yr. $\frac{34}{4}$ yr. $= 8\frac{2}{4}$ yr. $= 8\frac{1}{2}$ yr.

3. Each pupil in a class had $2\frac{1}{3}$ sheets of paper. There were 11 pupils in the class. How many sheets had all the pupils? $11 \times 2\frac{1}{3}$ sheets $= ?$

$2\frac{1}{3}$ sheets $= \frac{6}{3}$ sheets $+ \frac{1}{3}$ sheet $= \frac{7}{3}$ sheets. $11 \times \frac{7}{3}$ sheets $= \frac{77}{3}$ sheets. $\frac{77}{3}$ sheets $= 25\frac{2}{3}$ sheets.

4. There is still another way to get the answer for **1.** Suppose we ask, $10 \times 1\frac{1}{2} = ?$ $1\frac{1}{2} = \frac{3}{2}$.

Then $10 \times \frac{3}{2} = \frac{10}{2} \times 3$ or $5 \times 3 = 15$.

We can do this whenever the fraction divides the multiplier exactly.

5. Make questions, asking $4 \times 3\frac{1}{5} = ?$ $6 \times 3\frac{2}{3} = ?$ $2 \times 1\frac{3}{5} = ?$ $3 \times 2\frac{3}{4} = ?$

6. $6\frac{1}{10}¢ \times 5 = ?¢$. $3\frac{1}{2}$ yd. $\times 8 = ?$ yd. $4\frac{1}{6}$ yr. $\times 4 = ?$ yr. $\$2\frac{1}{5} \times 10 = \$\ ?$ $\$3\frac{2}{5} \times 5 = \$\ ?$

GENERAL REVIEW

1. Add $4 + 17 + (3 \times 3) + 6 + 7 + 3 - 7$.

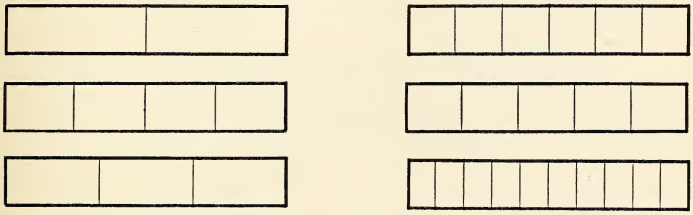
2. Answer, $20 - 4 + 10 - (4 \times 2) + (12 \div 3) + 18 = ?$

3. Tell what are the *minuend*, the *subtrahend*, and the *difference* or *remainder* in subtraction.

4. What are the meanings of A.M. and of P.M. in telling time?

5. Give some of the multiplication tables you know.

6. Tell ratio and fraction facts about these:



7. What do we mean by *ratio?* by *fraction?*

COPY AND ANSWER WRITE

1.

23	32	43	50	333	2000	123	400	99	99
$\times 4$	$\times 3$	$\times 6$	$\times 8$	$\times 3$	$\times 4$	$\times 5$	$\times 10$	$\times 5$	$\times 7$

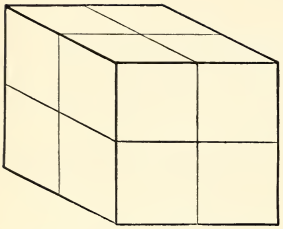
2. Add 63, 95, 18, 100, 74. 3. Add 1544, 10, 987, 1009.

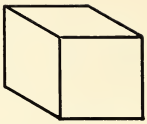
4. Subtract from 89: 19, 27, 32, 76, 54, 49, 11, 55, 68.

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 area?

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 × 2 × 2 cu. in. = 8 cu. in.

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 the sizes in inches of boxes.

REVIEW QUESTIONS

5. The difference between two numbers is 7, and the smaller number is 6. What is the larger number?

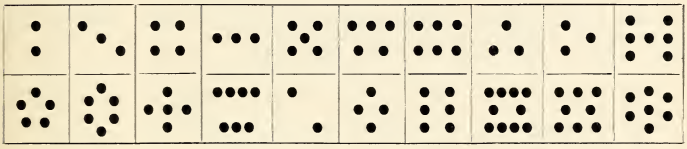
6. How many 9's are there in 18? How many 2's? 9 is what part of 18?

7. What is the ratio of 2 to 16? of 4 to 16? of 16 to 2? of 16 to 4?

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=	$\frac{10}{2}$=	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.

HALVES AND FOURTHS

1. Emma's mother cut a pie into halves. Then she cut each half into 2 equal parts. What part of the whole pie should we call each of those parts?

2. If Emma got $\frac{1}{4}$ of the pie, how many fourths were left?

3. I bought a cake and ate $\frac{2}{4}$ of it. How much of the cake was left?

4. Fred had a large orange. He cut it into halves. Then he cut each half into 2 equal parts. In how many pieces was the orange then?

5. 4)17 4)19 4)21 4)29 4)34 4)39 4)43 4)47

6. How many 4's are there in 24? 36? 12? 16? 20? 40? 46? 44? 8? 28? 32?

7. $\frac{1}{4}$ of 28 = ? $\frac{2}{4}$ of 28 = ? $\frac{3}{4}$ of 28 = ? $\frac{1}{2}$ of 28 = ?

8. $\frac{1}{4}$ of 36 = ? $\frac{2}{4}$ of 36 = ? $\frac{3}{4}$ of 36 = ? $\frac{1}{2}$ of 36 = ?

9. $\frac{1}{4}$ of 8 = ? $\frac{2}{4}$ of 8 = ? $\frac{3}{4}$ of 8 = ? $\frac{1}{2}$ of 8 = ?

10. $\frac{1}{4}$ of 20 = ? $\frac{2}{4}$ of 20 = ? $\frac{1}{2}$ of 20 = ? $\frac{3}{4}$ of 20 = ?

11. $\frac{1}{4}$ of 32 = ? $\frac{3}{4}$ of 32 = ? $\frac{1}{2}$ of 32 = ? $\frac{2}{4}$ of 32 = ?

12. $\frac{1}{4}$ of 48 = ? $\frac{2}{4}$ of 48 = ? $\frac{1}{2}$ of 48 = ? $\frac{3}{4}$ of 48 = ?

13. $\frac{1}{4}$ of 40 = ? $\frac{3}{4}$ of 40 = ? $\frac{2}{4}$ of 40 = ? $\frac{1}{2}$ of 40 = ?

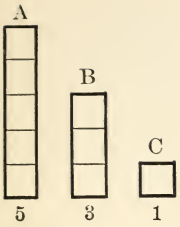
14. $\frac{1}{4}$ of 16 = ? $\frac{2}{4}$ of 16 = ? $\frac{3}{4}$ of 16 = ? $\frac{1}{2}$ of 16 = ?

15. $\frac{1}{4}$ of 24 = ? $\frac{2}{4}$ of 24 = ? $\frac{1}{2}$ of 24 = ? $\frac{3}{4}$ of 24 = ?

16. $\frac{1}{4}$ of 44 = ? $\frac{3}{4}$ of 44 = ? $\frac{2}{4}$ of 44 = ? $\frac{1}{2}$ of 44 = ?

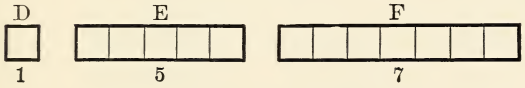
17. $\frac{1}{4}$ of 12 = ? $\frac{1}{2}$ of 12 = ? $\frac{2}{4}$ of 12 = ? $\frac{3}{4}$ of 12 = ?

RATIOS

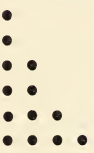


A is $5 \times C$. B is $3 \times C$.
C is $\frac{1}{5}$ of A. C is $\frac{1}{3}$ of B.

We say that the *ratio* of A to C is 5; and that the *ratio* of B to C is 3. Ratio means how large anything is compared with anything else. We say that $\frac{1}{5}$ is the ratio of C to A; and that $\frac{1}{3}$ is the ratio of C to B. This means that C is $\frac{1}{5}$ of A and $\frac{1}{3}$ of B.



What is the ratio of F to D? of E to D? of D to E? of D to F? of D to $E + F$?



The ratio of 6 to 1 is 6.

The ratio of 4 to 1 is 4.

The ratio of 2 to 1 is 2.

The ratio of 1 to 2 is $\frac{1}{2}$. Why?
The ratio of 1 to 4 is $\frac{1}{4}$. Why?
The ratio of 1 to 6 is $\frac{1}{6}$. Why?

In the forms A, B, and C, the ratio of B to A is $\frac{3}{5}$, because B is $\frac{3}{5}$ of A. The ratio of A to B is $\frac{5}{3}$, because A is three thirds of B and two thirds of B together.

The ratio of 4 to 6 things is $\frac{4}{6}$, because 1 is $\frac{1}{6}$ of 6 and there are 4×1 thing in 4 things. The ratio of 6 to 4 is $\frac{6}{4}$, because 1 is $\frac{1}{4}$ of 4 and there are 6×1 thing in 6 things.

1. What is the ratio of 1 to 7? of 7 to 1? of 2 to 7? of 7 to 2? of 3 to 7? of 7 to 3? of 3 to 10? of 10 to 3?

2. Find the ratio of 4 to 8, 16, 12, 2, 20.

SIX AND SIXTHS

1. $6\overline{)25}$ $6\overline{)31}$ $6\overline{)38}$ $6\overline{)74}$ $6\overline{)63}$ $6\overline{)51}$
   $6\overline{)14}$ $6\overline{)44}$ $6\overline{)57}$ $6\overline{)38}$ $6\overline{)19}$ $6\overline{)68}$

2. $\frac{1}{6}$ of $24 = ?$ $\frac{2}{6}$ of $24 = ?$ $\frac{3}{6}$ of $24 = ?$ $\frac{4}{6}$ of $24 = ?$
   $\frac{5}{6}$ of $24 = ?$ $\frac{1}{4}$ of $24 = ?$ $\frac{2}{4}$ of $24 = ?$ $\frac{1}{2}$ of $24 = ?$
   $\frac{2}{4}$ = what other fraction?

Copy and answer:

3. $60 \div 20 = ?$ $80 \div 40 = ?$ $3 \times 20 = ?$ $50 \div 50 = ?$
4. $80 \div 20 = ?$ $90 \div 30 = ?$ $20 \times ? = 80$ $60 \div 30 = ?$
5. $70 \div 10 = ?$ $100 \div 50 = ?$ $10 \times ? = 70$ $100 \div 10 = ?$
6. $100 - 50 = ?$ $100 - 30 = ?$ $100 - 80 = ?$ $100 - 60 = ?$
7. $100 \div 5 = ?$ $40 \div 4 = ?$ $100 \div 10 = ?$ $80 \div 2 = ?$
8. $70 \div 7 = ?$ $80 \div 4 = ?$ $40 \div 2 = ?$ $100 \div 2 = ?$
9. $80 \div 8 = ?$ $50 \div 5 = ?$ $60 \div 2 = ?$ $30 \div 3 = ?$
10. $29 = (6 \times 4) + ?$ $14 = (6 \times 2) + ?$ $33 = (6 \times 5) + ?$
11. $20 = (6 \times 3) + ?$ $75 = (6 \times 12) + ?$ $40 = (6 \times 6) + ?$
12. $59 = (6 \times 9) + ?$ $67 = (6 \times 11) + ?$ $44 = (6 \times 7) + ?$
13. $51 = (6 \times 8) + ?$ $65 = (6 \times 10) + ?$ $9 = (6 \times 1) + ?$
14. $(6 \times 7) + 3 - 5 - 5 = ?$ $(4 \times 4) + 6 + 6 - 2 - 5 = ?$
15. $(9 \times 6) + 6 - 10 - 3 + 1 = ?$ $(5 \times 9) + 10 + 4 + 5 - 6 = ?$
16. $(5 \times 7) + 5 + 10 - 8 - 2 - 1 = ?$ $(6 \times 2) + 6 + 5 - 8 - 1 = ?$
17. $(6 \times 5) + 10 + 10 + 5 - 3 - 4 = ?$ $(6 \times 4) + 6 + 5 + 10 - 8 = ?$

18. Tom had some apples. He gave five to each of eleven boys and had four left for himself. How many had he in all at first?

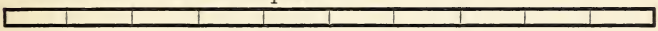
19. $(12 \times 3) - (8 \times 4) + 8 = ?$ $5 + 8 - 6 + 3 = ?$

FRACTIONS

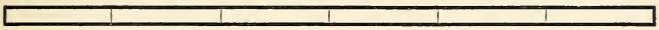
$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{10}$, $\frac{1}{12}$, are fractions. So also are $\frac{2}{3}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{5}{6}$, $\frac{2}{10}$, $\frac{3}{10}$,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

When fractions are written in figures, 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 taking 5 of them.

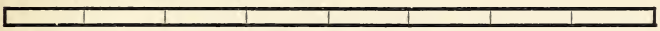
Point out halves and quarters.



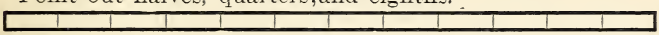
Point out fifths and tenths.



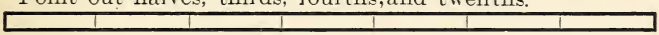
Point out thirds and sixths.



Point out halves, quarters, and eighths.

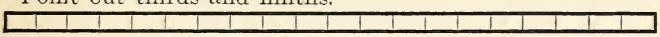


Point out halves, thirds, fourths, and twelfths.



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 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 $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{7}{10}$.

FRACTIONS AND RATIOS

1. Count by 3's from 21 to 36.

2. $3+3+3+3+3+3+3=?$ Seven 3's $=?$ $3\times 7=?$ $7\times 3=?$

3. Add 3 to 21. How many 3's are there in 24? What is $\frac{1}{3}$ of 24? $8\times 3=?$ $3\times 8=?$

4. Add 3 to 24. 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 $27=?$

5. Add 3 to 27. 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 $30=?$ $10\times 3=?$ $3\times 10=?$

6. $30+3=?$ 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? $33+3=?$

7. Count by 3's from 3 to 36. 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? $3\times 12=?$ $12\times 3=?$

8. $\frac{1}{3}$ of $36=?$ $\frac{1}{6}$ of $36=?$ $\frac{1}{12}$ of $36=?$ $\frac{1}{9}$ of $36=?$ $\frac{1}{4}$ of $36=?$

9. $\frac{1}{3}=\frac{?}{6}$. $\frac{1}{6}=\frac{?}{12}$. $\frac{1}{3}=\frac{?}{12}$. $\frac{1}{3}=\frac{?}{9}$.

10. What is the ratio to 36 of 3; 4; 6; 9; and 12?

11. What is the ratio of 36 to 3; 4; 6; 9; and 12?

12. What is the ratio of $\frac{1}{10}$ to $\frac{1}{5}$? of $\frac{1}{4}$ to $\frac{1}{12}$?

13. Take $\frac{1}{8}$ from $\frac{1}{4}$.

14. How much more is $\frac{1}{6}$ of 24 than $\frac{1}{8}$ of 24?

15. Find $\frac{3}{8}$ of 48.

FRACTIONS

The equal parts of numbers are called *fractions.*

Fold or cut paper to show facts in fractions.

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

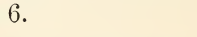
5. $\frac{1}{2}$ of $10 = ?$ **6.** $\frac{1}{2}$ of $12 = ?$ **7.** $\frac{1}{2}$ of $14 = ?$

8. $\frac{1}{2}$ of $16 = ?$ **9.** $\frac{1}{3}$ of $12 = ?$ **10.** $\frac{1}{3}$ of $15 = ?$

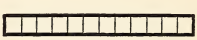
11. $\frac{1}{3}$ of $18 = ?$ **12.** $\frac{1}{3}$ of $21 = ?$ **13.** $\frac{1}{4}$ of $16 = ?$

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

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



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



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

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

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

20. What are $\frac{2}{3}$ of 18? 15? 21? 24? 27? 30?

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

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

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

24. 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?

25. What is $\frac{1}{12}$ of 24? 60? 144? 288?

TENS

I. What is the largest number that can be expressed by one figure?

II. What is the largest number that can be expressed by two figures?

III. In the number 100 is there any unit in units' place? Is there any ten in tens' place?

	A	*B*	*C*	*D*
1.	$40 + 10 = ?$	$90 + 10 = ?$	$50 + 10 = ?$	$70 + 10 = ?$
2.	$30 + 10 = ?$	$70 + 20 = ?$	$50 + 20 = ?$	$60 + 20 = ?$
3.	$30 + 30 = ?$	$20 + 30 = ?$	$20 + 10 = ?$	$20 + 20 = ?$
4.	$40 + 60 = ?$	$40 + 50 = ?$	$40 + 20 = ?$	$40 + 40 = ?$
5.	$60 + 40 = ?$	$60 + 30 = ?$	$50 + 40 = ?$	$50 + 50 = ?$
6.	$20 + 70 = ?$	$20 + 80 = ?$	$70 = 20 + ?$	$80 + 20 = ?$
7.	$40 + 60 = ?$	$30 + 70 = ?$	$60 = 30 + ?$	$50 + 40 = ?$

REVIEW QUESTIONS

8. How many times can 10 be taken from 30?

9. If 3 be taken three times from 15, what will be the remainder?

10. By how much does 20 exceed 11?

11. A boy had 13¢. He gave 4¢ to one boy and 5¢ to another. How many cents had he left?

12. How much must I add to 30 to make it 41?

13. After giving away 13 marbles, a boy had 21 left. How many had he at first?

14. What number must be taken from 17 to leave 11?

15. The sum of two numbers is 23, and the smaller number is 7. What is the larger number?

16. A boy had 23 apples. To how many boys could he give four apples each? and how many apples would he have left?

TENS

Copy and answer:

	A	*B*	*C*	*D*
1.	$55=50+?$	$40+?=50$	$70+9=?$	$30+1=?$
2.	$60=50+?$	$45+?=55$	$70+10=?$	$30+5=?$
3.	$65=55+?$	$50+?=60$	$90+1=?$	$30+8=?$
4.	$70=60+?$	$55+?=60$	$90+3=?$	$30+9=?$
5.	$75=70+?$	$55+?=65$	$90+5=?$	$30+10=?$
6.	$80=70+?$	$60+?=70$	$90+8=?$	$50+3=?$
7.	$85=80+?$	$65+?=75$	$90+9=?$	$50+5=?$
8.	$90=80+?$	$70+?=75$	$40+2=?$	$50+6=?$
9.	$95=90+?$	$80+?=85$	$40+4=?$	$50+7=?$
10.	$100=90+?$	$90+?=100$	$40+7=?$	$50+10=?$
11.	8 tens $=?$	$95+?=100$	$40+8=?$	$70+5=?$
12.	30 tens $=?$	70 tens $=?$	$40+10=?$	$70+6=?$
13.	10 tens $=?$	7 tens $=?$	$60+4=?$	$70+8=?$
14.	2 tens $=?$	40 tens $=?$	2 tens $\times 3=?$	20 tens $=?$

RECITE

15. Answer the questions by columns as well as by rows. Answer also without following any regular order.

16. How many different questions are there above on this page?

Answer:

	E	*F*	*G*	*H*
17.	$50-30=?$	$40-10=?$	$70-20=?$	$100-40=?$
18.	$80-60=?$	$50-20=?$	$80-20=?$	$100-30=?$
19.	$90-80=?$	$70-30=?$	$60-40=?$	$50-50=?$
20.	$90-60=?$	$80-50=?$	$70-60=?$	$40-30=?$

UNITS, TENS, HUNDREDS

How many units or ones does the figure 9 represent? 6? 8? 7? 4? 5?

Show these by such objects as splints, counters, pennies, dots, or crosses. The figure is not the number itself. It only represents the number of ones.

How many units do the figures 1 and 1 represent in 11? Each 1 does not represent the same number of units.

We read the letters in words from left to right, and we read the names of numbers also from left to right, as for example, 975, nine hundred seventy-five; but we tell the place and value of any figure by reading the figures themselves from right to left. In 11, beginning at the right, the first 1 means one unit, and the second 1 means ten units, or 1 ten.

The zeros in 10, in 20, in 30, show that there are no units in units' place, and that the 1, or 2, or 3 represents tens. Read 20, 30, 40, 50, 60, 70, 80, 90, and tell for what each figure stands.

1. In the number 19, which figure has greater value?

2. How many 1's or units are there in 18? in 12? in 13? in 17? in 14? in 16? in 15? in 19?

3. How many tens and how many units are there in 27? 36? 42? 68? 57? 79? 85? 93?

4. In 600, the first zero at the right shows that the number has no units, and the second zero shows that it has no tens. How many hundreds are there?

5. In 468, which figure has the greatest value? Which the least? Explain.

FIVES AND FIFTHS

1. $5 \div 5 = ?$ $10 \div 5 = ?$ $25 \div 5 = ?$ $35 \div 5 = ?$
   $45 \div 5 = ?$ $60 \div 5 = ?$ $50 \div 5 = ?$ $30 \div 5 = ?$
   $55 \div 5 = ?$ $20 \div 5 = ?$ $15 \div 5 = ?$ $40 \div 5 = ?$

2. $5\overline{)5}$ $5\overline{)10}$ $5\overline{)11}$ $5\overline{)12}$ $5\overline{)13}$ $5\overline{)14}$ $5\overline{)17}$
   $5\overline{)19}$ $5\overline{)20}$ $5\overline{)28}$ $5\overline{)30}$ $5\overline{)35}$ $5\overline{)39}$ $5\overline{)44}$
   $5\overline{)53}$ $5\overline{)47}$ $5\overline{)50}$ $5\overline{)54}$ $5\overline{)56}$ $5\overline{)59}$ $5\overline{)60}$

3. $\frac{1}{5}$ of $20 = ?$ $\frac{2}{5}$ of $20 = ?$ $\frac{3}{5}$ of $20 = ?$ $\frac{4}{5}$ of $20 = ?$
4. $\frac{1}{5}$ of $35 = ?$ $\frac{2}{5}$ of $35 = ?$ $\frac{3}{5}$ of $35 = ?$ $\frac{4}{5}$ of $35 = ?$
5. $\frac{1}{5}$ of $50 = ?$ $\frac{2}{5}$ of $50 = ?$ $\frac{3}{5}$ of $50 = ?$ $\frac{4}{5}$ of $50 = ?$
6. $\frac{1}{5}$ of $25 = ?$ $\frac{2}{5}$ of $25 = ?$ $\frac{3}{5}$ of $25 = ?$ $\frac{4}{5}$ of $25 = ?$
7. $\frac{1}{5}$ of $40 = ?$ $\frac{2}{5}$ of $40 = ?$ $\frac{4}{5}$ of $40 = ?$ $\frac{3}{5}$ of $40 = ?$
8. $\frac{1}{5}$ of $10 = ?$ $\frac{3}{5}$ of $10 = ?$ $\frac{4}{5}$ of $10 = ?$ $\frac{2}{5}$ of $10 = ?$
9. $\frac{1}{5}$ of $60 = ?$ $\frac{2}{5}$ of $60 = ?$ $\frac{3}{5}$ of $60 = ?$ $\frac{4}{5}$ of $60 = ?$
10. $\frac{1}{5}$ of $45 = ?$ $\frac{3}{5}$ of $45 = ?$ $\frac{2}{5}$ of $45 = ?$ $\frac{4}{5}$ of $45 = ?$
11. $\frac{1}{5}$ of $50 = ?$ $\frac{1}{10}$ of $50 = ?$ $\frac{1}{5} = \frac{?}{10}$ $50 \div ? = 25$
12. What is the ratio to 50 of 5, 10, and 25?
13. What is the ratio of 50 to 5, 10, and 25?

REVIEW DRAW

14. How many eighth notes equal two quarter notes in music?
15. Write measures of music, using quarter and eighth notes.
16. What is the volume of a cube 3 in. by 4 in. by 6 in.? What is the volume of a second cube whose ratio to the first cube is $\frac{1}{2}$?

NUMERATION TABLE

Periods	4th Billions			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	3d hundreds	2d tens	1st units
	8	1	6	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: Eight hundred sixteen billion, three hundred twenty-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; 10,660,608; 25,877,707; 100,767,100; 475,658,293; 1,500,000,000; 100,100,100,100.

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 billion, one hundred 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. Twenty-five million, four hundred eighty-six thousand, three hundred fifteen.

e. Five hundred fifty-five million, six hundred thirty-four-thousand, twenty-two.

f. Three hundred ninety-one 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 801,007,010 are how many units? tens? hundreds? thousands? ten-thousands? hundred-thousands? millions? hundred-millions?

MULTIPLICATION TABLE 8

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 forward from 1 and backward from 100, emphasizing the numbers printed in **black face** figures.

2. Learn this table.

$8 \times 1 = 8$	$8 \times 5 = 40$	$8 \times 9 = 72$
$8 \times 2 = 16$	$8 \times 6 = 48$	$8 \times 10 = 80$
$8 \times 3 = 24$	$8 \times 7 = 56$	$8 \times 11 = 88$
$8 \times 4 = 32$	$8 \times 8 = 64$	$8 \times 12 = 96$

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

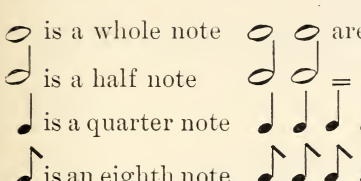
10	11	12	4	7	8	8	8	8
8	8	8	8	8	8	6	5	9

5. $64 \div 8 \div 4 = ?$ $96 \div 12 \div 6 = ?$ $6 \times 2 \times 4 = ?$
$24 \div 3 \times 6 = ?$ $88 \div 11 \div 4 = ?$ $72 \div 8 \div 3 = ?$

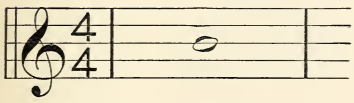
6. What is the highest number that multiplied by 12 gives a number less than 100? Notice that $2 \times 12 = ?$ $3 \times 12 = ?$ $4 \times 12 = ?$ $5 \times 12 = ?$ $6 \times 12 = ?$ $7 \times 12 = ?$ $8 \times 12 = ?$ Add another 12 to 8×12. $9 \times 12 = ?$

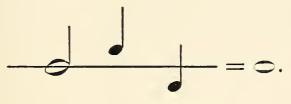
MUSIC FRACTIONS

In music we have equal parts or fractions of time. A whole note is the musical unit of time.



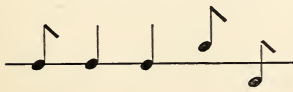
The space between the two vertical bars in this drawing is one measure. One whole note would take all the time in this measure. Two half notes would take all the time. Two quarter notes and one half note would also take all the time.

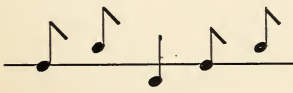


1. 

2. 

3. 

4. 

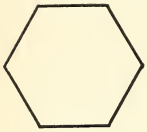
5. 

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. $\frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 1.$

MANY-SIDED FIGURES

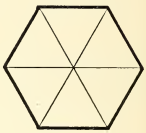
The bees always make their cells with six sides of equal length. A figure with six equal sides is called a hexagon. We can find its center by drawing lines to opposite angles. Where the lines cross is the center of the hexagon. These lines divide the hexagon into six equal parts.

Hexagon

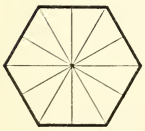


Each one of these equal parts is a triangle. If we divide each side of the hexagon into two equal parts, and draw a line inside of each triangle from the center of the hexagon to the middle point of each side, the hexagon will have twelve equal parts and twelve triangles.

Sixths



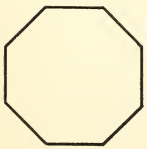
Twelfths



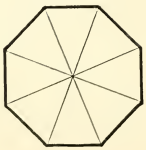
1. Point out $\frac{1}{6}$ of the hexagon; $\frac{2}{6}$; $\frac{3}{6}$.
2. Point out $\frac{1}{12}$ of the hexagon; $\frac{2}{12}$; $\frac{3}{12}$; $\frac{4}{12}$; $\frac{5}{12}$; $\frac{6}{12}$.
3. Show that $\frac{1}{2} = \frac{3}{6} = \frac{6}{12}$ of the hexagon.
4. Show that $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$ 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

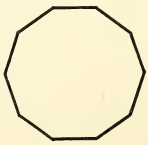


Eighths

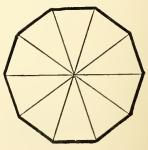


A figure with ten sides is called a

Decagon



Tenths



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. $\frac{1}{2} = \frac{?}{4}$ $\frac{1}{2} = \frac{?}{6}$ $\frac{1}{2} = \frac{?}{8}$ $\frac{1}{8} = \frac{?}{12}$ $\frac{1}{2} = \frac{?}{20}$

$\frac{1}{2}$ equals any fraction of which the number of parts taken is $\frac{1}{2}$ of the whole number of equal parts. If there are ten equal parts, then $\frac{1}{2} = \frac{5}{10}$, $\frac{1}{2}$ = five of the ten equal parts.

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 fraction of which the number of equal parts is three times the number of equal parts taken.

The **numerator** of a fraction, written above the line shows the number of parts taken, and the **denominator**, written below the line, shows the number of equal parts.

REVIEW

10. Point off into periods and read:

1000000 1217633 3939390 4000004 38714672
44699216 355466219 716219622 556623288 700015271

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 15 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?

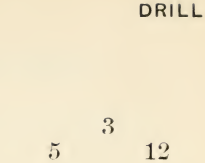
9. John's father needed 18 two-cent stamps for his letters to go to places in this country, and 2 five-cent stamps for letters to go to England. How much money should he give John to take to the post office to pay for letters?

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?

REVIEW



This circle list may be used as the outline of many 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: $3 + 5 + 8$, and so on to 12.

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 circle list.

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. Give the ratios of 12 to 7, 12 to 4, and so on; of 7 to 3, 7 to 5, and so on.

14. Draw pictures to illustrate the questions in **13**.

15. If sugar is 5¢ a lb., milk is 7¢ a qt., eggs are 2¢ each, bread is 8¢ a loaf, and so for a list to be made beside the "watch," let Mary and John and William try to find the costs of the number of pounds or of things put on the face of the watch.

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.

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 is the ratio to 96: of 6; 8; 12; 24; and 32?

5. What is the ratio of 96: to 6; 8; 12; 24; and 32?

6. $\frac{1}{8}$ of 40 = ? $\frac{2}{8}$ of 40 = ? $\frac{1}{4}$ of 40 = ? $\frac{1}{4} = \frac{?}{8}$

MULTIPLICATION

Products not over 100.

$$\left.\begin{matrix} 8\times12 \\ 12\times8 \\ 3\times32 \\ 32\times3 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 5\times9 \\ 9\times5 \\ 3\times15 \\ 15\times3 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 5\times6 \\ 3\times10 \\ 6\times5 \\ 10\times3 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 8\times4 \\ 2\times16 \\ 4\times8 \\ 16\times2 \end{matrix}\right\}=?$$

$$\left.\begin{matrix} 9\times8 \\ 6\times12 \\ 8\times9 \\ 12\times6 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 4\times12 \\ 6\times8 \\ 12\times4 \\ 8\times6 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 3\times6 \\ 2\times9 \\ 6\times3 \\ 9\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 2\times6 \\ 3\times4 \\ 6\times2 \\ 4\times3 \end{matrix}\right\}=?$$

$$\left.\begin{matrix} 9\times11 \\ 11\times9 \\ 3\times33 \\ 33\times3 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 8\times10 \\ 4\times20 \\ 10\times8 \\ 20\times4 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 2\times10 \\ 5\times4 \\ 10\times2 \\ 4\times5 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 7\times10 \\ 10\times7 \\ 2\times35 \\ 35\times2 \end{matrix}\right\}=?$$

$$\left.\begin{matrix} 9\times6 \\ 6\times9 \\ 2\times27 \\ 27\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 6\times10 \\ 5\times12 \\ 10\times6 \\ 12\times5 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 6\times7 \\ 7\times6 \\ 2\times21 \\ 21\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 5\times10 \\ 2\times25 \\ 10\times5 \\ 25\times2 \end{matrix}\right\}=?$$

$$\left.\begin{matrix} 4\times4 \\ 8\times2 \\ 2\times8 \\ 3\times12 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 7\times5 \\ 5\times7 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 7\times3 \\ 3\times7 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 11\times8 \\ 8\times11 \end{matrix}\right\}=?$$

$$\left.\begin{matrix} 7\times8 \\ 8\times7 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 2\times7 \\ 7\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 3\times9 \\ 9\times3 \end{matrix}\right\}=?$$

$$\left.\begin{matrix} 6\times6 \\ 12\times3 \\ 4\times9 \\ 2\times18 \\ 9\times4 \\ 18\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 8\times3 \\ 6\times4 \\ 3\times8 \\ 2\times12 \\ 4\times6 \\ 12\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 4\times10 \\ 8\times5 \\ 10\times4 \\ 5\times8 \\ 2\times20 \\ 20\times2 \end{matrix}\right\}=?\qquad \left.\begin{matrix} 10\times10 \\ 2\times50 \\ 50\times2 \\ 4\times25 \\ 25\times4 \end{matrix}\right\}=?$$

$$9\times9=?$$

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 with a period . 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 altogether 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 and the tens of dollars together.

There are never any hundreds of cents to add together, because hundreds of cents are units of dollars.

200¢ = $? 300¢ = $? 500¢ = $? 800¢ = $?

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 and tell why we use each of the zeros that you see in the four different numbers of dollars and cents.

4. From \$2.40 take \$1.30.

\$2.40
1.30
\$1.10

0¢ less 0¢ are 0¢. Write 0 in units' place.
4 tens ¢ less 3 tens ¢ are 1 ten ¢.
\$2 less \$1 is \$1. The *decimal point* in the answer divides the ¢ from the \$.

5. Subtract

\$2.75	\$3.85	\$12.90	\$8.35	\$6.40
1.45	1.85	9.85	7.25	.03

6. From \$2.45 take \$1.98.

\$2.45
1.98
.47

We cannot take from 5¢ 8¢, but from 4 tens ¢ we can take 1 ten ¢. 15¢ − 8¢ = 7¢.
We cannot take 9 tens ¢ from 3 tens ¢, but from 20 tens ¢ we can take 10 tens ¢.

13 tens − 9 tens = 4 tens. \$1 − \$1 = \$0.

7. Subtract

\$3.60	\$2.15	\$10.20	\$20.00	\$32.15
1.75	.90	3.50	8.75	10.00

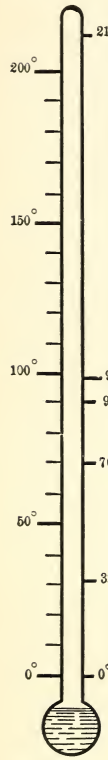
8. Mary had three dollars and seventy cents, and spent one dollar and a quarter for a beautiful doll. How much money had she left?

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 the fire goes out, we feel 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 or how cold it is. Thermometer is from *thermo*, heat, and *meter*, measure. Inside the glass of the thermometer is a liquid heavier than water. This is a metal called quicksilver or mercury. It looks like silver, but it flows quickly. Did you ever see little balls of quicksilver run across a table? This quicksilver needs more room and goes up the tube of the glass, when it is warm, but gets smaller and goes down in the glass when it is cold. If the glass is put in water with broken ice in it, the quicksilver goes to 32°. If we hold the bulb or thick end tight in one hand, the quicksilver goes nearly to 98°. In boiling water the quicksilver marks 212°. Hot weather is 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 pleasant at that temperature or warmth, 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.

DATES

There are always seven days in every week. There are always at least four weeks or twenty-eight days in every month. There are twelve months in every year. A hundred years make one century. We are living in the twentieth century, because it is more than 1900 years since Jesus Christ was born. 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 we tell 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.

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				

This calendar is true for any month when the first day of the month falls on Sunday and when the month has 31 days. This calendar represents December, 1901, and March, 1903. If the 31st day were omitted, it would represent June, 1902, and November, 1903, also.

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.

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. What is the ratio of $\frac{1}{8}$ to $\frac{1}{2}$? of $\frac{1}{4}$ to $\frac{1}{8}$?

5. Draw a square with an area of 16 sq. in.

6. What is the volume in cubic inches of a cube $2 \times 3 \times 4$?

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 altogether to make one whole note of time in the measure.

13. What is the ratio of 7 apples to 1 apple? of 10 boys to 100 boys? of 1000 soldiers to 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.

$7 \times 5 = 35$

$7 \times 10 = 70$

105

Though we must understand multiplication in this way, we should learn to write the process in a simpler way.

$\begin{array}{r} 15 \\ 7 \\ \hline 105 \end{array}$

3. Find 9×25.

$9 \times 5 = 45$

$25 = 5 + 20$

$9 \times 20 = 180$

$\begin{array}{rr} 45 & 25 \\ 180 & 9 \\ \hline 225 & 225 \end{array}$ multiplicand, multiplier, product

4. Multiply:

16	15	13	14	20	17	18
4	5	7	5	6	7	6

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. How many pounds do you think a buggy weighs? an ordinary carriage? a good carriage-horse? a cow? a ten-year-old boy?

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?

REVIEW

1.	2.	3.	4.	5.	6.	7.	8.
8)24	9)45	2)16	5)35	7)14	3)8	2)30	6)54
6)42	2)11	6)48	3)9	5)30	7)35	9)63	10)50
10)20	10)80	5)50	9)18	8)24	3)21	2)7	7)42
8)18	3)23	5)52	9)72	3)10	4)36	4)16	10)60
12)48	6)54	4)8	7)21	7)28	4)32	7)84	6)12
5)15	8)32	7)63	8)72	11)55	7)56	2)22	9)81
4)40	8)48	4)28	4)12	5)15	3)27	10)100	7)35
5)7	4)30	10)70	2)4	8)16	6)30	3)13	4)4
5)45	10)10	3)15	4)20	2)18	2)14	7)70	5)40
9)9	5)20	4)21	5)35	2)17	8)80	9)11	6)18
8)56	6)36	7)17	8)28	8)40	9)36	3)18	6)20
10)90	7)63	6)60	4)24	10)80	3)20	8)64	2)10
3)13	3)24	10)40	7)49	10)83	9)90	2)12	9)63
8)24	3)26	5)25	3)6	9)54	9)92	6)24	5)35

9.	10.	11.
$2\times3\times3\times3=?$	$2\times2\times2\times2=?$	$3\times2\times2\times2\times3=?$
$7\times2\times2\times2=?$	$2\times3\times3=?$	$3\times3\times2\times5=?$
$3\times2\times2\times5=?$	$2\times2\times5=?$	$3\times2\times2\times2\times2=?$
$3\times7\times3=?$	$2\times2\times3\times3=?$	$3\times3\times11=?$
$2\times3\times11=?$	$2\times2\times7=?$	$2\times5\times2\times5=?$
$7\times2\times5=?$	$2\times5\times3=?$	$2\times2\times2\times5=?$
$3\times2\times2\times2\times3=?$	$2\times2\times2\times2\times2=?$	$2\times3\times7=?$
$2\times2\times2\times2\times5=?$	$2\times2\times3\times3=?$	$2\times3\times2\times2\times2=?$
$3\times3\times3\times3=?$	$5\times2\times2\times5=?$	$2\times5\times5=?$

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.

Proof:

249
249
249
249
249
249
249
1743

Seven times 4 tens are 28 tens; then 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; then 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.

2. Multiply 4 by 370.

370	multiplicand
4	multiplier
1480	product

Add 4 times 370.

Proof:

370
370
370
370
1480

3. Multiply 21 by 5 and the product by 3. $21 \times 5 \times 3 = 315$.

21
5
105
3
315

Proof:

21
21
21
21
21
105

105
105
105
315

4. Multiply these numbers:

I	II	III	IV	V	VI	VII	VIII	IX
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

$$\begin{array}{r} \$2.40 \\ 4 \\ \hline \$9.60 \end{array}$$

We multiply just as in ordinary multiplication: $0 \times 4 = 0$. $4 \times 4 = 16$. $2 \times 4 = 8$. $8 + 1 = 9$. 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 figures 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:

$15.00	$3.33	$5.00	$5.00	$20.00
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, we write our problem as in this case.

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 2¢ × 65?

$$\begin{array}{r} 65 \\ 2¢ \\ \hline 130¢ \end{array}$$

$130¢ = 100¢ + 30¢$

$100¢ = \$1.$ $\quad 30¢ = \$.30$

$130¢ = \$1.30$

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?

$$\begin{array}{r} 91 \\ \$.05 \\ \hline \$4.55 \end{array}$$

Here again we use the amount to be multiplied; 5 cents, 5¢, or $.05 as the apparent multiplier.

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 the answers to the first five, by either method.

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 of 1.

5317
5317
5317
5317
5317
5317
5317
5317
42,536

2d proof of 1.

8 7's are 56. Write 6. Carry 50.

8 10's are 80.

80 + 50 = 130.

Write 30. Carry 100.

8 300's are 2400.

2400 + 100 = 2500.

Write 500. Carry 2000.

8 5,000's are 40,000.

40,000+2,000=42,000.

6
30
500
2000
40000
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? How many feet did he ride?

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?

REVIEW RECITE

6. John and Tom had a dozen and a half trout which they caught in a brook. Each trout weighed about $\frac{1}{2}$ lb. 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?

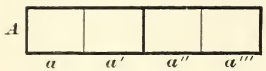
9. Make a drawing to show that $\frac{1}{3}$ of anything equals $\frac{2}{6}$ of it.

10. Multiply

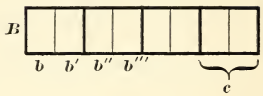
15	20	31	64	28	71	52	31	23	25
6	7	5	4	3	7	9	12	11	8

RATIOS, 2, 4, 8, 3, 6, 12

Halves and Fourths



Fourths and Eighths



1. Compare a, a', a'', a'''. Read these a, a prime, a second, a third.

2. Compare $a + a'$ with A.

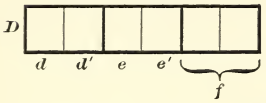
3. What part of A is a? $a + a'$? $a + a' + a''$?

4. Is it true that $\frac{1}{2}$ of A equals $\frac{2}{4}$ of A?

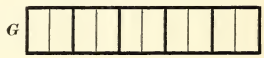
5. Into how many parts is B divided? What part of B is b? c? $b + b'$?

6. Is it true that $\frac{1}{2}$ of B equals $\frac{4}{8}$ of B?

Thirds and Sixths



Fifths and Tenths

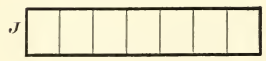


Read = equal

7. Does $\frac{2}{3}$ of $D = \frac{4}{6}$ of D? $\frac{4}{5}$ of $G = \frac{8}{10}$ of G?

8. Compare $d + d'$ with $e + e' + f$.

Sevenths



Twelfths

9. Is $\frac{3}{7}$ more or less than $\frac{1}{2}$? Measure.

10. Show that $\frac{3}{12} = \frac{1}{4}$; $\frac{2}{12} = \frac{1}{6}$; $\frac{4}{12} = \frac{1}{3}$; $\frac{6}{12} = \frac{1}{2}$.

11. When is the ratio of one number to another represented by a whole number? When is it represented by a fraction?

FRACTIONS AND RATIOS

1. What is the ratio of 1¢ to 9¢? of 9¢ to 1¢?

2. What is the ratio of 6¢ to 1¢? of 6¢ to 3¢? of 4¢ to 2¢?

3. What part of 50 is 5? of 500 is 5?

4. What is $\frac{1}{12}$ of a dozen?

5. What is the ratio of 1 to 12? of 12 to 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. What is the ratio of 2 to 10? of 10 to 2?

12. A basket contained 14 eggs. The cook took out $\frac{1}{7}$ of them. How many eggs did she take out?

13. What is the ratio of 2 eggs to 14 eggs?

14. George had 15 pears. He gave away 3. What part did he give away?

15. What is the ratio of 3 to 15? of 15 to 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 $2 \times \frac{1}{2}$? Why?

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 16 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?

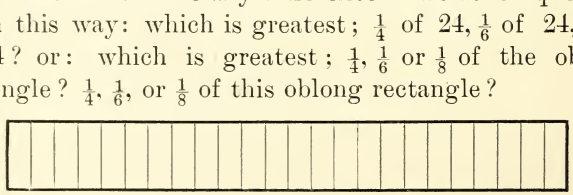
11. $\frac{3}{5}$ of 15 figs are how many figs?

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. Would it make any difference if we asked question 14 in this way: which is greatest; $\frac{1}{4}$ of 24, $\frac{1}{6}$ of 24, or $\frac{1}{8}$ of 24? or: which is greatest; $\frac{1}{4}$, $\frac{1}{6}$ or $\frac{1}{8}$ of the oblong rectangle? $\frac{1}{4}$, $\frac{1}{6}$, or $\frac{1}{8}$ of this oblong rectangle?



16. Point out $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{12}$ of this oblong.

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)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)429
2. $\frac{81}{9} = ?$
3. $96 \div 12 = ?$
4. 11)132
5. 6)737
6. $\frac{48}{8} = ?$
7. $108 \div 9 = ?$
8. 11)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.

$$\begin{array}{r} 2)\overline{486} \\ \overline{243} \end{array}$$

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:

$$\begin{array}{r} 400 \div 2 = 200 \\ 80 \div 2 = 40 \\ 6 \div 2 = 3 \\ \hline 486 \div 2 = 243 \end{array}$$

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.

$$\begin{array}{r} 3)\overline{1842} \\ \overline{614} \end{array}$$

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.

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?

GENERAL REVIEW

1. Write in figures these fractions: three fourths, two fifths, one sixth, seven twelfths, nine tenths, five ninths.

2. If a line is one inch long, show by drawing other lines under it the ratios $\frac{1}{2}$, 2, 3, and 5.

3. A measure of music in $\frac{4}{4}$ time had in it four notes; of these one was a half note and another was a quarter note. The other two were equal. What were they?

4. The minute hand was two fifths of the way around the clock from XII. How many minutes was it past twelve?

5. What is the ratio of 20 minutes to an hour? Draw a circle to show this.

6. Draw a pentagon and divide it into ten equal parts.

7. Write three fractions that equal one third.

8. What fraction with a unit as its numerator equals two eighths? three twelfths? Show these facts by drawings.

9. What is the volume of a cube $\frac{1}{2}$ in. $\times$ 3 in. $\times$ 6 in.?

10. What is a fraction?

11. Write in words these numbers: 1070, $\frac{7}{9}$, 1214860.

12. Which is larger, one eighth or one tenth of anything?

13. John bought a quarter's worth of eggs at 15¢ a dozen. How many did he buy?

14. Mary bought six slate pencils for 2¢; but Tom got ten for 4¢. Whose pencils were cheaper? Why?

15. It was 150° in the sun, but 98° in the shade. What was the difference in number of degrees?

MULTIPLICATION TABLE, 9

9 gives us an interesting multiplication table.

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

1. Notice that the multiples of 9 in this *number table* present the appearance of steps, in lines like stairs.

A **multiple** is the product of one number by another.

2. 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.

3. Learn this table:

$9 \times 1 = 9$	$9 \times 5 = 45$	$9 \times 9 = 81$
$9 \times 2 = 18$	$9 \times 6 = 54$	$9 \times 10 = 90$
$9 \times 3 = 27$	$9 \times 7 = 63$	$9 \times 11 = 99$
$9 \times 4 = 36$	$9 \times 8 = 72$	$9 \times 12 = 108$

4. Answer: $3\overline{)9}$ $18 \div 9 = ?$ $18 \div 6 = ?$ $18 \div 2 = ?$ $18 \div 3 \div 3 = ?$ $3\overline{)27}$ $36 \div 9 = ?$ $36 \div 12 = ?$ $36 \div 6 = ?$ $5\overline{)45}$ $9\overline{)54}$ $7\overline{)63}$ $8\overline{)72}$ $9\overline{)81}$ $10\overline{)90}$ $11\overline{)99}$ $9\overline{)108}$

5. In what other multiplication tables do we have the multiples of 9 as far as 100?

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

1. Write this number table in two colors.

2. Counting by ones, we find one seven in seven and two sevens in fourteen. How many sevens do we find in 21? in 28? in 35? in 42? in 49? in 56? in 63? in 70? in 77? in 84?

3. Do you notice to what number of times we carry each multiplication table?

4. Learn this table:

$7 \times 1 = 7$	$7 \times 5 = 35$	$7 \times 9 = 63$
$7 \times 2 = 14$	$7 \times 6 = 42$	$7 \times 10 = 70$
$7 \times 3 = 21$	$7 \times 7 = 49$	$7 \times 11 = 77$
$7 \times 4 = 28$	$7 \times 8 = 56$	$7 \times 12 = 84$

5. Answer: $49 \div 7 =$ $77 \div 11 =$ $84 \div 12 =$ $35 \div 7 =$?
$56 \div 7 =$ $63 \div 9 =$ $28 \div 7 =$ $70 \div 7 =$ $42 \div 6 =$?

6. Multiply:

8	7	12	11	6	9	10	4	5
7	7	7	7	7	7	7	7	7

FRACTIONS AND RATIOS

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 is the ratio of 8 to 16? of 16 to 8? of 8 to 8?

$10 \div 8 = ?$ $12 \div 8 = ?$ $15 \div 8 = ?$ $19 \div 8 = ?$

7. $8\overline{)9}$ $8\overline{)11}$ $8\overline{)13}$ $8\overline{)14}$ $8\overline{)17}$ $8\overline{)20}$

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. What is the ratio of 9 to 18? of 18 to 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. $9\overline{)11}$ $9\overline{)13}$ $9\overline{)15}$ $9\overline{)19}$ $9\overline{)16}$ $9\overline{)18}$

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 $18¢ = ?$

FRACTIONS

1. What is $\frac{1}{9}$ of 27? $\frac{1}{3}$ of 27 = ? $\frac{2}{9}$ of 27 = ? $\frac{3}{9}$ of 27 = ? $\frac{3}{9}$ = what other fraction?

2. $\frac{4}{9}$ of 27 = ? $\frac{5}{9}$ of 27 = ? $\frac{8}{9}$ of 27 = ? $\frac{2}{3}$ of 27 = ? $\frac{6}{9}$ of 27 = ? Then $\frac{2}{3}$ = what other fraction?

3. What is $\frac{1}{3}$ of 30? $\frac{2}{3}$ of 30? $\frac{3}{3}$ of 30?

4. What is $\frac{1}{4}$ of 40? $\frac{2}{4}$ of 40? $\frac{3}{4}$ of 40? $\frac{4}{4}$ of 40?

5. What is $\frac{1}{5}$ of 50? $\frac{3}{5}$ of 50? $\frac{5}{5}$ of 50?

6. What is $\frac{1}{6}$ of 60? $\frac{2}{6}$ of 60? $\frac{4}{6}$ of 60? $\frac{5}{6}$ of 60?

7. What is $\frac{1}{7}$ of 70? $\frac{3}{7}$ of 70? $\frac{6}{7}$ of 70?

8. What is $\frac{1}{8}$ of 80? $\frac{4}{8}$ of 80? $\frac{7}{8}$ of 80?

9. $10\overline{)20}$ $\frac{1}{10}$ of 20 = ? $\frac{1}{10}$ of 30 = ? $10\overline{)30}$ $\frac{2}{10}$ of 30 = ?

10. $\frac{1}{10}$ of 40 = ? $10\overline{)40}$ $10\overline{)50}$ $\frac{1}{10}$ of 50 = ? $\frac{3}{10}$ of 50 = ?

11. $\frac{1}{10}$ of 60 = ? $10\overline{)60}$ $\frac{1}{10}$ of 70 = ? $10\overline{)70}$ $\frac{2}{10}$ of 70 = ?

12. $10\overline{)80}$ $\frac{1}{10}$ of 80 = ? $10\overline{)90}$ $\frac{1}{10}$ of 90 = ? $10\overline{)100}$ $\frac{1}{10}$ of 100 = ?

13. How many 9's are there in 81? $\frac{1}{9}$ of 81 = ? $9 \times 9 = ?$ $81 + 9 = ?$

14. How many 9's are there in 90? $90 = 9 \times ?$

15. What is $\frac{1}{9}$ of 90? $\frac{1}{10}$ of 90 = ?

16. How many 10's are there in 90? $10 \times 9 = ?$

17. Divide 245 by 4 exactly.

$4\overline{)245}$

$61\frac{1}{4}$

4 is contained in 24 tens 6 times, without remainder. 4 is contained in 5 once, with 1 unit remaining. $1 \div 4 = \frac{1}{4}$.

18. Divide 267 by 4, 5, 3, 7, 9, and 8.

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 is the ratio of 7 to 49? of 49 to 7? of 77 to 7? of 14 to 7? of 7 to 63? of 7 to 84?

5. $\frac{1}{8}$ is the ratio of 7 to — ? $\frac{1}{2}$ is the ratio of 7 to — ?

6. $\frac{1}{12}$ is the ratio of 7 to — ? $\frac{1}{9}$ is the ratio of 7 to — ?

7. 2 is the ratio of 14 to — ? 4 is the ratio of 28 to — ?

8. 12 is the ratio of 84 to — ? 5 is the ratio of 35 to — ?

MULTIPLICATION TABLE, 11

The number 11 gives us the easiest multiplication table.

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. The multiples of 11 in black face figures, like the multiples of 9, make a line of stairs in the *number table.*

2. In all multiples of 11 below 100 the figures for units and tens are the same.

3. Learn this table.

$11 \times 1 = 11$	$11 \times 5 = 55$	$11 \times 9 = 99$
$11 \times 2 = 22$	$11 \times 6 = 66$	$11 \times 10 = 110$
$11 \times 3 = 33$	$11 \times 7 = 77$	$11 \times 11 = 121$
$11 \times 4 = 44$	$11 \times 8 = 88$	$11 \times 12 = 132$

4. Answer: $2 \times 2 \times 11 = ?$ $8)\underline{88}$ $7 \times 11 = ?$ $11 \times 5 = ?$ $132 \div 11 = ?$ $11 \times 11 = ?$ $3 \times 3 \times 11 = ?$ $3 \times 2 \times 11 = ?$ $11)\underline{99}$ $3 \times 2 \times 2 \times 11 = ?$ $11 \times 3 = ?$ $11)\underline{110}$ $12)\underline{132}$

5. Of these numbers, which can be divided evenly without remainders by other numbers — 4, 5, 6, 7, 8, 9, 10, 11, 12?

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. $4 = ? \times 2$. $10 = ? \times 5$. $6 = ? \times 3$. $8 = ? \times 4$. $9 = ? \times 3$. $12 = 2 \times 2 \times 3$. $7 \times 12 = ?$ $11 \times 12 = ?$ $12 \times 12 = ?$

REVIEW

1. How many 9's are there in 99? $\frac{1}{9}$ of 99 = ?
$\frac{2}{9}$ of 99 = ? $\frac{3}{9}$ of 99 = ? $\frac{5}{9}$ of 99 = ? $\frac{7}{9}$ of 99 = ? $\frac{8}{9}$ of 99 = ?

2. $11 \times 12 = ?$ $12 \times 11 = ?$ $132 \div 12 = ?$ $132 \div 11 = ?$

3. How many 12's are there in 132? How many 11's?
$\frac{1}{12}$ of 132 = ? $\frac{1}{11}$ of 132 = ? $\frac{2}{12}$ of 132 = ? $\frac{3}{12}$ of 132 = ?
$\frac{7}{12}$ of 132 = ?

4. $11 \times 11 = ?$ $\frac{1}{11}$ of 121 = ? $\frac{3}{11}$ of 121 = ? $\frac{7}{11}$ of 121 = ?

5. What part of 121 is 11? What is the ratio of 11 to 121?

6. $12 \times 5 = ?$ $12 \times 6 = ?$ $12 \times 8 = ?$ $12 \times 12 = ?$
$\frac{1}{12}$ of 144 = ? $\frac{2}{12}$ of 144 = ? $\frac{3}{12}$ of 144 = ? $\frac{4}{12}$ of 144 = ?
$\frac{6}{12}$ of 144 = ? $144 \div 12 = ?$ How many 12's in 144?

7. 9)108 12)144 11)110 10)120 12)108 10)100

10)110 12)120 12)132 11)132 11)121 12)144

8. Multiply 9, 12, 11, 10, 8, 5, 3, 7, 6, 4, by 9 and add 4; by 10 and add 2; by 11 and add 3; by 12 and add 5.

9. Find the products:

$42 \times 11 = ?$ $13 \times 12 = ?$ $18 \times 12 = ?$ $76 \times 11 = ?$
$19 \times 12 = ?$ $98 \times 12 = ?$ $99 \times 12 = ?$ $65 \times 12 = ?$
$5 \times 3 \times 4 = ?$ $6 \times 4 \times 5 = ?$ $6 \times 7 \times 2 = ?$ $8 \times 10 \times 5 = ?$
$11 \times 3 \times 12 = ?$ $6 \times 15 \times 4 = ?$ $3 \times 17 \times 5 = ?$ $8 \times 5 \times 13 = ?$
$7 \times 6 \times 15 = ?$ $11 \times 7 \times 6 = ?$ $12 \times 5 \times 4 = ?$ $3 \times 11 \times 5 = ?$

ROMAN NUMERALS

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.

I = 1 V = 5 X = 10 L = 50 C = 100 D = 500 M = 1000

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 is the ratio of C to L? of D to C? of XVIII to IX? of XVI to XII? of XL to XX? of M to D?

SIMPLE CANCELLATION

3. Willie bought 8 lb. of brown sugar for his mother at $4\frac{1}{2}¢$ a pound. What was the cost?

$4\frac{1}{2}¢ = \frac{9}{2}¢$. $9¢ \times 4 = 36¢ = \frac{9}{2}¢ \times 8$. $\frac{9}{2}¢ \times 8 = 9¢ \times 4$, for $\frac{1}{2} \times 8 = 1 \times 4$.

4. Mary bought 12 paper dolls at $1\frac{1}{3}¢$ each. What did she pay? $1\frac{1}{3}¢ = \frac{4}{3}¢$. $12 \times \frac{4}{3}¢ = 4 \times 4¢$, for $12 \times \frac{1}{3} = 4 \times 1$. Explain in full the processes partly omitted in 3 and 4.

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 is the ratio of a ton of coal to four hods of coal that weigh twenty-five pounds each?

14. What is the ratio of 3 yd. to 2 ft.? to 12 ft.? to 36 ft.?

15. Name some numbers that have the ratio of 10 to 3, 7, 9, 10, 50, 8, 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

$$\begin{array}{r} 6)\$3.30 \\ \$.55 \end{array}$$

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?

$$\begin{array}{r} 8)\$3.60 \\ \$.45 \end{array}$$

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 (n.)
10 cents make one dime (d.)
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. At 5¢ apiece how many cents will 7 oranges cost?

15. James bought 4 oranges at 4¢ each. What change should he get from a quarter which he gave in payment?

TIME MEASURE.

30 days are usually counted as 1 month.

1 mo. = 30 days.

365 days are usually counted as 1 year.

1 yr. = 365 days.

There are about $52\frac{1}{7}$ 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 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

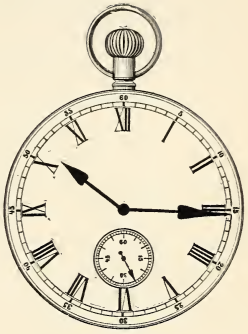
1 day = 24 hrs.

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 2 hr. 5 min.?
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 vacations do we have?

TIME

1. In which month does New Year's Day come?

2. In which month does Washington's Birthday come?

3. In which month does your birthday come?

4. Lincoln's Birthday comes in the month of ——.

5. Memorial Day comes in the month of ——.

6. Independence Day is ——.

7. Thanksgiving Day is usually the last Thursday in ——.

8. Christmas Day is the 25th 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?

REVIEW

1.

$8 + 3 + 4 + 1 = ?$	$7 + 6 + 3 - 6 = ?$
$5 + 5 + 5 - 4 = ?$	$6 + 7 - 2 = ?$
$3 + 4 + 1 + 2 = ?$	$9 + 1 + 5 - 3 = ?$
$4 + 4 - 2 - 9 = ?$	$12 - 6 - 3 = ?$
$26 - 10 - 5 - 1 = ?$	$18 + 2 + 4 - 1 = ?$

2. How many 2's are in 22? How many 11's in 22?

$\frac{1}{11}$ of $22 = ?$	$\frac{2}{11}$ of $22 = ?$	$\frac{3}{11}$ of $22 = ?$
$\frac{5}{11}$ of $22 = ?$	$\frac{8}{11}$ of $22 = ?$	$\frac{10}{11}$ of $22 = ?$
$\frac{11}{11}$ of $22 = ?$	$\frac{1}{2}$ of $22 = ?$	$\frac{2}{2}$ of $22 = ?$

3. 9)12 8)14 3)17 5)21 6)16 4)13 6)21 3)20

2)24 2)22 8)24 6)24 3)24 4)24 11)22 12)24

4.	**5.**	**6.**	**7.**
$24 = 8 \times ?$	$24 = 6 \times ?$	$24 = 4 \times ?$	$24 = 3 \times ?$
$24 = 2 \times ?$	$24 = 12 \times ?$	$22 = 11 \times ?$	$22 = 2 \times ?$
$24 = ? \times 3$	$24 = ? \times 6$	$24 = ? \times 8$	$22 = ? \times 2$
$24 = ? \times 12$	$24 = ? \times 4$	$6 \times ? = 24$	$8 \times ? = 24$
$11 \times ? = 22$	$3 \times ? = 24$	$12 \times ? = 24$	$4 \times ? = 24$
$2 \times ? = 22$	$2 \times ? = 24$	$7 + 3 - 5 = ?$	$8 + 5 - 4 = ?$

8. $2 + 4 - 1 = ?$ $16 - 6 + 5 = ?$ $20 - 12 - 1 = ?$

9. $10 - 4 - 2 = ?$ $8 - 5 + 3 = ?$ $6 - 2 + 1 = ?$

10. $20 - 10 - 4 = ?$ $12 - 6 + 2 = ?$ $18 - 9 - 4 = ?$

11. Add:

18	16	21	13	17	19	19	17	18
14	15	10	11	14	12	14	15	17

12. Add:

\$4	3 min.	5 yd.	4 ft.	9 in.
\$6	2 min.	3 yd.	7 ft.	3 in.
\$6	5 min.	5 yd.	8 ft.	2 in.

FRACTIONS AND RATIOS

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. What is the ratio of 12 to 108? of 9 to 108?

$108 \div 12 = ?$ $108 \div 9 = ?$

5. $11 \times 8 = ?$ $8 \times 11 = ?$ $11 \times 9 = ?$ $9 \times 11 = ?$
$99 \div 11 = ?$

6. How many 11's are there in 99? $\frac{1}{11}$ of 99 = ? $\frac{2}{11}$ of 99 = ?

7. $10 \times 7 = ?$ $10 \times 9 = ?$ $10 \times 10 = ?$ $10 \times 11 = ?$
$10 \times 12 = ?$ $9 \times 10 = ?$ $11 \times 10 = ?$ $12 \times 10 = ?$
$\frac{1}{10}$ 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 is the ratio of a dollar to a dime? of a dime to a dollar?

13. What is the ratio of a dollar to a half dollar? to a quarter dollar?

GENERAL REVIEW

1. $\frac{2}{11}$ of 11 = ? $\frac{5}{11}$ of 11 = ? $\frac{8}{11}$ of 11 = ?

2. $\frac{2}{12}$ of 12 = ? $\frac{6}{12}$ of 12 = ? $\frac{1}{2}$ of 12 = ?

3. What part is 2 of 6, 10, 16, 18, 20, 4, 8, 12, 14?

4. What part is 3 of 6, 12, 18, 15, 9?

5. What part is 4 of 16, 12, 8, 20?

6. What part is 5 of 10, 15, 20?

7. What part of 18 is 6? of 20 is 10? of 18 is 9? of 14 is 7? of 12 is 6?

8. What is the number of 2's in 4, 20, 16, 14, 8, 10, 12, 18, 6?

9. How many 3's are there in 9? 6? 15? 12? 18?

10. How many 4's are there in 20? 4? 8? 12? 16?

11. What is the number of 5's in 20, 10, 5, 15?

12. How many 6's are there in 12? 18? 24? 30?

13. How many 7's are there in 14? 9's in 18? 10's in 20? 12's in 72?

14. $\frac{1}{3}$ of \$21 = ? $\frac{2}{3}$ of \$21 = ? $\frac{1}{7}$ of 14¢ = ? $\frac{2}{7}$ of 14¢ = ?

15. $\frac{3}{7}$ of 14¢ = ? $\frac{4}{7}$ of 14¢ = ? $\frac{5}{7}$ of 14¢ = ? $\frac{6}{7}$ of 14¢ = ?

16. Add:

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

SUMS

1. Find the sum of four hundred fifty-one, two thousand eight hundred six, four thousand ninety-three, six thousand two hundred seventy.

2. Find the sum of seven hundred sixty-three, two thousand seventeen, five thousand four hundred fifty, six thousand three hundred nine.

3. Find the sum of six thousand four hundred sixty-three, one hundred ninety-six, forty-seven, two thousand three hundred eighty.

4. Find the sum of two hundred forty-seven, two thousand nine hundred eighteen, ninety-four, four thousand six hundred forty-seven.

5. Find the sum of nine thousand one hundred forty-five, four hundred thirty-six, two thousand one hundred seventy-two, nine.

6. Find the sum of three thousand three hundred thirty, four hundred eight, two thousand one hundred ninety-seven, six thousand four hundred five.

7. Find the sum of seven thousand eighteen, eight hundred ninety, six thousand seven hundred fifty-two, five thousand two hundred seventy-four.

8. Find the sum of seventeen, nine thousand eight hundred sixty, one thousand twenty-four, eight thousand six hundred five.

9.	10.	11.	12.	13.	14.
2333	91600	71461	2222	78912	13456
4567	7149	9147	333	3456	987
8912	86004	90061	44444	78	29
3456	19130	4713	5555	98765	98613

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 8 boys in Will's class, including Will himself. Each boy has 28 teeth. How many teeth 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. If 5 men build a wall in 8 days, how many men can build it in one day?

2. If 5 men build a wall in 12 days, in how many days can one man build it?

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 cistern is emptied by 5 pipes, all the same in size, in 16 minutes. How many such pipes will empty the cistern in one minute?

7. If a box weighs 3 pounds, what is the weight of 32 such boxes?

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 78 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

1. From 45 subtract 29.

$45 = 40 + 5$
$29 = 20 + 9$

$45 = 30 + 15$
$29 = 20 + 9$
$16 = 10 + 6$

We cannot take 9 from 5. However, we can take one ten from forty, for $40 = 30 + 10$. $10 + 5 = 15$. 15 less 9 are 6. Then we take the two tens in twenty from the three tens in thirty. The remainder is one ten. $10 + 6 = 16$, the difference between 45 and 29.

2. From 74 take 37.

$74 = 70 + 4$
$37 = 30 + 7$

$74 = 60 + 14$
$37 = 30 + 7$
$37 = 30 + 7$

3. A farmer had 84 sheep and lambs all together. There were 35 lambs. How many sheep had he?

4. A boy had 38 marbles. Of these, 19 marbles were new and perfect in shape. How many of his marbles were old?

5. Find the remainders:

42	55	52	63	98	84	67	85	95	88	79	36
27	29	36	38	75	52	54	38	36	9	19	28
85	91	82	73	57	32	41	54	66	97	86	75
38	72	81	14	48	13	29	39	46	58	27	25

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?

ROMAN NOTATION

This notation uses seven capital letters: I, V, X, L, C, D, M.

I = 1; V = 5; X = 10; L = 50; C = 100; D = 500; M = 1000.

I = 1	XVI = 16	LXXX = 80
II = 2	XVII = 17	LXXXI = 81
III = 3	XIX = 19	XC = 90
IV = 4	XX = 20	XCI = 91
V = 5	XXI = 21	CI = 101
VI = 6	XXX = 30	CC = 200
VII = 7	XXXI = 31	CCC = 300
VIII = 8	XL = 40	CCCC = 400
IX = 9	XLI = 41	D = 500
X = 10	L = 50	DC = 600
XI = 11	LI = 51	DCC = 700
XII = 12	LX = 60	DCCC = 800
XIII = 13	LXI = 61	DCCCC = 900
XIV = 14	LXX = 70	M = 1000
XV = 15	LXXI = 71	MM = 2000

Compare these two ways of writing numbers and give some reasons why the Roman notation is easier and some reasons why it is harder than our common notation.

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.

EXERCISES

IV = ?	DXI = ?	LXXI = ?
XXIII = ?	MDXXI = ?	XLIX = ?
XIX = ?	MCCCCXCII = ?	XXVIII = ?
LIV = ?	MV = ?	MIX = ?
XXXV = ?	DXIV = ?	MDXI = ?
D = ?	CDLXX = ?	L = ?
DLV = ?	CMX = ?	LXXXIV = ?
DC = ?	CCCI = ?	MDCCCLXI = ?
DCCC = ?	XCIX = ?	MDCCCC = ?
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 = ?

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.

Where have you seen Roman figures used ?

SUBTRACTION

1. From 232 take 141.

$232 = 200 + 30 + 2$
$141 = 100 + 40 + 1$

$232 = 190 + 40 + 2$
$141 = 100 + 40 + 1$
$91 = 90 + 0 + 1$

We cannot take 4 tens from 3 tens. $200 = 190 + 10$. $10 + 30 = 40$. Hence we say $2 - 1 = 1$, $40 - 40 = 0$, $190 - 100 = 90$, $90 + 0 + 1 = 91$, which is the remainder or difference.

2. From 232 take 143.

$232 = 200 + 30 + 2$
$143 = 100 + 40 + 3$

$232 = 200 + 20 + 12$
$143 = 100 + 40 + 3$

$232 = 180 + 40 + 12$
$143 = 100 + 40 + 3$
$89 = 80 + 0 + 9$

We cannot take 3 units from 4 units. And we cannot take 4 tens from 3 tens. If we take 1 ten from 3 tens, we will have to take 2 tens from 200. Hence we have 12 from the 2 units given and the 10 taken from 30. 12 less $3 = 9$. And we have 40 from the 20 left when we took 10 from 30 and from the 20 taken from the 20 tens in 200. 40 less $40 = 0$. Last, we have 180, the difference between 200 and the 20 given to 20 to make 40; and from 180 we take 100, leaving 80. $80 + 0 + 9 = 89$, the difference between 232 and 143.

3. From 2453 take 1541.

$2453 = 2000 + 400 + 50 + 3$
$1541 = 1000 + 500 + 40 + 1$

$2453 = 1000 + 1400 + 50 + 3$
$1541 = 1000 + 500 + 40 + 1$
$912 = 0 + 900 + 10 + 2$

Comparing these, we see that in each case except one the subtrahend is less than the minuend. But 400 is less than 500. Hence we take 1 thousand from 2 thousands. $1000 + 400 = 1400$.

SUBTRACTION

1. From 2456 take 1587.

$$2456 = 2000 + 400 + 50 + 6 = 1000 + 1300 + 140 + 16$$
$$1587 = 1000 + 500 + 80 + 7 = 1000 + 500 + 80 + 7$$
$$869 = 0 + 800 + 60 + 9$$

Or we may represent in this form the processes of taking:

$$\begin{array}{cccc} & {\scriptstyle 13} & {\scriptstyle 14} & \\ {\scriptstyle 1} & 3 & 4 & {\scriptstyle 16} \\ 2 & 4 & 5 & 6 \\ 1 & 5 & 8 & 7 \\ \hline & 8 & 6 & 9 \end{array}$$

After we have practiced a good many subtractions, we find it much easier to carry all the "takings" of tens and hundreds and thousands in the memory, and not to write them upon paper at any time.

Subtract:

2.	**3.**	**4.**	**5.**	**6.**	**7.**
142	253	111	194	185	643
93	96	22	95	106	554
8.	**9.**	**10.**	**11.**	**12.**	**13.**
1894	1847	1853	5236	4116	3829
1886	1739	967	4348	3208	3759

14. From 308 take 209.

$$308 = 300 + 8 = 290 + 18$$
$$209 = 200 + 9 = 200 + 9$$
$$99 = 90 + 9$$

We cannot take 9 from 8; and we cannot take 1 ten from no ten. But we can take 1 ten from 30 tens, leaving 29 tens.

15. Subtract 1605 from 2503; 3406 from 4401; 1989 from 5000.

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, with fractional quotient, if necessary.

$$7\overline{)7212}$$
$$1030\tfrac{2}{7}$$

Proof:

1030		Quotient
$\times 7$		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:

$$\begin{array}{r} 436 \\ \times\ 12 \\ \hline 5232 \end{array}$$

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.

DIVISION

Read and answer:

A.	$40 \div 5 = ?$	$5)\underline{46}$	$\frac{48}{5} = ?$	$7)\underline{63}$	$72 \div 6 = ?$
B.	$12 \div 4 = ?$	$\frac{11}{4} = ?$	$4)\underline{13}$	$9)\underline{72}$	$48 \div 8 = ?$
C.	$\frac{67}{3} = ?$	$\frac{35}{7} = ?$	$\frac{20}{5} = ?$	$8)\underline{80}$	$36 \div 6 = ?$
D.	$\frac{24}{4} = ?$	$\frac{48}{6} = ?$	$\frac{84}{7} = ?$	$\frac{50}{5} = ?$	$108 \div 8 = ?$
E.	$\frac{18}{9} = ?$	$\frac{56}{8} = ?$	$\frac{33}{11} = ?$	$\frac{45}{11} = ?$	$18 \div 9 = ?$
F.	$12)\underline{72}$	$9)\underline{118}$	$6)\underline{36}$	$7)\underline{49}$	$49 \div 6 = ?$
G.	$\frac{72}{4} = ?$	$\frac{108}{9} = ?$	$\frac{36}{6} = ?$	$\frac{49}{7} = ?$	$56 \div 8 = ?$

WRITE

Copy and answer:

1.	$6)\underline{41019}$	9.	$8100406 \div 6 = ?$	17.	$4)\underline{84920} = ?$
2.	$8)\underline{704653}$	10.	$100610067 \div 8 = ?$	18.	$5)\underline{256075} = ?$
3.	$7)\underline{378697}$	11.	$123456789 \div 9 = ?$	19.	$5)\underline{405620} = ?$
4.	$2)\underline{48206}$	12.	$200000000 \div 7 = ?$	20.	$6)\underline{612978} = ?$
5.	$9146291 \div 2 = ?$	13.	$2)\underline{60428} = ?$	21.	$6)\underline{960726} = ?$
6.	$714632 \div 3 = ?$	14.	$3)\underline{39630} = ?$	22.	$7)\underline{49714} = ?$
7.	$1234610 \div 4 = ?$	15.	$4)\underline{12804} = ?$	23.	$7)\underline{364847} = ?$
8.	$7000000 \div 5 = ?$	16.	$3)\underline{120936} = ?$	24.	$5)\underline{465845} = ?$

25. What is the ratio of seventy million people to a family of fifteen persons? of five persons?

MULTIPLICATION

1. Multiply 73 by 45.

$$\begin{array}{rl} & 73 \text{ multiplicand} \\ & 45 \text{ multiplier} \\ 5 \times 73 = & 365 \text{ first partial product} \\ 40 \times 73 = & 292 \text{ second partial product} \\ & 3285 \text{ total product} \end{array}$$

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.

$$\begin{array}{rlrl} & 175 & & 2763 \text{ multiplicand} \\ & 24 & & 58 \text{ multiplier} \\ 4 \times 175 = & 700 & 8 \times 2763 = & 22104 \text{ partial product} \\ 20 \times 175 = & 350 & 50 \times 2763 = & 13815 \text{ partial product} \\ 24 \times 175 = & 4200 & 58 \times 2763 = & 160254 \text{ total product} \end{array}$$

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 a day for 5 days?

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?

MULTIPLICATION

Multiply each multiplicand by each multiplier.

Why will there be 100 products?

Punctuate the multiplicands and the products so as to read the thousands correctly and quickly.

Multiplicands		Multipliers		Multiplicands		Multipliers	
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

DIVISION

Divide each dividend by each divisor.

Punctuate the dividends and the quotients so as to read the thousands correctly and quickly.

Dividends		Divisors		Dividends		Divisors	
A	355680	(*k*)	6	*F*	316169	(*p*)	5
B	39521	(*l*)	3	*G*	695201	(*q*)	7
C	118560	(*m*)	4	*H*	10824	(*r*)	8
D	711369	(*n*)	2	*I*	129888	(*s*)	11
E	750889	(*o*)	9	*J*	119064	(*t*)	12

1. What is the ratio of one hundred thousand persons to ten? Of one million to one 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?

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	8512	615	10342	735	45346	32682
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.

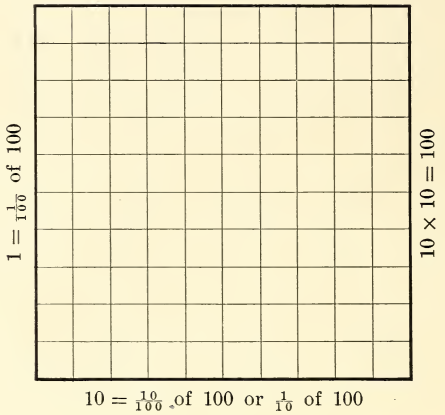
22. From three thousand eight hundred twenty take two thousand six hundred five.

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? $33\frac{1}{3} \times 3 = ?$

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.**

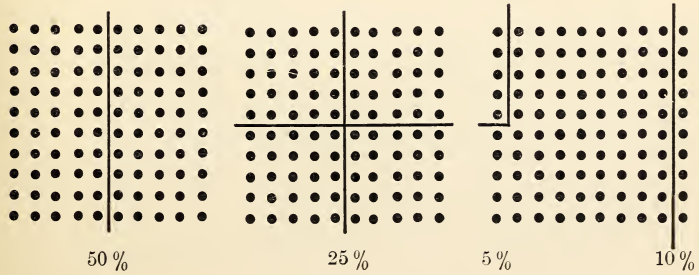
6% of $1 is $\frac{6}{100}$ of 100¢, or 6¢

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.

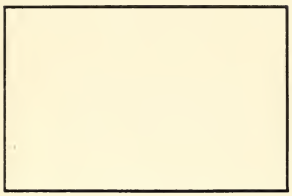
4% of $1000 is $\frac{4}{100}$ of $1000 $\quad \$\frac{1000}{100}=\$10 \quad \$10\times 4=\$40$

2% of $5000 is $\frac{2}{100}$ of $5000 $\quad \$\frac{5000}{100}=\$50 \quad \$50\times 2=\$100$



AREAS

We find the **areas** of rectangles in square measure by multiplying the lengths of the adjoining sides.

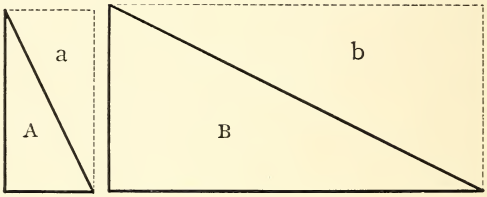


1. If the sides of this rectangle were 2 inches and 3 inches, its area would be 2 in. × 3 in. = 6 square inches = 6 sq. in.

2. If a mirror is 3 ft. × $4\frac{1}{2}$ ft. in size, its area is $13\frac{1}{2}$ sq. ft.

We find the areas of right-angled triangles by multiplying together the lengths of the sides which make the right angle and dividing their 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 in. × $\frac{1}{2}$ in. = $\frac{1}{2}$ 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. 1 in. × 2 in. = 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 $\frac{1}{2}$.

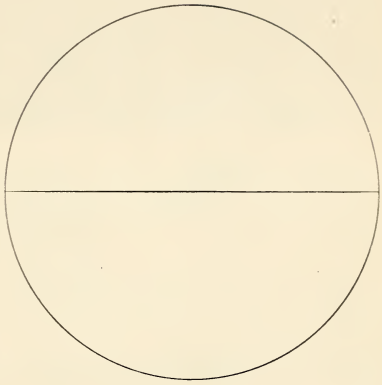
Find the areas of these triangles:

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.

$2 \text{ in.} \times 3\frac{1}{7} = 6\frac{2}{7} \text{ in.}$

2. Find the circumference of a circle 4 yd. in diameter.

$4 \text{ yd.} \times 3\frac{1}{7} = 12\frac{4}{7} \text{ yd.}$

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.

SCHOOL PER CENTS

1. John had 87% in his arithmetic, 60% in reading, 80% in manual work, 75% in drawing, 70% in music, 60% in spelling, and 90% in Nature study. What was his average, if each study counted the same?

87%
60
80
75
70
60
90
522

7)522
$74\frac{4}{7}\%$

2. But what was his per cent if arithmetic counted 3 points, reading and manual work 2 points each, and the other exercises 1 point each?

87% × 3 = 261
60 × 2 = 120
80 × 2 = 160
75 × 1 = 75
70 × 1 = 70
60 × 1 = 60
90 × 1 = 90
11 836

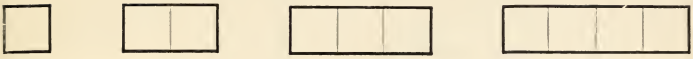
11)836
76%

3. Find the averages of various reports.

4. In a class of 36 boys and girls $33\frac{1}{3}\%$ were girls. How many girls were there? How many boys? 50% were not absent in October. How many came every day? 25% were tardy once each during the entire school year. How many were tardy?

5. In another class of 45 boys and girls $33\frac{1}{3}\%$ were girls. How many boys were there? How many girls? 80% were not absent in October. How many came every day? 9 were tardy once during the year. What per cent of 45 was that? What is the ratio of 9 to 45? $\frac{1}{5}$ is what per cent of 100?

RATIOS AND FRACTIONS

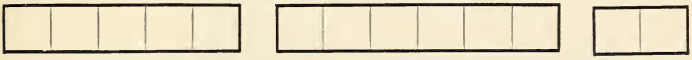


1. What is the ratio of A to B? of B to A? of A to C? of B to C?

2. Why is the ratio of B to C $\frac{2}{3}$ and of C to B $\frac{3}{2}$?

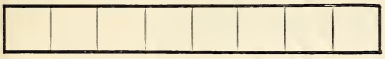
3. What is the ratio of A to D? of D to A? of B to D? of D to B?

4. Why is the ratio of C to D $\frac{3}{4}$ and of D to C $\frac{4}{3}$?



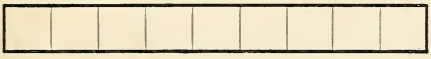
5. What is the ratio of B to E? of E to B? of B to F? of F to B?

6. What fraction of E is C? D? of F is C? is D?



7. What is the ratio of G to H? of H to G? of D to H? of H to D?

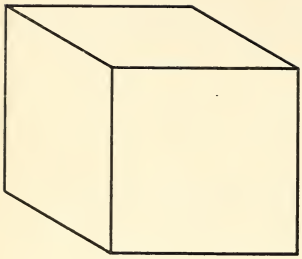
8. What fraction of H is B? is E? is F?



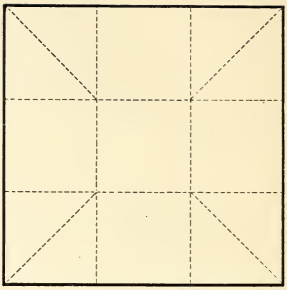
9. What forms show the ratio $\frac{7}{10}$? $\frac{5}{9}$? $\frac{3}{8}$? 4? $\frac{10}{6}$? $\frac{1}{2}$? $\frac{1}{3}$?

10. Fold paper to show fractions and ratios like these.

11. Make drawings of larger sizes, showing similar ratios and fractions.



Cubic inch



$1\frac{1}{2}$ in. $\times$ $1\frac{1}{2}$ 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. $\times$ 3 in. in size.

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. $\times$ 3 in. $\times$ 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. $\times$ 9 in. $\times$ 12 in.?

7. A cardboard box 3 in. $\times$ 7 in. $\times$ 11 in. will be found to contain almost exactly 1 gallon. What is its volume in cubic inches?

TABLES OF MEASURES

Area	Volume
144 sq. in. = 1 sq. ft.	1728 cu. in. = 1 cu. ft.
9 sq. ft. = 1 sq. yd.	27 cu. ft. = 1 cu. yd.
43560 sq. ft. = 1 acre	Capacity
640 acres = 1 sq. mile	$31\frac{1}{2}$ gal. = 1 bbl.

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. I bought a barrel of vinegar for $3, and sold 27 gal. at 10¢ a gallon. How many gallons were left; and how much money had they cost me?

5. There were 3000 cu. in. in the volume of an iron box. If it was 10 in. on one side and 30 on another, how many inches was it on the third side? Was its volume greater or less than 2 cu. ft.? By how much?

6. I found that what I supposed were 10 cu. yd. of earth in a space only 90 ft. by 6 ft. by 4 ft. What amount too small was the actual amount of earth there?

7. 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?

8. In 8 acres are how many sq. ft.?

9. In 12 bbl. are how many gal.?

ADDITION SUMS AND PROBLEMS

1.	2.	3.	4.	5.
93	6702	417	4	300
618	564	64	85	761
4192	83	8163	307	95
1216	1709	350	6890	8
904	341	19	42	604

6.	7.	8.	9.	10.
6819	17	7621	38	3042
1706	420	874	2719	817
324	1608	19	450	96
8270	9743	3240	8063	2403

11.	12.	13.	14.	15.
7268	2763	8006	6543	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?

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. One week a wheat buyer gained $2741, the next week he lost $713, the next week he lost $1284, but the next week he gained $925. How much more did he gain than lose during the month?

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 gave a mortgage for the rest of the purchase price. What was the sum for which the mortgage was given?

9. Mr. Jones owed Mr. Smith $163; in payment he gave a horse and $49 in cash. At what was the horse valued?

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

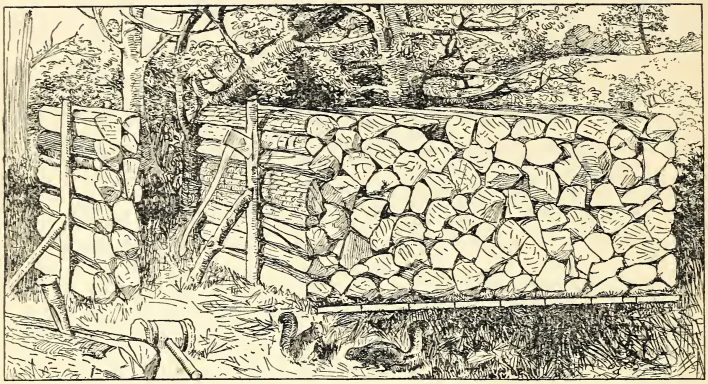
1. Read the multiplication table of each number, beginning $2 \times 1 = 2$, $2 \times 2 = 4$, $2 \times 3 = 6$, and so through 2's; then $3 \times 1 = 3$, and so on through all numbers.

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?

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 8 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?

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?

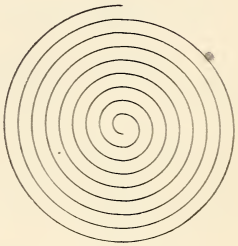
2. Mrs. Thompson paid 48¢ for 2 quires of paper. How much per sheet was this?

3. Mary asked for 5 quires of paper, but received only 5 score of sheets. What was the difference?

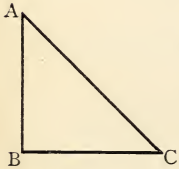
LENGTHS

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 $C = ?$

3. $AB = 4$ 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. In our notation we used these orders.

Hundreds	Tens	Units
6	3	9

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 four tenths. $39.4 = 39\frac{4}{10}$.

39.42 is read thirty-nine 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?

$20¢ = 10¢ \times 2$. $7.4¢ \times 10 = 74¢$. $74¢ \times 2 = 148¢$. $148¢ = \$1.48$.

Do you see that we can change cents to dollars by moving the decimal point 2 places to the left?

$100¢ = \$1$. $148¢ \div 100 = \$1.48$.

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

Is this bill correct?
Draw up other bills.

RATIOS OF MEASURES RECITE

1. What is the ratio of $1 to 10¢? of 25¢ to $2?

2. What is the ratio of 1 ft. to 2 yd.? of 3 yd. to 2 ft.? of 2 ft. to 4 yd.?

3. What is the ratio of 1 gill to 1 gal.? of 2 gal. to 3 pt.? of 3 pt. to 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 is the ratio of a ton to five hundred pounds?

7. The ratio of the distance I ran to the number of feet in a mile was $\frac{1}{4}$. How far did I run? Answer in feet and in miles.

8. What is the ratio of 10 quires to a ream? Of a ream to 5 quires? Of a ream to 60 quires?

GENERAL REVIEW

1. Beginning at 1, count by 11 to 144.

2. What is a thermometer? What does it measure? How?

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 is the ratio of $\frac{1}{8}$ to $\frac{1}{16}$? of $\frac{1}{10}$ to $\frac{1}{50}$?

5. What are the *dividend*, the *divisor*, and the *quotient* in division?

6. Tell the Roman notation for the present year.

WRITE

7. Add \$13.25, \$26.14, \$168.90, and \$1000.

8. Write the heading of a letter with date and addresses of your correspondent and yourself.

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¢?

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 ¢	= 1 n.
10 cents	= 1 dime	10 ¢	= 1 d.
100 cents	= 1 dollar	100 ¢	= $1

TEST OF SUCCESS

A boy or girl who is able to answer correctly in writing every one of such questions as these twelve, knows this book sufficiently well to begin another.

1. Multiply 6408 by 765.
2. Divide 18929 by 11.
3. Add 2612, 39827, 207, 180279.
4. Subtract $1829 from $3716.
5. Write in Arabic figures the number, CXLIV.
6. What is the ratio of 84 to 12? of 12 to 84?
7. How many minutes are there in two and a half hours?
8. What is $\frac{3}{8}$ of 96?
9. 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?
10. Draw a square and divide it into halves and fourths.
11. Measure accurately in feet and inches the size of the floor of your class room.
12. Write the general multiplication table in full.