ELEMENTARY ARITHMETIC

MOREY'S ARITHMETICS

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BY

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PREFACE

THIS Primary Arithmetic, the outcome of many years of observation and actual teaching experience, is based on the idea that number is essentially abstract, and that the prime object in the first years of school is to teach number as number. To secure accuracy and facility, a large amount of drill work in the fundamental processes is provided, and is so arranged as to furnish thorough and frequent review of all subjects previously studied.

The application of number to the affairs of everyday life has not been neglected. An abundance of oral and written problems within the limits of the comprehension of pupils furnishes material for concrete work.

Technical explanations of processes, necessarily confusing to immature minds, are purposely omitted. A minimum of theory and a maximum of practice are generally conceded to be the wisest method of teaching the principles of arithmetic to young pupils.

Experience proves that a primary arithmetic should be simple, progressive, and teachable, and in a direct and practical way aim to develop arithmetical power. It is

the earnest hope of the author that the present book will be found to fulfill these requirements.

The author wishes to acknowledge his indebtedness to all who have assisted in the preparation of the manuscript, and especially to Mr. Myron T. Pritchard, Master of the Everett School, Boston, Massachusetts, for wise counsel and criticism.

C. W. M.

CONTENTS

PART I

PART II

PART III

Figure Drill
Like course in reading which
is all phonics for a year or
two. We have been through
that craze in reading.

PRIMARY ARITHMETIC

PART I

WRITING AND READING NUMBERS

When you answer the question "How old are you?" you use a number to tell how many years you have lived.

Numbers tell how many.

We represent numbers by signs called figures.

The single figures which represent numbers are:

0	1	2	3	4	5	6	7	8	9
Zero	One	Two	Three	Four	Five	Six	Seven	Eight	Nine

By uniting these figures we can express any number.

0 is called zero, naught, or cipher, and means not anything, or nothing.

When we write 1, the figure 1 stands in the first or units' place.

When we write 10, the figure 1 stands in the second or tens' place.

Ten means 1 ten and no unit.

Eleven is written 11, and means 1 ten and 1 unit.

1. Write twelve, and tell in what place each figure stands, and what it means.

2. Write in figures and tell what they mean: thirteen; fourteen; fifteen; sixteen; seventeen; eighteen; nineteen.

3. Twenty means two tens, and is written 20.

4. Thirty means three tens, and is written ——.

5. Forty means —— tens, and is written ——.

6. Write fifty, and tell what it means.

7. Write and explain the meaning of sixty; seventy; eighty; ninety.

8. Twenty-four means 2 —— and 4 ——, and is written 24.

9. Thirty-six means —— —— and —— ——, and is written ——.

10. Write the following in figures, and tell what each figure means:

Fifteen.	Twenty-nine.	Fifty-four.
Twenty-five.	Eighty-four.	Forty-six.
Fifty-two.	Seventy-eight.	Thirty-eight.
Sixty-three.	Ninety-two.	Ninety-nine.

11. Read the following, and tell what each figure means:

11	38	75	42	55	27	19	87	22	33
28	49	83	35	94	62	48	17	43	61

READING AND WRITING NUMBERS: HUNDREDS

When we write 100, the figure 1 stands in the third or hundreds' place.

100 means 1 hundred, no tens, no units.

1. 200 means 2 ——, ——, ——.

2. 420 means —— hundreds, —— tens, —— units.

3. 362 means —— ——, —— ——, —— ——.

4. Read the following and tell what each figure means:

120	243	304	257	764	439	333	438
694	876	938	468	999	606	840	677

5. Write the following numbers in figures:

Thirty-seven.	One hundred twenty-four.
Sixty-two.	Three hundred thirty-seven.
Forty-nine.	Two hundred forty.
Eighty-three.	Six hundred forty-seven.
Seventy-seven.	Five hundred thirty-nine.

ADDITION: EXPLANATION OF SIGNS

The sign of addition is +, and is read "and," or "plus." 3 + 5 is read "3 and 5," or "3 plus 5."

The sign of equality is =, and is read "equal," "equals," "is," or "are."

3 + 5 = 8 means that 5 added to 3 equals 8.

1. 2 horses + 7 horses = —— horses.

2. 6 men + 2 men = ——.

3. Add the following numbers:

5	3 pencils	8	6 desks	8	6	9	4 days
8	7 pencils	3	5 desks	6	6	4	9 days
7	6 pencils	7	8 desks	4	7	5	6 days
9	8 pencils	6	2 desks	7	3	7	7 days
4	4 pencils	5	9 desks	5	9	6	2 days

DRILL TABLE IN ADDITION: PRIMARY COMBINATIONS

NOTE. Use this table frequently for rapid oral work, until accuracy and quickness in making the combinations are acquired. The combinations must be thoroughly memorized.

	A	*B*	*C*	*D*	*E*
1.	0 + 0	0 + 2	2 + 1	6 + 3	9 + 7
2.	0 + 9	1 + 1	1 + 3	7 + 0	0 + 8
3.	5 + 0	1 + 9	2 + 2	2 + 3	6 + 4
4.	3 + 6	5 + 1	2 + 9	3 + 3	0 + 4
5.	1 + 0	4 + 6	5 + 2	3 + 9	4 + 4
6.	4 + 9	6 + 2	2 + 0	1 + 8	5 + 3
7.	7 + 1	2 + 8	4 + 1	5 + 4	8 + 1
8.	5 + 6	6 + 0	7 + 2	4 + 0	0 + 3
9.	9 + 0	5 + 7	6 + 1	7 + 6	4 + 2
10.	1 + 4	9 + 1	5 + 8	3 + 2	7 + 3
11.	0 + 7	2 + 4	8 + 7	5 + 9	9 + 6
12.	3 + 8	1 + 7	3 + 4	9 + 3	1 + 5
13.	3 + 0	4 + 8	2 + 7	8 + 9	9 + 4
14.	7 + 4	8 + 0	6 + 8	3 + 7	8 + 4
15.	5 + 5	6 + 6	8 + 2	6 + 5	4 + 7
16.	3 + 1	7 + 5	1 + 2	8 + 5	8 + 3
17.	2 + 5	6 + 9	7 + 7	9 + 2	8 + 6
18.	0 + 6	3 + 5	8 + 8	7 + 9	4 + 3
19.	6 + 7	1 + 6	4 + 5	0 + 5	9 + 9
20.	9 + 5	7 + 8	2 + 6	9 + 8	0 + 1

PROBLEMS IN ADDITION *Oral*

1. In one pasture there are 4 cows and in another 7 cows. How many in both pastures?

2. I saw 5 children on one double-runner and 4 on another. How many children did I see on both?

3. Mary paid 5 cents for a block of paper and 2 cents for a pencil. What did she pay for both?

4. A hat cost 4 dollars and a pair of shoes 3 dollars. Both together cost ——.

5. Mrs. Jones's hens laid 7 eggs on Monday and 5 on Tuesday. How many did they lay in both days?

6. In Dorothy's schoolroom there are 8 rows of seats and in Susie's there are 7 rows. In both rooms there are —— rows of seats.

7. One of Herman's brothers gave him 6 marbles and his other brother gave him 9 marbles. Herman then had how many marbles?

8. On one side of a street there are 9 houses and on the other side 7 houses. How many houses on both sides?

9. Henry had 6 cents in his bank. His father gave him 5 cents more. How many cents did he then have?

10. Willie is 6 years old and his brother James is 8 years old. What is the sum of their ages?

11. Fannie has 4 schoolbooks and 9 storybooks. How many books has she in all?

SUBTRACTION: EXPLANATION OF SIGN

The sign of subtraction is $-$, and is read "minus." $8 - 3$ is read "eight minus three," or "eight less three." $8 - 3 = ?$ 12 pencils $-$ 4 pencils $= ?$ 9 marbles $-$ 5 marbles $= ?$ 15 eggs $-$ 8 eggs $= ?$

Same quality as p 4

DRILL TABLE IN SUBTRACTION: FOR RAPID ORAL WORK

NOTE. Use this table frequently until accuracy and rapidity in making the combinations are acquired. Thorough memorizing of the combinations is absolutely essential.

	A	*B*	*C*	*D*	*E*
1.	1 – 1	8 – 1	12 – 3	5 – 3	13 – 4
2.	11 – 2	2 – 2	8 – 2	12 – 4	5 – 2
3.	6 – 1	11 – 3	3 – 3	8 – 3	12 – 5
4.	9 – 7	5 – 1	11 – 4	4 – 4	8 – 4
5.	13 – 5	9 – 8	4 – 3	11 – 5	5 – 5
6.	8 – 5	7 – 1	6 – 2	10 – 1	11 – 6
7.	11 – 7	8 – 6	7 – 2	13 – 6	10 – 2
8.	10 – 3	11 – 8	8 – 7	7 – 3	15 – 6
9.	2 – 1	10 – 4	6 – 3	9 – 6	7 – 4
10.	12 – 6	3 – 1	10 – 5	11 – 9	15 – 7
11.	6 – 4	12 – 7	3 – 2	10 – 6	16 – 9
12.	7 – 5	13 – 7	12 – 8	15 – 8	14 – 8
13.	9 – 1	7 – 6	14 – 7	12 – 9	15 – 9
14.	14 – 5	9 – 2	6 – 5	13 – 8	14 – 9
15.	10 – 7	6 – 6	9 – 3	17 – 9	16 – 7
16.	5 – 4	10 – 8	7 – 7	9 – 4	9 – 5
17.	4 – 1	13 – 9	10 – 9	8 – 8	16 – 8
18.	14 – 6	4 – 2	17 – 8	18 – 9	9 – 9
19.	15 – 7	13 – 7	16 – 7	12 – 9	17 – 8
20.	16 – 9	15 – 8	13 – 6	11 – 4	13 – 8

PROBLEMS IN SUBTRACTION *Oral*

1. Louise had 15 cents. She spent 5 cents for a pin. How many had she left?

2. There were 13 sheets of paper in a box. Ellen used 4 of them. How many were left?

3. Out of 17 jars of preserves 8 were broken. How many were left?

4. The class had 10 words in a spelling lesson. John misspelled 2. How many did he spell correctly?

5. There were 13 trees on a street. How many were left after 7 were cut down?

6. A bat and a ball cost 18 cents. The bat cost 10 cents. What did the ball cost?

7. Charles bought a wheel for 15 dollars and sold it for 9 dollars. What was his loss?

8. Mr. Fisher sold 7 of his 12 sheep. How many had he left?

9. Mr. Brown had 12 cows. He now has 4. How many did he sell?

10. A grocer had 16 barrels of sugar in the morning and 7 barrels at night. How many barrels had he sold?

ADDITION *Oral and Written*

5	8	1	4	7	2	6	3	9

1. Add 1 to each of these numbers; add 10; 2; 7; 4; 8; 3; 6; 9; 5.

2. Write all the sets of two numbers of one figure each whose sum is 12. Thus, $3+9$, $4+8$, $5+7$, $6+6$.

Whose sum is 5; 6; 7; 8; 9; 10; 11; 13; 14; 15; 16; 17; 18.

3. Write in a row all the numbers between 10 and 100 that end in 1, and add 1 to each. Thus,

11	21	31	41	51	61	71	81	91
1	1	1	1	1	1	1	1	1

4. Then add 2; 3; 4; 5; 6; 7; 8; 9, to each number ending in 1.

5. Write in a row all the numbers between 10 and 100 that end in 2, and add 1; 2; 3; 4; 5; 6; 7; 8; 9, to each.

6. Write in rows all the numbers between 10 and 100 that end in 3; 4; 5; 6; 7; 8; 9; and successively add 1; 2; 3; 4; 5; 6; 7; 8; 9, to the numbers in each row.

SUBTRACTION *Oral and Written*

12	15	18	10	13	17	14	11	16

1. Subtract 1 from each of the numbers. Subtract 3; 9; 2; 4; 6; 8; 5; 7.

2. What must be added to each of the following numbers to make 10?

2	9	1	6	5	8	3	7	10	4

3. What must be added to each of the numbers in the row above to make 11? 12? 13? 14? 15? 16? 17? 18? 19? 20?

4. Write in a row all the numbers between 10 and 100 that end in 9, and subtract 1 from each. Thus,

19	29	39	49	59	69	79	89	99
1	1	1	1	1	1	1	1	1

Then from each number in the row subtract 2; 3; 4; 5; 6; 7; 8; 9.

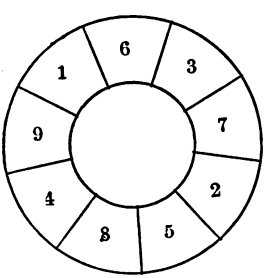
5. Write in a row all the numbers between 10 and 100 that end in 8, and subtract 1; 2; 3; 4; 5; 6; 7; 8; 9, from each.

6. Write in rows all the numbers between 10 and 100 that end in 7; 6; 5; 4; 3; 2; 1; 0, and from each subtract 1; 2; 3; 4; 5; 6; 7; 8; 9.

DRILL EXERCISES: ADDITION AND SUBTRACTION

TO THE TEACHER: The following exercises are designed for rapid oral work in addition and subtraction. The diagrams should be drawn on the board. If the lines are put on with paint, much labor will be saved. The chief obstacle to good work in arithmetic is lack of concentration of attention. Therefore, *use these exercises frequently*, and *do not tolerate any hesitation in giving answers*. Constant practice is the key to success.

I



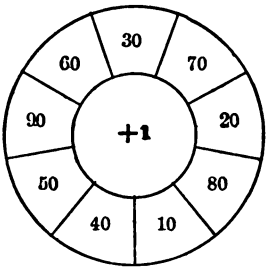
1. Beginning with any number in the circle, add the numbers successively till 100 or any given number is reached.

2. Beginning with 100 or any given number, subtract successively the numbers in the circle till nothing remains.

3. Write successively: 1; 2; 3; 4; 5; 6; 7; 8; 9 in the inner circle, and add the number in the inner circle to each number in the outer circle.

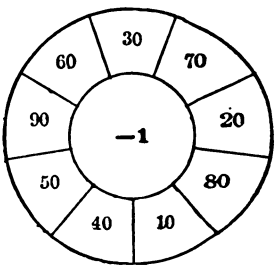
4. Write successively the numbers from 10 to 20 in the inner circle, and subtract the numbers in the outer circle.

II



1. Add 1 to each number in the outer circle.

III



2. Subtract 1 from each number in the outer circle.

3. Use successively 2; 3; 4; 5; 6; 7; 8; 9 in the center spaces.

4. Write in the outer circles 31; 71; 21; etc.; then 32; 72; 22; etc.; then 33; 73; 23; etc., until you reach 39; 79; 29; etc., using 1; 2; 3; 4; 5; 6; 7; 8; 9 in the center spaces with each series written in the outer circles.

IV

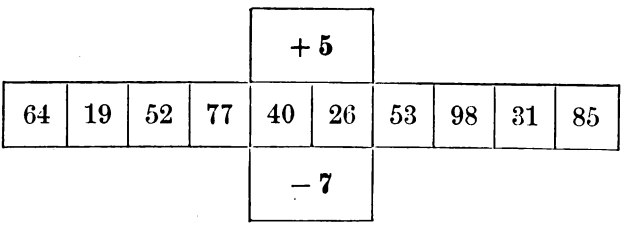
6		3
2		7
5		1
9		4
1	53	8
4		2
7		5
3		6
8		9

1. Add each number in the left-hand column to the number in the center space.

2. Subtract each number in the right-hand column from the number in the center space.

3. Use in the center space any number of two figures ending in 0; 1; 2; 3; 4; 5; 6; 7; 8; 9.

V



1. Add the number in the upper space to the numbers in the row.
2. Subtract the number in the lower space from the numbers in the row.
3. Use other numbers in the upper and lower spaces.
4. Write other numbers in the row.

VI

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
1.	7	9	5	1	4	6	5	2	7	8
2.	3	7	4	9	6	2	5	4	8	1
3.	9	8	3	7	6	8	7	9	8	6
4.	6	1	7	7	7	2	8	8	4	3
5.	2	4	6	1	9	1	5	3	5	7
6.	3	5	7	6	7	9	2	4	6	8
7.	7	1	3	8	8	7	9	9	2	5
8.	6	5	4	9	3	9	7	8	1	3

1. Add each column from top to bottom; from bottom to top.
2. Add each row from left to right; from right to left.
3. Take any number, 1; 2; 3; 4; 5; 6; 7; 8; 9; 12; 15; 37; 42, and add to it each row from left to right; from right to left. Add to it each column from top to bottom; from bottom to top.
4. Add each number in any row or column to any given number between 10 and 100 ending in 1; 2; 3; 4; 5; 6; 7; 8; 9.
5. Subtract each number in any row or column from any number between 10 and 100 ending in 0; 1; 2; 3; 4; 5; 6; 7; 8; 9.

VII

Drill exercise in the harder combinations in addition.

Write in a row all the numbers between 10 and 100 that

(1) end in 1; add 9 to each.
(2) end in 2; add 9 to each; add 8.
(3) end in 3; add 9 to each; add 8; 7.
(4) end in 4; add 9 to each; add 8; 7; 6.
(5) end in 5; add 9 to each; add 8; 7; 6; 5.
(6) end in 6; add 9 to each; add 8; 7; 6; 5; 4.
(7) end in 7; add 9 to each; add 8; 7; 6; 5; 4; 3.
(8) end in 8; add 9 to each; add 8; 7; 6; 5; 4; 3; 2.
(9) end in 9; add 9 to each; add 8; 7; 6; 5; 4; 3; 2; **1.**

VIII

Drill exercise in the harder combinations in subtraction.

Write in a row all the numbers between 10 and 100 that

(1) end in 8; subtract 9 from each.
(2) end in 7; subtract 9 from each; 8.
(3) end in 6; subtract 9 from each; 8; 7.
(4) end in 5; subtract 9 from each; 8; 7; 6.
(5) end in 4; subtract 9 from each; 8; 7; 6; 5.
(6) end in 3; subtract 9 from each; 8; 7; 6; 5; 4.
(7) end in 2; subtract 9 from each; 8; 7; 6; 5; 4; 3.
(8) end in 1; subtract 9 from each; 8; 7; 6; 5; 4; 3; 2.
(9) end in 0; subtract 9 from each; 8; 7; 6; 5; 4; 3; 2; 1.

EXERCISE

1. $5 + 6 + 7 - 2 = —$ **2.** $7 + 8 - 5 + 3 = —$

3. $8 - 2 + 3 + 7 = —$ **4.** $9 - 3 + 7 - 2 = —$

5. $10 - 5 + 8 - 3 = —$ **6.** $6 + 5 - 4 + 8 = —$

NOTE. The multiplication and division tables may be developed by blocks. The use of objects, however, should not be continued longer than is absolutely necessary. Objects are helpful in building the tables, but not in memorizing the various combinations. The multiplication and division tables of any particular number should be closely connected in teaching.

Care should be taken that the symbols of number do not take the place of the proper mental concepts of number.

MULTIPLICATION: TABLE OF 2'S

1. Count by 2's to 24.

2+2	= —	Two	2's = —
2+2+2	= —	Three	2's = —
2+2+2+2	= —	Four	2's = —
2+2+2+2+2	= —	Five	2's = —
2+2+2+2+2+2	= —	Six	2's = —
2+2+2+2+2+2+2	= —	Seven	2's = —
2+2+2+2+2+2+2+2	= —	Eight	2's = —
2+2+2+2+2+2+2+2+2	= —	Nine	2's = —
2+2+2+2+2+2+2+2+2+2	= —	Ten	2's = —
2+2+2+2+2+2+2+2+2+2+2	= —	Eleven	2's = —
2+2+2+2+2+2+2+2+2+2+2+2	= —	Twelve	2's = —

2. Learn:

The sign of multiplication is $\times$, and is read "times."

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

You can say the table of 2's in two ways:

(1) One 2 is 2, two 2's are 4, three 2's are 6, etc.

(2) Once 2 is 2, two times 2 is 4, three times 2 is 6, etc.

DRILL EXERCISES

3. Multiply the number in the center space by each number in the rows.

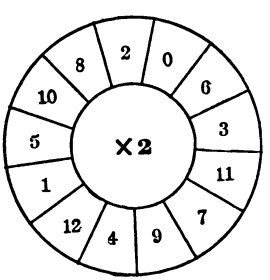
6	1	0	11	8	2
		× 2			
5	9	4	12	7	3	10

4. Multiply the numbers in the rows by the number in the center space.

5. Multiply, and add 1 to each product. Thus, 6 times 2 are 12, and 1 are 13. In like manner multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1 from each product. Multiply, and subtract 2.

The device at the right may be used for variety.



7. 2 + 2 + 2 = ——. Three 2's are ——. 3 × 2 = ——.

8. 3 + 3 = ——. Two 3's are ——. 2 × 3 = ——.

Do you see that 2 × 3 is just the same as 3 × 2?

9. $2+2+2+2=$ ——. Four 2's are ——. $4\times2=$ ——.

10. $4+4=$ ——. Two 4's are ——. $2\times4=$ ——.

Then 2×4 and 4×2 equal the same number.

11. $2+2+2+2+2=$ ——. 5 times 2 = ——.
$5+5=$ ——. 2 times 5 = ——.

12. Show that 6 2's and 2 6's equal the same number.

13. In like manner compare the other combinations in the table of 2's.

A similar comparison of the combinations in the other tables should be made as each table is studied.

NOTE. *An absolute mastery of the various multiplication tables must be secured.*

MULTIPLYING BY 2

1. Put two 43's into one number. We can do this in two ways, by adding two 43's, or by multiplying 43 by 2. Thus,

By adding	By multiplying
43	43
43	2
86	86

Two times 3 units = 6 units; write 6 in the units' place. Two times 4 tens = 8 tens; write 8 in the tens' place. The result, 86, is called the *product*. 43 is called the *multiplicand*. 2 is called the *multiplier*.

NOTE. The best results will be obtained at this stage of the pupil's progress by making the operation as mechanical as possible. Multiply this way: two 3's are 6; two 4's are 8; product, 86.

2. Multiply:

24	31	44	32	21	42	33	22	23	34
2	2	2	2	2	2	2	2	2	2

3. Multiply by 2:

120	130	111	140	122	333	222	322
432	103	324	132	212	214	401	243

4. Multiply by 2:

50	51	60	61	70	71	80	81	90	91
54	63	82	73	94	83	93	64	84	72

5. Multiply 203 by 2.

$$\begin{array}{r} 203 \\ \times\ 2 \\ \hline 406 \end{array}$$

6. Multiply 408 by 2.

$$\begin{array}{r} 408 \\ \times\ 2 \\ \hline 816 \end{array}$$

7. Multiply by 2:

101	202	303	402	201	403	304	102
406	308	207	409	305	406	108	309

PROBLEMS IN 2'S *Oral*

1. $3 \times 2 =$ ——. Three times 2 tops are ——.

2. One apple costs 2 cents. Three apples will cost —— times —— cents, or —— cents.

3. $7 \times 2 =$ ——. Seven times 2 chickens are ——.

4. Seven yards of ribbon at 2 cents a yard will cost ——.

5. $8 \times 2 =$ ——. Eight times 2 knives are ——.

6. What will eight 2-cent stamps cost?

7. $9 \times 2 =$ ——. Nine times 2 spools of thread are ——.

8. At 2 cents a spool, 9 spools of thread will cost ——.

9. $12 \times 2 =$ ——. Twelve times 2 eggs are ——.

10. What must be paid for a dozen eggs at 2 cents apiece?

DIVISION: TABLE OF 2'S

1. Count by 2's to 24. Count back by 2's from 24 to 0.

One	2 = —	2 ÷ 2 = —	Seven	2's = —	14 ÷ 2 = —
Two	2's = —	4 ÷ 2 = —	Eight	2's = —	16 ÷ 2 = —
Three	2's = —	6 ÷ 2 = —	Nine	2's = —	18 ÷ 2 = —
Four	2's = —	8 ÷ 2 = —	Ten	2's = —	20 ÷ 2 = —
Five	2's = —	10 ÷ 2 = —	Eleven	2's = —	22 ÷ 2 = —
Six	2's = —	12 ÷ 2 = —	Twelve	2's = —	24 ÷ 2 = —

2. Learn:

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

In the expression 6 ÷ 2 — six divided by two — we mean how many times 2 is contained in 6; that is, how many 2's are there in 6. We call 6 the *dividend*, 2 the *divisor*, and the result, 3, the *quotient*. The sign of division is ÷, and is read "divided by." 6 ÷ 2 means that the number before the sign is to be divided by the number after the sign.

NOTE. An absolute mastery of the various multiplication and division tables must be secured. The simple learning of the combinations in their order is not sufficient. The pupil does not know any table until he can recognize instantly and with absolute accuracy any of its combinations under any and all circumstances. Each daily exercise should begin with a rapid oral review of all tables previously learned. The pupil who works rapidly is far more likely to be accurate than one who works slowly.

DRILL EXERCISE: DIVIDING BY 2

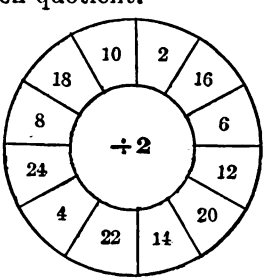
3. Divide each number in the rows by the number in the center space.

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

4. Divide, and add 1 to each quotient. Thus, 4 divided by 2 is 2, and 1 are 3. In like manner divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to each quotient.

5. Divide, and subtract 1 from each quotient.

The device at the right may be used for variety.



$6 = 2 + 2 + 2$ Six is made up of three 2's,
$6 = 3 + 3$ or two 3's.

Then, $6 \div 2 = 3$, and $6 \div 3 = 2$.

$8 = 2 + 2 + 2 + 2$ 8 contains 2 four times. $8 \div 2 = 4$
$8 = 4 + 4$ 8 contains 4 two times. $8 \div 4 = 2$

6. Treat in like manner the numbers 10, 12, 14, to 24.

As each table is studied, all the combinations of the other division tables should be similarly treated.

DIVIDING BY 2 *Oral and Written*

1. $2 \div 2$ $20 \div 2$ $4 \div 2$ $40 \div 2$ $6 \div 2$ $60 \div 2$

$2)\underline{86}$ is another way of writing $86 \div 2$.

$$\begin{array}{r} 2)86 \\ \hline 43 \end{array}$$

Proof: $\begin{array}{r} 43 \\ 2 \\ \hline 86 \end{array}$

2 is contained in 8 (tens), 4 (tens) times; write 4 under the 8. 2 is contained in 6 (units), 3 (units) times; write 3 under the 6. 2 is contained in 86, 43 times.

NOTE. Make this work as mechanical as possible. Say, 2 in 8, 4 times; 2 in 6, 3 times; quotient, 43.

2. $22 \div 2$ $66 \div 2$ $26 \div 2$ $82 \div 2$ $28 \div 2$

3. $48 \div 2$ $80 \div 2$ $68 \div 2$ $42 \div 2$ $60 \div 2$

4. $2)\underline{228}$ $2)\underline{824}$ $2)\underline{604}$ $2)\underline{408}$ $2)\underline{282}$ $2)\underline{264}$

5. $2)\underline{466}$ $2)\underline{442}$ $2)\underline{646}$ $2)\underline{242}$ $2)\underline{440}$ $2)\underline{660}$

PROBLEMS *Oral*

1. $10 \div 2 =$ ——. I can buy —— 2-cent stamps for 10 cents, for there are —— 2's in 10.

2. $12 \div 2 =$ ——. How many 2-quart bottles will it take to hold 12 quarts of milk?

3. $14 \div 2 =$ ——. How many 2-cent newspapers can you buy for 14 cents?

4. $18 \div 2 =$ ——. Willie saves 2 cents a day. How long will it take him to save 18 cents?

5. $24 \div 2 =$ ——. How many pieces of ribbon 2 yards long can be cut from a roll of 24 yards?

6. How many pencils at 2 cents apiece can you buy with 20 cents?

FINDING ONE HALF A NUMBER *Oral*

To find one half of a number is to find one of its two equal parts. One half is written $\frac{1}{2}$.

8	14	20	16	4	18
		$\frac{1}{2}$ of			
24	12	2	22	6	10

1. Find $\frac{1}{2}$ of the numbers in the rows.

2. 3 is $\frac{1}{2}$ of — 11 is $\frac{1}{2}$ of — 9 is $\frac{1}{2}$ of — 7 is $\frac{1}{2}$ of —
6 is $\frac{1}{2}$ of — 2 is $\frac{1}{2}$ of — 5 is $\frac{1}{2}$ of — 4 is $\frac{1}{2}$ of —
10 is $\frac{1}{2}$ of — 12 is $\frac{1}{2}$ of — 1 is $\frac{1}{2}$ of — 8 is $\frac{1}{2}$ of —

3. When 2 articles cost 6 cents, one will cost $\frac{1}{2}$ of —— cents, or —— cents. What will one article cost when 2 cost 8 cents? 2 cents? 12 cents? 16 cents? 4 cents?

DIVIDING BY 2: REMAINDERS *Oral*

1. Divide by 2, giving quotients and remainders:

$2\overline{)13}$ 2 is contained in 13 6 times, and 1 over.
6, and 1 over

5 15 7 17 9 19 11 21 3 23

2. When pears are 2 cents each, with 7 cents I can buy —— pears and have —— cent left.

3. Lizzie has 9 cents. How many paper dolls at 2 cents each can she buy, and how much money will she have left?

4. I can separate 11 apples into 2 piles of —— apples each, and have —— apple left over.

5. How many two-dollar books can you buy with 15 dollars? How much money will you have left?

REVIEW EXERCISES *Oral*

	A	*B*	*C*	*D*	*E*
1.	$2 + 2$	$2 - 2$	2×2	$12 \div 2$	$\frac{1}{2}$ of 14
2.	$4 + 2$	$4 - 2$	4×2	$24 \div 2$	$\frac{1}{2}$ of 2
3.	$8 + 2$	$8 - 2$	8×2	$18 \div 2$	$\frac{1}{2}$ of 24
4.	$3 + 2$	$3 - 2$	3×2	$10 \div 2$	$\frac{1}{2}$ of 16
5.	$6 + 2$	$6 - 2$	6×2	$16 \div 2$	$\frac{1}{2}$ of 8
6.	$9 + 2$	$9 - 2$	9×2	$4 \div 2$	$\frac{1}{2}$ of 22
7.	$12 + 2$	$12 - 2$	12×2	$6 \div 2$	$\frac{1}{2}$ of 18
8.	$5 + 2$	$5 - 2$	5×2	$2 \div 2$	$\frac{1}{2}$ of 4
9.	$10 + 2$	$10 - 2$	10×2	$8 \div 2$	$\frac{1}{2}$ of 12
10.	$1 + 2$	$11 - 2$	1×2	$20 \div 2$	$\frac{1}{2}$ of 6
11.	$7 + 2$	$7 - 2$	7×2	$22 \div 2$	$\frac{1}{2}$ of 20
12.	$11 + 2$	$11 - 2$	11×2	$14 \div 2$	$\frac{1}{2}$ of 10

Make up problems from the numbers given in this exercise. Thus, for row 5:

1. Harry had six doves and bought two more. How many had he then?

2. Philip had six doves and sold two. How many had he left?

3. Willie had two marbles and James had six times as many. How many marbles had James?

4. How many 2-cent tops can be bought with 16 cents?

5. What is $\frac{1}{2}$ of 8 cents?

NOTE. The pupils should make up problems based on the combinations of each group of abstract exercises throughout the book.

MULTIPLYING BY 2 *Written*

NOTE. If the teacher does not wish to spend the time to teach the following work now, it may be omitted for a few lessons.

1. Multiply 36 by 2.

$$\begin{array}{r} 36 \\ \times\ 2 \\ \hline 12 \\ 6 \\ \hline 72 \end{array}$$

2 times 6 units are 12 units, or 1 ten and 2 units; write the 1 ten in the tens' place and the 2 units in the units' place. 2 times 3 tens are 6 tens; write the 6 tens in the tens' column. The sum of the units is 2, and the sum of the tens 7. The product is 72.

$$\begin{array}{r} 36 \\ \times\ 2 \\ \hline 72 \end{array}$$

A shorter way is as follows:
2 times 6 units are 12 units, or 1 ten and 2 units; write the 2 in the units' place, and add the 1 ten to the product of 2 times 3 tens, making 7 tens.

In your work multiply this way:
2 times 6 are 12; write 2 under the 6.
2 times 3 are 6, and 1 are 7; write 7 under the 3.

2. Multiply:

15	47	58	66	98	84	79	28	93	19
2	2	2	2	2	2	2	2	2	2

3. Multiply by 2:

67	39	57	18	28	37	48	56	27	77
17	97	25	65	35	95	75	85	45	55

4. Mr. Baker's house rent is 19 dollars a month. How much will he pay in 2 months?

5. Harry bought 2 doves at 28 cents apiece. How much did he pay for them?

6. There are 52 weeks in a year. How many weeks are there in 2 years?

DIVIDING BY 2

Written

1. Divide 126 by 2.

2)126
  63

Proof: 63
× 2
126

2 in 12, 6 times; write 6 under the 2.
2 in 6, 3 times; write 3 under the 6.
2 is contained in 126, 63 times.

NOTE. Make this work as mechanical as possible.

2. 2)124 2)146 2)120 2)144 2)168 2)122

3. 2)180 2)128 2)142 2)184 2)140 2)166

4. Divide 618 by 2.

2)618
  309

Proof: 309
× 2
618

2 in 6, 3 times; write 3 under the 6.
2 in 1, 0 times; write 0 under the 1.
2 in 18, 9 times; write 9 under the 8.

5. 2)210 218 ÷ 2 2)812 214 ÷ 2 2)414

6. 2)416 816 ÷ 2 2)410 418 ÷ 2 2)612

7. Divide 56 by 2.

2)56
  28

Proof: 28
× 2
56

2 in 5, 2 times and 1 over; write 2 under the 5.
2 in 16, 8 times; write 8 under the 6.

8. 32 ÷ 2 52 ÷ 2 30 ÷ 2 96 ÷ 2 78 ÷ 2

9. 50 ÷ 2 72 ÷ 2 38 ÷ 2 70 ÷ 2 76 ÷ 2

10. What is $\frac{1}{2}$ of 58?

11. How many times is 2 contained in 74?

NOTE. The following problems should be thoroughly analyzed by the teacher with the children. The problems may then be used for oral or written work at the discretion of the teacher. The greatest hindrance to the correct solving of problems is the incomplete understanding of the conditions of the problems. Continue the analysis of subsequent groups of problems until pupils acquire the power of grasping the conditions stated.

As the object of problem work is to teach children to think, rather than to learn combinations of numbers, all the combinations used in problem work in the earlier part of the book are purposely simple.

PROBLEMS *Oral and Written*

1. What will 2 quarts of beans cost at 8 cents a quart?

ANALYSIS : Since 1 quart costs 8 cents, 2 quarts will cost 2 times 8 cents, or 16 cents.

2. Jennie pays 19 cents for a doll, 7 cents for cloth, 8 cents for thread, and 5 cents for a paper of needles. What does she pay for all?

3. A knife that cost 25 cents was sold for 9 cents. What was the loss?

4. At 24 cents a dozen, what will half a dozen lemons cost? What will 2 dozen cost?

5. If you have 22 postal cards, and give away 2, how many will you have left?

6. If you have 22 postal cards, and give away one half of them, how many will you have left?

7. Mr. White raised 9 bushels of tomatoes. His neighbor, Mr. Bates, raised twice as many. How many bushels did they both raise?

8. Elizabeth bought 6 2-cent stamps and 6 1-cent stamps. What did she pay for all?

9. A farmer has four bins of potatoes. In one bin there are 19 bushels, in another 9 bushels, in another 7 bushels, and in another 5 bushels. How many bushels in all?

10. Henry walks 4 miles every day in going to school. How far will he walk in 2 days?

11. If a pair of rabbits costs 40 cents, what does 1 rabbit cost?

12. A family uses 13 quarts of milk a week. How many quarts in 2 weeks?

13. Emily had 19 pansy plants. A friend gave her 6 more. How many had she then?

Drill on Exercise V, page 11.

Drill on Exercise VI, page 11.

DRILL EXERCISES *Oral*

1.

8 is	— × 2	14 is	— × 2	18 is	— × 2
20 is	or	22 is	or	10 is	or
6 is	2 × —	2 is	2 × —	16 is	2 × —

2.

3 is		2 is		1 is	
7 is	$\frac{1}{2}$ of —	5 is	$\frac{1}{2}$ of —	6 is	$\frac{1}{2}$ of —
10 is		12 is		9 is	

3.

$\frac{1}{2}$ of 8		$\frac{1}{2}$ of 14		$\frac{1}{2}$ of 18	
$\frac{1}{2}$ of 20	is —	$\frac{1}{2}$ of 22	is —	$\frac{1}{2}$ of 10	is —
$\frac{1}{2}$ of 6		$\frac{1}{2}$ of 2		$\frac{1}{2}$ of 16	

4. Count to 100 by 2's, beginning with 2; beginning with 1.

5. Count back by 2's from 100; from 99.

DRILL TABLE: ADDITION AND SUBTRACTION

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
1.	10	14	17	11	15	18	12	16	19	13
2.	50	54	57	51	55	58	52	56	59	53
3.	80	84	87	81	85	88	82	86	89	83
4.	20	24	27	21	25	28	22	26	29	23
5.	60	64	67	61	65	68	62	66	69	63
6.	90	94	97	91	95	98	92	96	99	93
7.	30	34	37	31	35	38	32	36	39	33
8.	70	74	77	71	75	78	72	76	79	73
9.	40	44	47	41	45	48	42	46	49	43

1. Add 1 to each number in column *A*. Add 10; 2; 3; 4; 5; 6; 7; 8; 9. In like manner add the numbers from 1 to 10 to the numbers in the other columns.

2. Subtract the numbers from 1 to 10 from the numbers in the columns.

NOTE. The above exercises may be varied by working by rows.

ADDITION AND SUBTRACTION COMPARED

Subtraction is the opposite of addition.

Thus,	$5+4=9$	$9-5=4$	$9-4=5$
1.	$4+8=?$	$12-4=?$	$12-8=?$
2.	$9+7=?$	$16-9=?$	$16-7=?$
3.	$6+5=?$	$11-6=?$	$11-5=?$
4.	$3+7=?$	$10-7=?$	$10-3=?$
5.	$8+7=?$	$15-8=?$	$15-7=?$
6.	$9+6=?$	$15-9=?$	$15-6=?$

PROBLEMS *Oral*

1. I have 5 apples in one basket and 7 in another basket. In both baskets there are —— apples.

2. If I have 12 apples and give away 5, how many have I left?

3. If I have 12 apples, how many must I give away to have 7 left?

4. You have 6 cents and you earn 9 more. How many have you then?

5. You have 15 cents in your pocket when you go out to play. When you go home you can find but 9. You must have lost ——.

6. Out of 15 cents you pay 9 cents for a block of paper and a pencil. You then have —— cents.

What name is given to the result, or answer, in addition? In subtraction? In multiplication? In division?

MULTIPLICATION: TABLE OF 3'S

1. Count by 3's to 36.

3+3	=—	Two	3's =—
3+3+3	=—	Three	3's =—
3+3+3+3	=—	Four	3's =—
3+3+3+3+3	=—	Five	3's =—
3+3+3+3+3+3	=—	Six	3's =—
3+3+3+3+3+3+3	=—	Seven	3's =—
3+3+3+3+3+3+3+3	=—	Eight	3's =—
3+3+3+3+3+3+3+3+3	=—	Nine	3's =—
3+3+3+3+3+3+3+3+3+3	=—	Ten	3's =—
3+3+3+3+3+3+3+3+3+3+3	=—	Eleven	3's =—
3+3+3+3+3+3+3+3+3+3+3+3	=—	Twelve	3's =—

2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

6	0	11	8	2	5	
			× 3			
9	4	12	7	3	10	1

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1 to each product. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1 from each product. Multiply, and subtract 2; 3.

7. Use 2 in the center space, and multiply as before.

MULTIPLYING BY 3 *Oral and Written*

1.	$3 \times 1 =$ —	$3 \times 2 =$ —	$3 \times 3 =$ —	$3 \times 4 =$ —
2.	$3 \times 10 =$ —	$3 \times 20 =$ —	$3 \times 30 =$ —	$3 \times 40 =$ —
3.	$3 \times 100 =$ —	$3 \times 200 =$ —	$3 \times 300 =$ —	$3 \times 400 =$ —

4. Multiply each of these numbers by 3. Use 2 as a multiplier.

21	32	13	22	31	43	52	61
230	322	311	113	333	223	132	321

5. Find 3 times each of these numbers. Find 2 times.

63	42	73	62	83	92	53	22
101	204	305	209	308	104	407	406

6. Multiply 24 by 3.

24
3
72

Multiply this way:
3 times 4 are 12; write 2 under the 4.
3 times 2 are 6, and 1 are 7; write 7 under the 2.

7. Multiply:

26	25	35	27	16	36	29	17	15	18
3	3	3	3	3	3	3	3	3	3

8. Multiply each of these numbers by 3. Multiply by 2.

34	28	54	37	65	39	75	44	87	55
58	66	94	46	56	84	48	72	63	76

PROBLEMS *Oral*

1. $3 \times 3 =$ ——. 3 times 3 dollars are ——.

2. Mr. Wilkins has 3 rows of pear trees, 3 trees in a row. How many trees has he in all?

3. $7 \times 3 =$ ——. 7 times 3 roses are ——.

4. Seven farmers have each 3 cows. How many cows have they?

5. $8 \times 3 =$ ——. 8 times 3 marbles are ——.

6. Eight boys have each a speller, a reader, and an arithmetic. How many books in all?

DIVISION: TABLE OF 3'S

1. Count by 3's to 36. Count back by 3's from 36 to 0.

One	3 = —	3 ÷ 3 = —	Seven	3's = —	21 ÷ 3 = —
Two	3's = —	6 ÷ 3 = —	Eight	3's = —	24 ÷ 3 = —
Three	3's = —	9 ÷ 3 = —	Nine	3's = —	27 ÷ 3 = —
Four	3's = —	12 ÷ 3 = —	Ten	3's = —	30 ÷ 3 = —
Five	3's = —	15 ÷ 3 = —	Eleven	3's = —	33 ÷ 3 = —
Six	3's = —	18 ÷ 3 = —	Twelve	3's = —	36 ÷ 3 = —

2. Learn:

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

You can say this table in 3 ways:
(1) 3 divided by 3 is 1, 6 divided by 3 is 2, etc.
(2) 3 in 3, once, 3 in 6, twice, etc.
(3) There is one 3 in 3, there are two 3's in 6, etc.

3. Divide each number in the rows by the number in the center space.

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

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to each quotient.

5. Divide, and subtract 1 from each quotient.

DIVIDING BY 3 *Oral and Written*

1.	$39 \div 3$	$96 \div 3$	$69 \div 3$		$93 \div 3$	$63 \div 3$
2.	$3\overline{)300}$	$3\overline{)330}$	$3\overline{)333}$	$3\overline{)303}$	$3\overline{)669}$	$3\overline{)963}$
3.	$3\overline{)306}$	$3\overline{)327}$	$3\overline{)618}$	$3\overline{)924}$	$3\overline{)612}$	$3\overline{)321}$
4.	$3\overline{)279}$	$3\overline{)243}$	$3\overline{)186}$	$3\overline{)219}$	$3\overline{)153}$	$3\overline{)129}$

5. Divide each of these numbers by 3:

42	54	75	84	45	57	48	72
102	132	117	108	135	114	144	105

NOTE. Show pupils that the product of the divisor and quotient equals the dividend. Require the proving of work until accuracy becomes a habit.

PROBLEMS *Oral*

1. $6 \div 3 =$ ——. When peaches are 3 cents each, I can buy —— for 6 cents, because there are —— 3's in 6.

2. $12 \div 3 =$ ——. How many 3-cent skeins of yarn can be bought for 12 cents?

3. $24 \div 3 =$ ——. For 24 cents I can buy —— 3-cent pencils, for 3 is contained in 24 —— times.

4. $27 \div 3 =$ ——. How many sheep at 3 dollars each can be bought for 27 dollars?

5. If one pear costs 3 cents, how many can be bought for 30 cents? For 24 cents? 15 cents? 6 cents? 12 cents? 36 cents? 27 cents? 9 cents? 33 cents? 18 cents? 21 cents?

NOTE. Children should not be allowed to write for seat work multiplication and division tables from memory, unless such work is carefully corrected in both matter and form.

FINDING ONE OF THE THREE EQUAL PARTS OF A NUMBER

To find one third of a number is to find one of its three equal parts.

30	24	12	3	27	18
		$\frac{1}{3}$ of			
21	33	15	9	36	6

1. Find $\frac{1}{3}$ of each of the numbers in the rows.

2. 4 is $\frac{1}{3}$ of — 2 is $\frac{1}{3}$ of — 1 is $\frac{1}{3}$ of — 9 is $\frac{1}{3}$ of —
12 is $\frac{1}{3}$ of — 11 is $\frac{1}{3}$ of — 10 is $\frac{1}{3}$ of — 5 is $\frac{1}{3}$ of —
6 is $\frac{1}{3}$ of — 8 is $\frac{1}{3}$ of — 7 is $\frac{1}{3}$ of — 3 is $\frac{1}{3}$ of —

3. Use $\frac{1}{2}$ in place of $\frac{1}{3}$.

DIVIDING BY 3: REMAINDERS *Oral*

1. Divide each of these numbers by 3, giving quotients and remainders:

4	14	11	25	7	28	16	19	31	26
5	22	17	10	8	13	20	29	23	32

2. Use 2 as a divisor.

NOTE. Pupils should be shown that all work in division involving a remainder may be proved by multiplying the quotient by the divisor and adding the remainder to that product. Require the proving of work until accuracy becomes a habit.

3. I have 17 cents. I can buy —— 3-cent pencils, and have —— left. I can buy —— 2-cent pencils and have —— left.

4. Samuel has 20 cents. How many 3-cent tops can he buy, and how many cents will he have left?

REVIEW EXERCISES *Sight*

	A	*B*	*C*	*D*	*E*
1.	2 + 3	12 − 3	2 × 3	12 ÷ 3	$\frac{1}{3}$ of 3
2.	4 + 3	4 − 3	4 × 3	24 ÷ 3	$\frac{1}{3}$ of 6
3.	8 + 3	8 − 3	8 × 3	18 ÷ 3	$\frac{1}{3}$ of 9
4.	3 + 3	3 − 3	3 × 3	33 ÷ 3	$\frac{1}{3}$ of 36
5.	6 + 3	6 − 3	6 × 3	36 ÷ 3	$\frac{1}{3}$ of 33
6.	9 + 3	9 − 3	9 × 3	9 ÷ 3	$\frac{1}{3}$ of 30
7.	12 + 3	12 − 3	12 × 3	30 ÷ 3	$\frac{1}{3}$ of 12
8.	5 + 3	5 − 3	5 × 3	21 ÷ 3	$\frac{1}{3}$ of 27
9.	10 + 3	10 − 3	10 × 3	15 ÷ 3	$\frac{1}{3}$ of 15
10.	1 + 3	11 − 3	1 × 3	27 ÷ 3	$\frac{1}{3}$ of 24
11.	7 + 3	7 − 3	7 × 3	6 ÷ 3	$\frac{1}{3}$ of 18
12.	11 + 3	11 − 3	11 × 3	3 ÷ 3	$\frac{1}{3}$ of 21

PROBLEMS *Oral and Written*

1. Susie paid 15 cents for 3 oranges. What did each orange cost?

2. John is 15 years old, and his brother Henry is 8 years old. What is the difference between their ages? What is the sum of their ages?

3. Arnold saved 17 cents for a ball. His aunt Harriet gave him enough more to make 25 cents. How much did his aunt give him?

4. A bushel of apples for 75 cents, and a bar of soap for 8 cents, will cost how much?

5. What is one half of 50 cents?

6. What must be paid for 7 spools of thread at 3 cents each, and 2 papers of needles at 5 cents each?

7. John has 14 pigeons and Willie has twice as many. How many has Willie?

8. A piece of cloth 36 inches long is cut into 3 equal pieces. What is the length of each piece?

9. One half pound of cheese at 16 cents a pound, and $\frac{1}{3}$ yard of cloth at 27 cents a yard, will cost how much?

10. Mary bought a box of paints for 7 cents, and gave a 10-cent piece in payment. What change did the storekeeper give her?

DRILL EXERCISES *Oral*

1. 15 is, 33 is, 3 is, 27 is } — × 3 or 3 × —

21 is, 30 is, 6 is, 18 is } — × 3 or 3 × —

24 is, 12 is, 36 is, 9 is } — × 3 or 3 × —

2. 3 is $\frac{1}{2}$ of — 3 is $\frac{1}{3}$ of — 3 is $\frac{1}{7}$ of 6 3 is $\frac{1}{7}$ of 9

3. 3 is, 6 is, 1 is } $\frac{1}{3}$ of —

10 is, 4 is, 8 is } $\frac{1}{3}$ of —

2 is, 9 is, 7 is } $\frac{1}{3}$ of —

11 is, 5 is, 12 is } $\frac{1}{3}$ of —

4. Count to 100 by 3's, beginning with 3; with 1; with 2.

5. Count back by 3's from 100; from 99; from 98.

ADDING NUMBERS *Oral and Written*

1. What is the sum of 31 and 25?

31 The sum of the units is 6; write 6 under the units' column.
25 The sum of the tens is 5; write 5 under the tens' column.
56 The sum is 56.

NOTE. Make this work as mechanical as possible. Think, 5 and 1, 6; 2 and 3, 5; sum, 56.

Add these numbers:

2.	13	22	44	31	42	24	35	52	16	53
	24	54	55	46	26	43	62	37	72	24
3.	213	223	443	251	715	327	472	332		
	346	435	546	418	223	541	216	465		

SUBTRACTING NUMBERS *Oral and Written*

1. Take 43 from 68.

68
43
25

3 units from 8 units leaves 5 units; write 5 under the units' column.

4 tens from 6 tens leaves 2 tens; write 2 under the tens' column.

The remainder, or difference, is 25.

NOTE. Make this work as mechanical as possible. Think, 3 from 8, 5; 4 from 6, 2; remainder, 25.

Subtract:

2.	39	87	76	65	38	86	98	85	68	97
	22	64	52	24	12	34	37	33	45	36
3.	64	83	57	48	77	49	75	83	96	77
	30	21	20	22	35	18	32	41	53	50
4.	764	845	939	486	679	668	889	687		
	223	314	717	204	430	137	307	365		

5. 88 – 27 59 – 33 98 – 25 97 – 50 67 – 26

READING AND WRITING NUMBERS: THOUSANDS

1. Read by groups:

1	3	4	50	60	77	88	90
10	30	44	55	606	770	808	999
100	300	444	505	660	707	888	909

2. Write in figures:

Two hundred forty.	Four hundred thirty-four.
Six hundred twenty-nine.	Three hundred three.
Seven hundred four.	Eight hundred twenty-five.

Five thousand is written 5000. The fourth place to the left is the thousands' place.

To make our reading easier, we separate by a comma large numbers into groups of three figures, counting from the right, calling the first group units and the second group thousands. Thus, in 3,287 we have 3 in the thousands' group, 287 in the units' group. We read it "three thousand, two hundred eighty-seven." Never use the word "and" to connect the parts of a whole number.

3. Read:

1,546 7,308 8,544 6,200 2,735 3,724

4. Write in figures:

Two thousand three hundred twenty-five.
Nine thousand six hundred thirty-eight.
Seven thousand three hundred.
Three thousand nine hundred fifty-three.
Five thousand two hundred thirty-three.

MULTIPLICATION: TABLE OF 4'S

1. Count by 4's to 48.

$4+4 = —$	Two 4's = —
$4+4+4 = —$	Three 4's = —
$4+4+4+4 = —$	Four 4's = —
$4+4+4+4+4 = —$	Five 4's = —

Complete this table through 12 4's.

2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

11	8	4	2	9	5	
			× 4			
12	7	3	10	1	0	6

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1 to each product. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1 from each product. Multiply, and subtract 2; 3; 4.

7. Write 2; 3 in the center space and multiply as before.

MULTIPLYING BY 4

1. Multiply by 4:

6	60	600	7	80	500	8	40	900
4	4	4	4	4	4	4	4	4
—	—	—	—	—	—	—	—	—

Multiply by 4:

2.	51	42	31	82	61	52	71	92
3.	101	302	407	503	906	422	802	506

4. Multiply 28 by 4.

28 — 4 times 8 are 32; write 2 under the 8.
4 — 4 times 2 are 8, and 3 are 11; write 11 at the left of the 2.
112 — The product is 112.

Multiply by 4:

5.	18	35	46	68	57	69	24	36	45	75
6.	48	59	27	36	15	25	66	75	38	85

7. Find 3 times each of the above numbers.

8. Find 2 times.

PROBLEMS *Oral*

1. How many shoes will it take to shoe 2 horses?

2. How many wheels have 5 automobiles?

3. Mr. Smith's hens lay 4 eggs a day. How many will they lay in a week?

4. John's father gathered 4 barrels of apples from each of his 8 trees. He gathered —— barrels in all.

5. A man walks 4 miles an hour. How far will he walk in 6 hours?

DIVISION: TABLE OF 4'S

1. Count by 4's to 48. Count back by 4's from 48 to 0.

One	4 = —	4 ÷ 4 = —	Seven	4's = —	28 ÷ 4 = —
Two	4's = —	8 ÷ 4 = —	Eight	4's = —	32 ÷ 4 = —
Three	4's = —	12 ÷ 4 = —	Nine	4's = —	36 ÷ 4 = —
Four	4's = —	16 ÷ 4 = —	Ten	4's = —	40 ÷ 4 = —
Five	4's = —	20 ÷ 4 = —	Eleven	4's = —	44 ÷ 4 = —
Six	4's = —	24 ÷ 4 = —	Twelve	4's = —	48 ÷ 4 = —

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

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

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to each quotient.

5. Divide, and subtract 1 from each quotient.

6. Write 2 in the center space and divide as before.

DIVIDING BY 4

1. 4)120 4)168 4)364 4)328 4)244 4)208 4)284

2. 4)404 4)436 4)820 4)412 4)828 4)416 4)824

Divide by 4:

3. 52 76 68 56 96 60 72 64

4. 100 132 196 200 164 152 176 144

5. Use 2 as a divisor in the above exercises.

PROBLEMS *Oral*

1. A grocer put up 32 ounces of tea in 4-ounce packages. How many packages did he make?

2. How many groups of 4 each are there in a dozen?

3. How many pounds of sugar, at 4 cents a pound, can you buy for 48 cents?

4. How many pieces of cloth 4 yards long can be cut from a piece 36 yards long?

5. How many 4-cent oranges can be bought with 28 cents?

6. Anna, Lizzie, Sarah, and Carrie shared 20 plums equally. How many plums did each get?

FINDING FOURTHS OF NUMBERS

To find $\frac{1}{4}$ of a number is to find one of its —— equal parts.

1. Find $\frac{1}{4}$ of the numbers in the rows.

Use $\frac{1}{2}$ in place of $\frac{1}{4}$.

16	28	40	8	20	4
		$\frac{1}{4}$ of			
32	12	36	44	24	48

2. 6 is $\frac{1}{4}$ of — 3 is $\frac{1}{4}$ of — 2 is $\frac{1}{4}$ of — 5 is $\frac{1}{4}$ of —
12 is $\frac{1}{4}$ of — 8 is $\frac{1}{4}$ of — 11 is $\frac{1}{4}$ of — 9 is $\frac{1}{4}$ of —
10 is $\frac{1}{4}$ of — 1 is $\frac{1}{4}$ of — 7 is $\frac{1}{4}$ of — 4 is $\frac{1}{4}$ of —

3. Use $\frac{1}{3}$ in place of $\frac{1}{4}$. Use $\frac{1}{2}$.

DIVIDING BY 4: REMAINDERS

Oral and Written

Divide the following numbers by 4, giving quotients and remainders:

1. 5 7 10 13 15 18 21 23 26 29
2. 6 9 11 14 17 19 22 25 27 30
3. $31 \div 4$ $33 \div 4$ $34 \div 4$ $35 \div 4$ $37 \div 4$
4. $4\overline{)38}$ $4\overline{)39}$ $4\overline{)41}$ $4\overline{)42}$ $4\overline{)43}$ $4\overline{)45}$ $4\overline{)46}$ $4\overline{)47}$
5. Use 3 as a divisor. Use 2.

EXERCISE

Solve quickly by groups:

$4+4$	$8+4$	$12+4$	$5+4$	$7+4$	$9+4$
$4-4$	$8-4$	$12-4$	$5-4$	$7-4$	$9-4$
4×4	8×4	12×4	5×4	7×4	9×4
$4\div4$	$8\div4$	$12\div4$	$5\div4$	$7\div4$	$9\div4$

PROBLEMS *Oral*

Make up examples for each of these groups. Thus, for group 3:

1. If you have 12 cents, and earn 4 cents more, you will have —— cents.

2. If you have 12 cents, and spend 4 cents, you will have —— cents.

3. If you save 4 cents a day, in 12 days you will save —— cents.

4. If you have 12 cents, and spend 4 cents a day, your money will last —— days.

PROBLEMS *Oral and Written*

1. When one bicycle costs 22 dollars, what must be paid for 2? For 3? For 4?

2. Four dozen buttons, at 9 cents a dozen, and a 5-cent spool of thread, will cost how much?

3. How many 4-cent oranges can you buy for 27 cents, and how many cents will you have left?

4. John's father is 48 years old, and John is $\frac{1}{4}$ as old. How old is John?

5. A copy book cost 8 cents, and a reader 3 times as much. What did the reader cost? What was paid for both copy book and reader?

6. What change ought you to bring back, if your mother gives you 2 10-cent pieces to pay for 2 quarts of milk at 8 cents a quart?

7. School keeps 5 hours a day. How many hours does school keep in 3 days? In 4 days?

8. Two boys bought a ball for 30 cents. Each paid one half the cost. How many cents did each pay?

9. Mr. Green raised 32 bushels of apples, and sold $\frac{1}{4}$ of them. How many bushels did he sell?

10. If you have 37 cents, and spend 8 cents, how many will you have left?

DRILL EXERCISES *Oral*

1. 12 is, 40 is, 8 is, 20 is } — × 4 or 4 × —

4 is, 24 is, 48 is, 32 is } — × 4 or 4 × —

28 is, 36 is, 44 is, 16 is } — × 4 or 4 × —

2. 4 is $\frac{1}{?}$ of 16 | 4 is $\frac{1}{?}$ of 8 | 4 is $\frac{1}{?}$ of 12

4 is $\frac{1}{2}$ of — | 4 is $\frac{1}{4}$ of — | 4 is $\frac{1}{3}$ of —

3. 9 is, 2 is, 8 is, 1 is } $\frac{1}{4}$ of — | 11 is, 3 is, 7 is, 12 is } $\frac{1}{4}$ of — | 6 is, 10 is, 5 is, 4 is } $\frac{1}{4}$ of —

4. Count to 100 by 4's, beginning with 4; with 1; with 2; with 3.

5. Count back by 4's from 100; from 99; from 98; from 97.

LIQUID MEASURE *Oral*

1. Learn:

4 gills	= 1 pint
2 pints	= 1 quart
4 quarts	= 1 gallon

NOTE. Pupils should fix the relations of this table by actual measurements.

We write pt. for pint or pints, qt. for quart or quarts, and gal. for gallon or gallons.

2. How many times must you fill the pint measure to make a quart? A pint is what part of a quart?

3. How many times must you fill the quart measure to make a gallon? A quart is what part of a gallon?

4. When milk is 8 cents a quart, what will a pint cost?

5. At 12 cents a quart, a gallon of molasses will cost —— cents.

6. Mrs. Atkins put up a gallon of pickles in pint jars. How many jars did she use?

7. At 4 cents a pint, a quart will cost —— cents, and a gallon will cost —— cents.

8. At 32 cents a gallon, a quart will cost —— cents, and a pint will cost —— cents.

9. Eleven quarts are —— gallons and —— quarts.

10. How many pints in 3 quarts 1 pint?

11. Three gallons are —— quarts, or —— pints.

12. One gallon 3 quarts are how many quarts?

13. Fourteen pints are —— quarts. Twenty-eight quarts are —— gallons.

REVIEW

Divide by 2:

1.	72	98	52	76	90	58	64	50
2.	146	138	182	118	132	154	136	198
3.	210	816	614	810	418	612	218	814
4.	1212	2416	4206	2018	3208	4812		

Multiply by 2:

5.	809	706	403	907	214	516	618	319
6.	126	427	539	848	345	337	647	736

7. Write in figures:

Ninety-six. One thousand four hundred forty.
Fifty-nine. Three thousand two hundred seven.
Two hundred thirty. Seven thousand six hundred twenty.

8. Read:

340 706 1312 6500 8604 4038

ADDITION *Oral and Written*

Add:

1.	62	24	12	25	34	61	53	25	60	46
	26	42	27	50	44	35	32	44	27	33

2.

41	7	21	20	30	42	91	85	22	84
23	32	4	3	20	3	83	71	83	31
2	20	63	50	94	84	32	30	71	82
11	10	1	6	5	60	52	63	33	2

3. $35 + 24$ $17 + 61$ $19 + 40$ $64 + 22$ $55 + 33$

4. $43 + 36$ $60 + 37$ $72 + 15$ $58 + 30$ $43 + 35$

SUBTRACTION *Oral and Written*

Subtract:

1.

86	57	88	36	69	87	46	75	68	99
44	30	27	12	25	40	20	42	47	67

2. $65 - 32$ $96 - 53$ $78 - 36$ $86 - 50$ $86 - 45$

3. $59 - 35$ $48 - 27$ $67 - 30$ $98 - 54$ $74 - 33$

4.

758	976	637	777	783	867	687	598
426	433	420	406	350	306	365	225

5. From 58 take 27. Take 46 from 79.

6. From 554 take 303. Take 437 from 678.

MULTIPLICATION: TABLE OF 5'S

NOTE. The table of 5's and the subsequent tables should be developed in the same manner as the preceding tables.

1. Learn:

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

DRILL EXERCISE

2. Multiply the number in the center space by each number in the rows.

0	11	8	2	5	9

× 5

4	12	7	3	10	1	6

3. Use the number in the center space as the multiplier.

4. Multiply, and add 1 to each product. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

5. Multiply, and subtract 1 from each product. Multiply, and subtract 2; 3; 4; 5.

6. Use 2; 3; 4 in the center space and multiply as before.

MULTIPLYING BY 5

Multiply by 5:

1.	30	40	50	60	70	91	81	71
2.	609	813	416	120	312	418	520	360
3.	22	34	45	56	67	94	78	89
4.	46	55	68	88	26	99	37	54

5. Use 2; 3; 4 as multipliers.

PROBLEMS *Oral*

1. Harry is 5 years old. His father is 8 times as old. What is the father's age?

2. If it takes 5 yards of cloth to make one dress, how many yards will it take to make 7 dresses?

3. What will 12 5-pound cans of coffee weigh?

4. Five 5-cent car rides will cost —— cents.

5. There are 5 school days in a week. In 9 weeks there are —— school days.

DIVISION: TABLE OF 5'S

1. Count by 5's to 60. Count back by 5's from 60 to 0.

NOTE. The table of 5's and the subsequent tables should be developed in the same manner as the preceding tables.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

5	25	45	10	35	50
		÷ 5			
15	30	55	20	60	40

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to each quotient.

5. Divide, and subtract 1 from each quotient.

DIVIDING BY 5

1. $100 \div 5$ $105 \div 5$ $150 \div 5$ $155 \div 5$ $350 \div 5$
2. $405 \div 5$ $255 \div 5$ $550 \div 5$ $450 \div 5$ $305 \div 5$

3. $5\overline{)110}$ $5\overline{)210}$ $5\overline{)440}$ $5\overline{)320}$ $5\overline{)120}$ $5\overline{)75}$ $5\overline{)80}$

4. $5\overline{)310}$ $5\overline{)230}$ $5\overline{)340}$ $5\overline{)140}$ $5\overline{)410}$ $5\overline{)130}$ $5\overline{)330}$

Divide by 5:

5. 510 535 135 530 115 540 145 165

6. 225 520 245 275 545 365 280 325

PROBLEMS *Oral*

1. A farmer paid 30 dollars for sheep at 5 dollars apiece. How many did he buy?

2. How many 5-cent car rides can you have for 50 cents?

3. How long will it take to save a quarter, if you save a nickel a day?

4. How many 5-cent pieces will make 15 cents? 35 cents?

5. If a sailboat moves at the rate of 5 miles an hour, how long will it take to sail 45 miles?

Find $\frac{1}{5}$ of each of the numbers in the rows in Drill Exercise on page 47.

DIVIDING BY 5: REMAINDERS

Oral and Written

1. $14 \div 5$, $5\overline{)14}$, and $\frac{14}{5}$, all mean the same thing.

There are 2 5's in 14, and 4 units over.

We can express our work like this:

$5\overline{)14}$

2, and 4 over

Or we can indicate the division of the 4 units thus, $\frac{4}{5}$.

$5\overline{)14}$

$2\frac{4}{5}$

Divide by 5, giving quotients and remainders:

2. 6 8 11 13 16 18 21 23 26 28

3. $\frac{7}{5}$ $\frac{9}{5}$ $\frac{12}{5}$ $\frac{24}{5}$ $\frac{17}{5}$ $\frac{33}{5}$ $\frac{46}{5}$ $\frac{52}{5}$ $\frac{41}{5}$ $\frac{48}{5}$

4. $37 \div 5$ $42 \div 5$ $39 \div 5$ $44 \div 5$ $32 \div 5$

5. $5\overline{)41}$ $5\overline{)51}$ $5\overline{)36}$ $5\overline{)47}$ $5\overline{)31}$ $5\overline{)54}$ $5\overline{)59}$

6. Divide by 2; 3; 4.

Drill on Exercise VI on page 11.

Drill on exercise on page 26.

PROBLEMS *Oral and Written*

1. A chair cost 12 dollars, and a cushion half as much. What was paid for both?

2. There are 24 hours in a day. How many hours in 2 days? In $\frac{1}{2}$ a day?

3. Three boys divided 45 foreign postage stamps equally. How many did each boy receive?

4. A farmer raised 58 bushels of corn, and kept 16 bushels for his own use. How many bushels did he sell?

5. On Tuesday there were 37 pupils present and 6 absent. How many pupils belong to the school?

6. Eighteen inches of snow fell in one day, and $\frac{1}{3}$ as much fell the next day. How many inches fell in both days?

7. A milkman delivers 9 cans of milk a day. How many cans will he deliver in 4 days?

8. What must be paid for 3 pairs of shoes at 3 dollars a pair, and an overcoat costing 18 dollars?

9. A dozen tumblers at 3 cents each, and a pitcher for 20 cents, will cost —— cents.

Drill on Exercises I and V, pages 115 and 116.

DRILL EXERCISES

Oral

1. 50 is, 35 is, 20 is, 10 is } — × 5 or 5 × —
   5 is, 60 is, 40 is, 25 is } — × 5 or 5 × —
   15 is, 30 is, 55 is, 45 is } — × 5 or 5 × —

2. 5 is $\frac{1}{4}$ of — 5 is $\frac{1}{5}$ of — 5 is $\frac{1}{7}$ of 15 5 is $\frac{1}{7}$ of 10
   5 is $\frac{1}{3}$ of — 5 is $\frac{1}{2}$ of — 5 is $\frac{1}{7}$ of 25 5 is $\frac{1}{7}$ of 20

3. Count to 100 by 5's, beginning with 5; 1; 2; 3; 4.

4. Count back by 5's from 100; 99; 98; 97; 96.

UNITED STATES MONEY

The coins in common use in our country are

the cent	the quarter dollar — 25 cents
the nickel — 5 cents	the half dollar — 50 cents
the dime — 10 cents	the dollar — 100 cents

In writing sums of money we use ct., or ¢, to represent cents, and the sign $ to represent dollars. Thus, 17 cents is written 17¢; 4 dollars is written $4.

5 cents	= 1 nickel
2 nickels	= 1 dime
10 cents	= 1 dime
10 dimes	= 1 dollar
2 quarters	= one half dollar
4 quarters	= one dollar
2 halves	= one dollar

1. Name 2 coins that make a dollar; 4 that make a dollar; 10 that make a dollar; 20 that make a dollar.

2. Name 2 coins that make a half dollar; 5 that make a half dollar; 10 that make a half dollar.

3. What 5 coins make a quarter dollar? Name 3 coins that make a quarter dollar.

4. What 2 coins make a dime? What 10 make a dime?

5. What 5 make a nickel?

6. Using the fewest coins possible, what coins must you have to pay for goods costing 7 cents? 10 cents? 12 cents? 15 cents? 21 cents? 24 cents? 25 cents? 16 cents? 30 cents? 27 cents? 35 cents? 40 cents?

If you had a quarter dollar to pay for each of the following goods, what change ought you to receive?

7. A pound of cheese for 16 cents.

8. A quart of milk for 8 cents.

9. Three quarts of milk at 8 cents a quart.

10. A package of cereal for 10 cents, and a yeast cake.

11. A blank book for a dime, and a pencil for a nickel.

12. Three yards of ribbon at 6 cents a yard.

13. A pound of steak for 23 cents.

14. A yard of cloth at 19 cents.

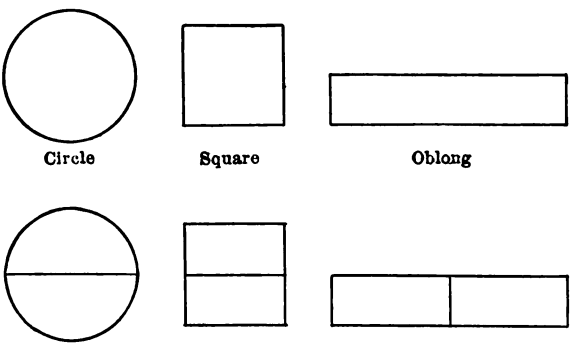
15. Two 3-cent pencils and a 5-cent rubber.

16. A 5-cent thimble, and 2 8-cent spools of silk.

NOTE. Pupils should be given much drill in making change in imaginary purchases. They should be encouraged to make up problems involving conditions with which they are all familiar in everyday transactions in buying and selling. Toy money may be used to advantage, one pupil acting as "storekeeper" until he proves his incompetency by an error in making change. Teach the ordinary business method of making change by counting. Thus, when a quarter dollar is given in payment for 2 yards of cloth at 6 cents a yard, the storekeeper says, "12 and 3 are 15, and 10 are 25," giving in change 3 pennies and a dime.

FRACTIONS *Oral*

1. Divide each of these figures into 2 equal parts.



Do you see that we have separated the circle, the square, and the oblong into 2 equal parts?

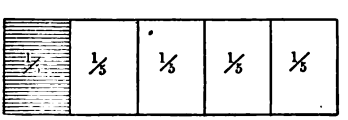
Each part is one half the whole figure.

We call a part of a whole thing a *fraction.*

2. Draw a line 12 inches long. Divide it into three equal parts. Each part is one —— of the line. How many inches is each part?

3. $\frac{2}{3}$ the line is —— times $\frac{1}{3}$ the line. Then $\frac{2}{3}$ the line is —— inches.

4. Draw an oblong and divide it into five equal parts.



5. Shade or color $\frac{1}{5}$; $\frac{2}{5}$; $\frac{4}{5}$.

6. Suppose the whole oblong to represent 20 acres. $\frac{1}{5}$ will represent —— acres. Why?

7. $\frac{2}{5}$ will represent —— acres, because $\frac{2}{5}$ is 2 times $\frac{1}{5}$.

8. In the figure, what is the number of acres represented by the unshaded portion?

9. If $\frac{1}{4}$ of a sum of money is \$6, $\frac{3}{4}$ of the sum is 3 times \$——, because $\frac{3}{4}$ is —— times $\frac{1}{4}$. $\frac{4}{4}$, or the whole, is 4 times \$6, because $\frac{4}{4}$ is —— times $\frac{1}{4}$.

10. Into how many thirds can anything be divided?

NOTE. This exercise is merely suggestive. Discontinue objective work as soon as possible. The prime object is to teach number as number.

READING AND WRITING NUMBERS

1. Read these numbers:

380 476 512 906 2417 8509 7614 1728

2. Write in figures:

Three hundred six. Five hundred sixty.
Seven hundred forty-three. Two hundred twenty.
Four thousand, two hundred.
Seven thousand, one hundred six.
Five thousand, eighty-four.
Six thousand, one hundred seventeen.

DICTATION EXERCISE

1. $15 + 5, \div 5, + 8, \div 4, + 5, \div 2, - 3 = ?$
2. $17 + 6, - 5, \div 2, \times 3, - 8, + 1, \div 5, \times 4 = ?$
3. $18 \div 3, + 4, \times 5, - 5, \div 5, \times 2, + 7, \div 5 = ?$
4. $25 - 10, \div 5, \times 3, - 7, \times 4, + 6, \div 2 = ?$

NOTE. Work like the above is excellent for securing concentration of attention. Five minutes daily spent in this way will develop surprising accuracy and quickness. Beginning with three or four operations, the work can gradually be extended.

ADDITION *Oral and Written*

1. Add:

85
57
73
38
253

Add the units' column without repeating the numbers you are to add. Thus, 11, 18, 23. The sum of the column is 23; that is, 2 tens and 3 units. Write the 3 units under the units' column, and add the 2 tens to the tens' column. Starting with the 2 tens, add the tens' column. Thus, 5, 12, 17, 25. Write down the 25. The sum of the numbers is 253. Always test your work by adding each column twice, once up and once down.

2.	28	17	53	38	59	47	25	76	28	44
	25	47	29	67	36	29	48	37	56	57
3.	58	43	18	17	9	14	25	36	19	28
	62	27	29	46	28	67	55	17	54	7
	77	36	33	58	17	8	29	47	63	36

SUBTRACTION *Oral and Written*

Subtract:

1.	835	587	328	836	527	986	876	968
	405	253	124	431	203	450	525	258

2. $798 - 376$ $974 - 654$ $764 - 343$ $459 - 239$

3. $472 - 170$ $146 - 132$ $843 - 510$ $257 - 152$

MULTIPLICATION: TABLE OF 6'S

1. Count by 6's to 72.

2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

8	2	5	9	4	12	
			× 6			
7	3	10	1	6	0	11

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1 to each product. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1 from each product. Multiply, and subtract 2; 3; 4; 5; 6 from the products.

7. Use 2; 3; 4 in the center space and multiply as before.

MULTIPLYING BY 6

Multiply by 6:

1.	24	35	46	57	68	59	77	86
2.	79	88	97	39	66	75	83	54
3.	202	803	414	712	809	513	617	315
4.	412	313	824	525	367	358	249	398

5. Use 5; 3; 4; 2 as multipliers in this exercise.

PROBLEMS *Oral*

1. What will 9 quarts of berries cost at 6 cents a quart?

2. At 7 dollars a ton, what must be paid for 6 tons of coal?

3. What will 5 pounds of sugar cost at 6 cents a pound?

4. How many working days are there in 10 weeks?

5. Helen made 12 boxes of candy for a fair. Each box held 6 ounces. How many ounces of candy did she use?

6. Eleven girls made dresses for themselves. Each girl used 6 yards of cloth. How many yards did it take for all the dresses?

DIVISION: TABLE OF 6'S

1. Count by 6's to 72. Count back by 6's from 72 to 0.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

24	54	6	30	48	12
		÷ 6			
66	36	18	72	60	42

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to the quotients.

5. Divide, and subtract 1 from each quotient.

6. Write 2; 3 in the center space and divide as before.

DIVIDING BY 6

1. $186 \div 6$ $306 \div 6$ $426 \div 6$ $540 \div 6$ $648 \div 6$
2. $6\overline{)132}$ $6\overline{)318}$ $6\overline{)264}$ $6\overline{)108}$ $6\overline{)150}$ $6\overline{)354}$

Divide by 6:

3. 432 270 528 444 312 576 336 468
4. 156 396 582 504 474 390 288 780
5. Use 3 as a divisor. Use 2.

PROBLEMS *Oral*

1. With 42 pinks a gardener made —— bunches by putting 6 into each bunch.
2. Mr. Olsen's coal bill was 54 dollars. He paid 6 dollars a ton. How many tons did he buy?
3. Among how many children can you divide 72 roses if you give 6 to each child?
4. Into how many groups of 6 blocks can you separate 48 blocks?
5. How long will it take to save 60 dollars if 6 dollars are saved every month?
6. How many 6-cent plates can you buy for 30 cents?

FINDING ONE SIXTH

1. Find $\frac{1}{6}$ of the numbers in the rows in Drill Exercise on page 56. Find $\frac{1}{3}$. Find $\frac{1}{2}$.
2. 6 is $\frac{1}{6}$ of —— 3 is $\frac{1}{6}$ of —— 11 is $\frac{1}{6}$ of ——
   5 is $\frac{1}{6}$ of —— 7 is $\frac{1}{6}$ of —— 12 is $\frac{1}{6}$ of ——
   2 is $\frac{1}{6}$ of —— 4 is $\frac{1}{6}$ of —— 9 is $\frac{1}{6}$ of ——
   10 is $\frac{1}{6}$ of —— 8 is $\frac{1}{6}$ of —— 1 is $\frac{1}{6}$ of ——
3. Use $\frac{1}{3}$ in place of $\frac{1}{6}$. Use $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{5}$.

DIVIDING BY 6: REMAINDERS

1. $7 \div 6$ $13 \div 6$ $19 \div 6$ $25 \div 6$ $31 \div 6$

2. $9 \div 6$ $15 \div 6$ $21 \div 6$ $27 \div 6$ $33 \div 6$

3. $6\overline{)11}$ $6\overline{)17}$ $6\overline{)23}$ $6\overline{)29}$ $6\overline{)35}$ $6\overline{)41}$ $6\overline{)49}$

4. $6\overline{)44}$ $6\overline{)56}$ $6\overline{)64}$ $6\overline{)47}$ $6\overline{)57}$ $6\overline{)37}$ $6\overline{)43}$

5. $\frac{52}{6}$ $\frac{59}{6}$ $\frac{71}{6}$ $\frac{65}{6}$ $\frac{56}{6}$ $\frac{68}{6}$ $\frac{39}{6}$ $\frac{61}{6}$ $\frac{25}{6}$ $\frac{31}{6}$

6. Use 3; 5; 2; 4 as divisors.

7. At 6 dollars a ton, how many tons of coal can be bought for 23 dollars? As many tons as 6 is contained times in 23.

$6\overline{)23}$

$3\frac{5}{6}$ *Answer*, $3\frac{5}{6}$ tons.

8. When shoes are 3 dollars a pair, how many pairs can I buy with 14 dollars?

$3\overline{)14}$

4, and 2 over. *Answer*, 4 pairs, and 2 dollars left over.

NOTE. Pupils should make up similar problems, using the combinations given above.

PROBLEMS *Oral and Written*

1. There are 54 children in a school. One sixth are absent. How many are absent? How many are present?

2. What is left of 35 cents after spending 8 cents?

3. Buttons are 6 cents a dozen. What will 3 dozen cost? If you give the storekeeper a 25-cent piece to pay for them, how many cents will he give in change?

4. Eddie earns 10 cents a day. How much will he earn in 6 days?

5. A man has 3 10-dollar bills, 5 5-dollar bills, and 4 2-dollar bills. How many dollars has he?

6. How many cords of wood at 8 dollars a cord can be bought for 20 dollars?

7. What is the cost of 2 pounds of sugar at 6 cents a pound, a dozen eggs for 30 cents, and a 2-cent yeast cake?

8. When $\frac{1}{4}$ of a ton of coal costs 2 dollars, what will a ton cost?

9. What is $\frac{1}{5}$ of 40? What is 5 times 40?

10. If 3 apples cost 5 cents, what will a dozen cost?

11. Gladys is 15 years old. How long before she will be 21 years old?

12. If a boy earns 4 dollars a week, how long will it take him to earn 24 dollars?

DRILL EXERCISES

Oral

1. 60 is, 36 is, 12 is, 66 is } — × 6 or 6 × —
   42 is, 54 is, 18 is, 48 is } — × 6 or 6 × —
   24 is, 72 is, 6 is, 30 is } — × 6 or 6 × —

2. 6 is $\frac{1}{7}$ of 30 — 6 is $\frac{1}{7}$ of 12 — 6 is $\frac{1}{7}$ of 36
   6 is $\frac{1}{7}$ of 24 — 6 is $\frac{1}{7}$ of 18

3. 5 is, 8 is, 2 is, 1 is } $\frac{1}{6}$ of —
   11 is, 7 is, 6 is, 9 is } $\frac{1}{6}$ of —
   3 is, 10 is, 4 is, 12 is } $\frac{1}{6}$ of —

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

5. Count to 100 by 6's beginning with 6; with 1; with 2; with 3; with 4; with 5.

6. Count back by 6's from 100; from 99; from 98; from 97; from 96; from 95.

LINEAR MEASURE

We measure lengths in inches, feet, and yards. _____ This line is 1 inch long. A line 12 times as long is called a foot.

1. Draw on the board a line 1 foot long.

2. Draw another line 3 times as long. We call this line a yard.

3. Learn:

12 inches	= 1 foot
3 feet	= 1 yard

We write in. for inch or inches, ft. for foot or feet, and yd. for yard or yards.

NOTE. A foot rule subdivided into inches, and a yardstick, are necessary for teaching the above table. Pupils should be given practice in making measurements.

4. How many inches in 2 feet? In 5 feet? In 6 feet?

5. How many in $\frac{1}{2}$ of a foot? In $1\frac{1}{2}$ feet? In $\frac{1}{4}$ of a foot? In $\frac{1}{3}$ of a foot?

6. How many feet in 2 yards? In 4 yards? In 3 yards?

7. How many inches in 1 yard?

8. Sarah's ball rolled 4 feet. How many inches did it roll?

9. Mary's ball rolled 3 feet 6 inches. How many inches did it roll?

10. What part of a yard is 1 foot?

11. Jennie is 3 feet 9 inches tall. How many inches is this?

12. A stone step is 6 inches high. What part of a foot is this?

13. How many feet in $\frac{1}{3}$ of a yard?

DRILL EXERCISE: FINDING PARTS OF NUMBERS

Oral and Written

12		40
44		28
20	$\frac{1}{4}$	4
32		36
8		16
24		48

1. Find $\frac{1}{4}$ of the numbers in the columns.

2. As 3 *apples* are 3 times 1 *apple*, so 3 *fourths* are 3 times 1 *fourth*. Use $\frac{3}{4}$ in the center space.

3. What is $\frac{3}{4}$ of 48? $\frac{1}{4}$ of 48 is ——; then $\frac{3}{4}$ must be 3 times ——, because $\frac{3}{4}$ is 3 times $\frac{1}{4}$.

4. Donald had 32 chickens. He sold $\frac{3}{4}$ of them. How many did he sell?

5. Mr. Perkins had 24 rose bushes. He gave away $\frac{3}{4}$ of them. How many had he left?

6. If 9 dollars are 1 fourth of my money, 4 fourths, or the whole, are 4 times —— dollars, or —— dollars.

7. Use $\frac{1}{2}$ in the center space.

8. What is $\frac{1}{2}$ of 12 + $\frac{3}{4}$ of 12?

9. An acre of land is worth 28 dollars. What is $\frac{3}{4}$ of it worth?

10. Two brothers sold papers after school. John earned 16 cents and James earned $\frac{3}{4}$ as many cents. How many cents did James earn?

11. From $\frac{1}{2}$ of 24 take $\frac{1}{2}$ of 14.

12. A man traveled 36 miles in 4 days. How far did he travel in 1 day?

13. A farmer raised 40 bushels of potatoes in one year and $\frac{3}{4}$ as many the next year. How many bushels did he raise the second year?

14. One fourth of a bushel of potatoes cost 20 cents. What will a whole bushel cost?

15. Mary had 18 cents. She spent $\frac{1}{2}$ of it for a ribbon. How many cents had she left?

REVIEW: DIVISION AND MULTIPLICATION

Divide by 4:

1.	68	140	264	212	252	188	132	376
2.	104	180	348	152	300	148	184	540
3.	420	836	428	816	272	384	136	532
4.	1220	1624	2028	2432	3628	3204	1608	2036

5. Use 2 as a divisor.

Multiply by 4:

6.	609	908	706	504	624	918	422	716
7.	547	228	356	527	432	845	647	476

READING AND WRITING NUMBERS

1. 200 is read ——.

2. 2,000 is read ——.

3. 20,000 is read "twenty thousand."

4. Read 16,207. We have —— in the thousands' group, —— in the units' group. We read it "sixteen thousand, two hundred seven."

5. In 27,045 what have we in the thousands' group? What in the units' group? Read the number.

6. Read these numbers:

8437 7325 16,000 12,275 26,453 65,184

7. Write in figures:

Six hundred fifty.
Eight hundred seventy-seven.
Nine hundred eighty.
Seven hundred six.
One thousand, seven hundred twenty-eight.
Three thousand, nine hundred sixty-three.
Twelve thousand, four hundred thirty-nine.
Twenty-five thousand, one hundred fifty-six.
Seventeen thousand, three hundred eight.
Thirty-six thousand, six hundred.

1. Name two numbers whose product is:

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1.	9	28	22	40	15	50	20	36
2.	24	8	45	10	32	27	35	14
3.	55	18	42	21	60	12	44	72
4.	16	25	6	48	33	54	66	30

2. Give products and quotients rapidly:

	A	*B*	*C*	*D*	*E*
1.	6×12	4×11	5×9	6×7	4×7
2.	$28 \div 4$	$72 \div 6$	$50 \div 5$	$66 \div 6$	$40 \div 4$
3.	4×12	5×10	6×8	5×6	4×8
4.	$42 \div 6$	$30 \div 5$	$32 \div 4$	$60 \div 6$	$44 \div 4$
5.	5×11	6×9	5×7	4×9	6×10
6.	$45 \div 5$	$48 \div 6$	$55 \div 5$	$48 \div 4$	$36 \div 6$
7.	6×10	$5 \div 8$	4×10	6×11	5×12
8.	$36 \div 4$	$60 \div 5$	$40 \div 5$	$54 \div 6$	$35 \div 5$

DICTATION EXERCISE

1. $30 \div 5, \times 6, \div 4, \times 3, -2, \div 5, \times 6, -1 = ?$
2. $16 - 4, \times 3, \div 4, +6, \div 5, \times 6, +3, \div 3 = ?$
3. $8 + 4, \div 3, +5, \times 4, \div 6, +8 = ?$
4. $20 - 6, \div 2, +9, \div 4, +7, -3 = ?$
5. $40 \div 4, +8, \div 6, +9, \div 6, +8, \div 5 = ?$

Drill on parts 1 to 9 of Exercise VII, page 12.
Drill on parts 1 to 9 of Exercise VIII, page 12.

ADDITION *Oral and Written*

Add and test your work:

1.	89	65	8	94	37	15	77	88	48	35
	74	48	39	37	64	48	58	8	78	70
	25	25	76	2	59	56	39	70	56	49
	39	17	84	78	38	6	67	96	60	57
2.	325	272	470	960	524	392	402	567		
	671	301	9	27	307	801	560	657		
	423	608	325	150	19	906	800	576		

3. Why is it best to add each column twice, first up and then down?

4. $83 + 75 + 43$.
5. $39 + 27 + 19$.
6. $56 + 67 + 49$.
7. $86 + 34 + 57$.

SUBTRACTION *Oral and Written*

Subtract:

1.	582	687	987	550	708	698	645	847
	402	263	232	320	506	492	442	435

2. From 3642 take 642. Take 840 from 3960.
3. From 7728 take 2216. Take 576 from 3876.

Find differences between:

4. 5720 and 2510 143 and 1276 3247 and 125
5. 4875 and 654 1347 and 5848 4360 and 2300

MULTIPLICATION: TABLE OF 7'S

1. Count by 7's to 84.
2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

2	5	9	4	12	7

$\times 7$

3	10	1	6	0	11	8

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1 to each product. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1 from each product. Multiply, and subtract 2; 3; 4; 5; 6; 7.

7. Use 2; 3; 4; 5; 6 in the center space and multiply as before.

MULTIPLYING BY 7 *Written*

Multiply by 7:

1.	13	140	15	160	17	180	19	190
2.	512	413	716	815	914	316	320	240

Find 7 times each of the following numbers:

3.	28	37	46	54	63	72	85	96
4.	122	321	503	648	237	362	731	843

5. Use 2; 3; 4; 5; 6 as multipliers.

PROBLEMS *Oral*

1. What are 7 barrels of cranberries worth at 9 dollars a barrel?

2. A board walk is made by placing 7 boards, each 7 feet long, end to end. How long is the walk?

3. Each of 7 boys picked 12 quarts of berries in a day. How many quarts did they all pick?

4. How many pennies must you have to make 7 rows, 8 in a row?

5. How far can you ride in 4 hours at the rate of 7 miles an hour?

6. How many days in a month of 4 weeks and 3 days?

DIVISION: TABLE OF 7'S

1. Count by 7's to 84. Count back by 7's from 84 to 0.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

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

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to the quotients.

5. Divide, and subtract 1 from each quotient.

DIVIDING BY 7 *Written*

1. $728 \div 7$ $763 \div 7$ $357 \div 7$ $287 \div 7$ $427 \div 7$

Divide by 7:

2. 644 553 413 504 196 322 595 546

3. $\frac{924}{7}$ $\frac{693}{7}$ $\frac{518}{7}$ $\frac{273}{7}$ $\frac{3528}{7}$ $\frac{5642}{7}$ $\frac{6321}{7}$ $\frac{4928}{7}$

PROBLEMS *Oral*

1. If an ice man sells 7 tons of ice a day, how long will it take him to sell 56 tons?

2. A boat sails 7 miles an hour. How long will it take to sail 35 miles?

3. A man owes 63 dollars. He pays 7 dollars a week. In how many weeks will he pay the debt?

4. How many weeks in 42 days?

5. When onions are 7 cents a quart, how many quarts can be bought for 84 cents?

FINDING SEVENTHS

1. Find $\frac{1}{7}$ of the numbers in the rows in Drill Exercise on page 67.

2. 7 is $\frac{1}{7}$ of — 2 is $\frac{1}{7}$ of — 1 is $\frac{1}{7}$ of — 6 is $\frac{1}{7}$ of —
   3 is $\frac{1}{7}$ of — 8 is $\frac{1}{7}$ of — 12 is $\frac{1}{7}$ of — 9 is $\frac{1}{7}$ of —
   10 is $\frac{1}{7}$ of — 11 is $\frac{1}{7}$ of — 4 is $\frac{1}{7}$ of — 5 is $\frac{1}{7}$ of —

3. Use $\frac{1}{6}$; $\frac{1}{3}$; $\frac{1}{5}$; $\frac{1}{4}$; $\frac{1}{2}$ in place of $\frac{1}{7}$.

DIVIDING BY 7: REMAINDERS

$57 \div 7 = 8$, and 1 over. $57 \div 7 = 8\frac{1}{7}$ $7\overline{)57}$ $8\frac{1}{7}$

Use either of the above forms.

1. $7\overline{)15}$ $7\overline{)23}$ $7\overline{)31}$ $7\overline{)39}$ $7\overline{)47}$ $7\overline{)55}$ $7\overline{)10}$

2. $12 \div 7$ $17 \div 7$ $25 \div 7$ $33 \div 7$ $41 \div 7$

3. $27 \div 7$ $34 \div 7$ $37 \div 7$ $29 \div 7$ $20 \div 7$

Divide by 7, giving quotients and remainders:

4. 43 53 73 83 50 72 68 52 57 82

5. 64 71 44 78 44 51 65 81 76 66

6. Use 2; 3; 4; 5; 6 as divisors in the above exercises.

PROBLEMS *Oral*

1. At 7 dollars a cord, how many cords of wood can be bought for 24 dollars?

2. A farm of 27 acres is divided into 5 fields. What is the area of each?

3. How many groups of 7 each can you make with 60 blocks? How many blocks left over?

4. How many cents will you have left over, if you divide 31 cents among 4 boys?

5. What is $\frac{1}{6}$ of 45 bushels of oats?

6. How many weeks in 24 days, and how many days over?

Drill on Exercise VI on page 11.

Drill on parts 2 and 3 of exercise on page 79.

PROBLEMS *Oral and Written*

1. Mary is 6 years old. Her father is 7 times as old and 5 years more. How old is her father?

2. In the month of February there are 28 days. How many weeks is this?

3. What change ought you to receive if you give a 50-cent piece to pay for 7 5-cent papers of needles?

4. Three boxes of butter weigh 30 pounds. What is the weight of 1 box?

5. Sarah has 7 10-cent pieces, and Dorothy has 2 25-cent pieces. Which has the more money? How much more?

6. An automobile is run 30 miles a day for a week. What is the distance traveled?

7. On Monday Mr. Brown had 40 dollars in the bank and 20 dollars more on Tuesday. On Wednesday he drew out 5 dollars. How much remained?

8. If I ride in the electric cars 4 times a day, paying 5 cents each time, how much will I spend in 5 days?

9. What is the cost of an acre of land when 7 acres cost 280 dollars?

10. Two hats cost 7 dollars. What will 4 cost?

Drill on Exercises I and II on page 115, and on Exercises V and VI on page 116.

DRILL EXERCISES

Oral

1. 28 is, 63 is, 14 is, 21 is } — × 7 or 7 × —

77 is, 42 is, 84 is, 56 is } — × 7 or 7 × —

70 is, 7 is, 49 is, 35 is } — × 7 or 7 × —

2. 7 is $\frac{1}{7}$ of 35 — 7 is $\frac{1}{7}$ of 28 — 7 is $\frac{1}{7}$ of 49

7 is $\frac{1}{7}$ of 14 — 7 is $\frac{1}{7}$ of 42 — 7 is $\frac{1}{7}$ of 21

3. 10 is, 6 is, 2 is, 12 is } $\frac{1}{7}$ of —

8 is, 5 is, 3 is, 1 is } $\frac{1}{7}$ of —

11 is, 7 is, 4 is, 9 is } $\frac{1}{7}$ of —

4. 7 is $\frac{1}{7}$ of — 7 is $\frac{1}{5}$ of — 7 is $\frac{1}{3}$ of —

7 is $\frac{1}{2}$ of — 7 is $\frac{1}{4}$ of — 7 is $\frac{1}{6}$ of —

5. Count to 100 by 7's, beginning with 7; with 8; with 2; with 3; with 4; with 5; with 6.

6. Count back by 7's from 100; from 99; from 98; from 97; from 96; from 95; from 94.

Divide by 5:

7.	105	205	355	475	245	425	215	335
8.	135	765	855	540	620	360	720	275

Multiply by 5:

9.	909	708	607	509	814	618	719	317
10.	365	436	724	656	872	299	347	598

READING AND WRITING NUMBERS

1. Read these numbers, first telling what you have in each group:

6396	24,391	33,333	45,125	56,008	39,112
9609	87,560	30,300	14,070	79,903	93,250

2. Write in figures:

Five hundred six.
One thousand eighty.
Seven thousand four hundred.
Three thousand five hundred.
Thirty thousand five hundred six.
Fifteen thousand four hundred six.
Twenty-six thousand eighty.
Seventy-seven thousand four hundred.
Ninety-three thousand five hundred.

Pretty large

DICTATION EXERCISE

1. $28 \div 7, +8, -3, \times 4, +6, \div 7, +9, \div 5 = ?$

2. $17 - 3, \div 2, \times 6, +3, \div 5, +5, \div 2, -1 = ?$

3. $32 \div 4, +1, \div 3, +7, \div 5, +4, +8, \div 7, -2 = ?$

4. $29 + 6, \div 7, \times 4, +1, \div 7, \times 9, -2, \div 5, +7 = ?$

5. $12 + 6, \div 2, +5, \div 7, \times 5, +8, \div 6, +4 = ?$

NOTE. Dictate similar work daily.

ADDITION *Oral and Written*

Add:

1.	56	85	18	24	27	90	12	66	39	87
	47	57	50	48	84	8	73	24	47	62
	38	72	49	57	60	72	69	7	88	73
	91	29	73	24	92	58	82	16	76	96
	60	95	87	38	26	20	47	92	9	22

2.	327	215	324	524	972	370	435	9	137
	426	412	256	430	376	640	625	54	67
	802	317	180	625	850	520	100	267	924
	910	819	27	815	420	180	78	852	107

SUBTRACTION

1. Subtract 38 from 62.

$$\begin{array}{r} 62 \\ 38 \\ \hline 24 \end{array}$$

As the number in the units' place in the minuend is less than the number in the units' place in the subtrahend, we change one of the tens in the minuend to units and add it to the 2 units. One ten taken from 6 tens leaves 5 tens; 1 ten equals 10 units; 2 units + 10 units equal 12 units. Then our problem reads:

Minuend 62 = 6 tens + 2 units = 5 tens + 12 units.
Subtrahend 38 = 3 tens + 8 units.
Remainder = 2 tens + 4 units, or 24.

In practice, we always change 1 ten to units mentally, and say 8 from 12, 4; 3 from 5, 2; remainder, 24.

To the Teacher: Do not use the term "borrowing," or allow the practice of writing figures above the minuend to show that the tens are decreased and the units are increased. Make the process as mechanical as possible.

2. Subtract:

43	84	35	50	61	72	96	80	44	63
15	37	16	24	36	33	58	37	16	35

Always test your work in subtraction. For example, if your problem is to take 26 from 54, you have 28 left. Then the remainder, 28, added to the subtrahend, 26, will give the minuend, 54.

$$\begin{array}{r} 54 \\ 26 \\ \hline 28 \end{array} \qquad \text{Proof:} \quad \begin{array}{r} 26 \\ 28 \\ \hline 54 \end{array}$$

Subtract, and test your work:

3.	110	211	316	121	423	514	625	736
	60	70	85	51	90	21	32	52
4.	817	327	424	525	626	327	428	339
	53	76	82	92	76	42	55	75

5.	339 – 53	435 – 62	536 – 74	637 – 83
6.	738 – 77	738 – 95	839 – 44	931 – 50
7.	143 – 52	247 – 64	348 – 73	446 – 84

MULTIPLICATION: TABLE OF 8'S

1. Count by 8's to 96.

2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

5	1	4	12	7	3	
			× 8			
10	9	6	0	11	8	2

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1 to each product. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1 from each product. Multiply, and subtract 2; 3; 4; 5; 6; 7; 8.

7. Use 2; 3; 4; 5; 6; 7 in the center space, and multiply as before.

MULTIPLYING BY 8

Multiply by 8:

1.	35	49	28	54	75	93	87	66
2.	6	57	79	38	95	26	43	56
3.	608	209	312	516	720	341	652	867
4.	414	558	492	386	527	243	318	622

5. Use 2; 3; 4; 5; 6; 7 as multipliers.

PROBLEMS *Oral*

1. If marbles are sold at the rate of 6 for a cent, how many can you buy for 8 cents?

2. Mr. Harper's business requires him to make a trip to New York 5 times a month. How many trips will he make in 8 months?

3. My rose bush has 8 clusters of 9 roses each. How many roses are on the bush?

4. Mr. White bought 8 3-pound pails of lard. How many pounds did he buy?

5. In the same pasture with 12 cows are 8 times as many sheep. How many sheep are there?

DIVISION: TABLE OF 8'S

1. Count by 8's to 96. Count back by 8's from 96 to 0.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

40	32	64	88	24	56
		÷ 8			
80	16	48	72	8	96

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to the quotients.

5. Divide, and subtract 1 from each quotient.

6. Write 2; 4 in the center space and divide as before.

DIVIDING BY 8

Divide by 8:

1. 640 104 144 372 176 456 704 576

2. $\frac{112}{8}$ $\frac{272}{8}$ $\frac{360}{8}$ $\frac{288}{8}$ $\frac{552}{8}$ $\frac{216}{8}$ $\frac{536}{8}$ $\frac{296}{8}$

3. $1648 \div 8$ $5624 \div 8$ $6432 \div 8$ $7240 \div 8$ $2408 \div 8$

4. Use 4 as a divisor. Use 2.

PROBLEMS *Oral*

1. How many 8-pound bags of flour can be made from 96 pounds of flour?

2. A piece of tape 48 inches long is cut into 8-inch pieces. How many are there?

3. 8 coats cost 72 dollars. What was that apiece?

4. The car fare between two places is 8 cents. How many times can you take the trip for 32 cents?

5. How many yards of ribbon, at 8 cents a yard, can you buy for 56 cents?

FINDING EIGHTHS

1. Find $\frac{1}{8}$ of the numbers in the rows in Drill Exercise on page 75. Find $\frac{1}{4}$. Find $\frac{1}{2}$.

2. 5 is $\frac{1}{8}$ of — 2 is $\frac{1}{8}$ of — 11 is $\frac{1}{8}$ of — 6 is $\frac{1}{8}$ of —
   1 is $\frac{1}{8}$ of — 10 is $\frac{1}{8}$ of — 8 is $\frac{1}{8}$ of — 12 is $\frac{1}{8}$ of —
   9 is $\frac{1}{8}$ of — 7 is $\frac{1}{8}$ of — 4 is $\frac{1}{8}$ of — 3 is $\frac{1}{8}$ of —

3. Use $\frac{1}{4}$; $\frac{1}{2}$; $\frac{1}{6}$; $\frac{1}{3}$; $\frac{1}{5}$; $\frac{1}{7}$ in place of $\frac{1}{8}$.

DIVIDING BY 8: REMAINDERS

Give quotients and remainders:

1. $\frac{10}{8}$ $\frac{59}{8}$ $\frac{25}{8}$ $\frac{31}{8}$ $\frac{76}{8}$ $\frac{27}{8}$ $\frac{74}{8}$ $\frac{22}{8}$ $\frac{46}{8}$

2. $54 \div 8$ $18 \div 8$ $77 \div 8$ $33 \div 8$ $46 \div 8$

3. $8\overline{)58}$ $8\overline{)47}$ $8\overline{)60}$ $8\overline{)43}$ $8\overline{)75}$ $8\overline{)93}$ $8\overline{)68}$

Divide the following numbers by 8, giving quotients and remainders:

4. 70 20 83 94 42 53 79 57 37 61

5. 89 12 78 50 91 45 85 36 71 65

6. Use 7; 6; 5; 4; 3; 2 as divisors.

DRY MEASURE *Oral*

1. Learn:

2 pints	= 1 quart
8 quarts	= 1 peck
4 pecks	= 1 bushel

NOTE. Pupils should fix the relations of this table by actual measurements with sawdust or other convenient material.

2. How many times must you fill the pint measure to make a quart of beans?

3. How many times must the grocer fill his quart measure to make a peck of onions?

4. A grocer measured a bushel of apples with a peck measure. How many times did he fill it?

5. How many quarts do you take every time you fill a peck measure? How many times do you fill a peck measure to make a bushel? Then, how many quarts are there in a bushel?

6. One peck 5 quarts are how many quarts?

7. Fifteen quarts are how many pecks and quarts?

8. Two bushels 3 pecks are how many pecks?

9. Twenty-seven pecks are how many bushels and pecks?

10. Sixty-two quarts are —— pecks and —— quarts.

11. Potatoes are 3 cents a quart. What is a peck worth?

12. Forty-eight cents a bushel is —— cents a peck and —— cents a quart.

13. A bushel of oats weighs 32 pounds. A peck will weigh ——.

14. A farmer gives his cow a quart of corn meal at night and a quart in the morning. How many days will a bushel last?

15. A quart is what part of a peck? A peck is what part of a bushel?

DRILL EXERCISES

Oral

1.

40 is	— × 8	8 is	— × 8	24 is	— × 8
72 is	or	96 is	or	56 is	or
16 is	8 × —	88 is	8 × —	80 is	8 × —
64 is		48 is		32 is	

2. 8 is $\frac{1}{7}$ of 24 8 is $\frac{1}{7}$ of 48 8 is $\frac{1}{7}$ of 16 8 is $\frac{1}{7}$ of 64
8 is $\frac{1}{7}$ of 40 8 is $\frac{1}{7}$ of 80 8 is $\frac{1}{7}$ of 32

3. 2 is, 4 is, 8 is, 3 is } $\frac{1}{8}$ of — 6 is, 9 is, 12 is, 5 is } $\frac{1}{8}$ of — 10 is, 1 is, 7 is, 11 is } $\frac{1}{8}$ of —

4. 8 is $\frac{1}{5}$ of — 8 is $\frac{1}{2}$ of — 8 is $\frac{1}{3}$ of — 8 is $\frac{1}{8}$ of —
8 is $\frac{1}{4}$ of — 8 is $\frac{1}{6}$ of — 8 is $\frac{1}{7}$ of —

5. Count to 100 by 8's, beginning with 8; with 1; with 2; with 3; with 4; with 5; with 6; with 7.

6. Count back by 8's from 100; from 99; from 98; from 97; from 96; from 95; from 94; from 93.

PROBLEMS *Oral and Written*

1. After selling dress patterns of 7 yards and 9 yards, what is left of a piece of goods containing 52 yards?

2. A farmer cut 8 cords of wood. He kept 1 cord for his own use and sold the rest for 5 dollars a cord. How much did he receive for it?

3. What is the cost of 2 pounds of rice at 12 cents a pound, and 8 pounds of sugar at 6 cents a pound?

4. When apples are sold at the rate of 3 for a cent, what will a dozen cost?

5. When bananas are sold at the rate of 2 for a nickel, what will a dozen cost?

6. Wood is 8 dollars a cord. How many cords can be bought with 60 dollars?

7. John earned 25 cents in one week and 10 cents the second week. What did he earn in both weeks?

8. Herbert has 9 postage stamps, and William has 3 times as many and 7 more. How many has William?

9. What is left after taking 9 bushels at one time, and 7 bushels at another, from a bin holding 25 bushels of potatoes?

10. After using for one year a carriage that cost 80 dollars, I sold it for 12 dollars less than I paid. What did I sell it for?

DRILL EXERCISE

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
1.	11	10	72	60	92	36	64	51	43	28
2.	20	12	81	73	93	52	37	63	29	44
3.	94	21	13	54	82	74	45	30	62	39
4.	83	65	22	14	75	89	31	46	53	61
5.	41	84	55	23	15	32	50	66	86	76
6.	95	42	91	85	24	16	38	56	67	90
7.	86	78	71	33	57	25	17	47	96	68
8.	99	58	34	49	98	97	26	18	69	80
9.	70	35	59	48	77	40	79	27	19	87

1. Add 1; 7; 2; 4; 8; 3; 6; 9; 5; 10 to each number.

2. Find the sum of each column.

3. Find the sum of each row.

4. Subtract 1; 7; 2; 4; 8; 3; 6; 9; 5; 10 from each number.

5. Subtract each number from 100.

DRILL EXERCISE: FINDING PARTS OF NUMBERS

Oral and Written

24		30
60		54
12	$\frac{1}{6}$	6
42		48
66		72
18		36

1. Find $\frac{1}{6}$ of the numbers in the columns.

2. Use $\frac{5}{6}$ in the center space. Use $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{2}$.

3. What is $\frac{1}{2}$ of 24 + $\frac{1}{3}$ of 24?

4. A man receives 12 dollars for his week's work. What does he receive a day? What will he earn in 6 weeks?

5. A grocer sells lemons for 30 cents a dozen. What must a customer pay for $\frac{2}{3}$ of a dozen? For 2 dozen?

6. A farmer cut 42 cords of wood. He sold $\frac{5}{6}$ of it. How many cords did he sell?

7. From $\frac{5}{6}$ of 48 take $\frac{1}{3}$ of 24.

8. Mr. Baker sold $\frac{1}{6}$ of 54 sheep. He sold how many?

9. If you have 48 marbles, and give away $\frac{1}{2}$ of them, how many have you left? If you gave away $\frac{1}{3}$ of them, how many would you have left?

10. How many are $\frac{3}{3}$ of 27 and $\frac{5}{6}$ of 12?

11. Mr. Smith has 6 cows in his barn. This is $\frac{1}{3}$ of all he owns. How many does he own?

12. One sixth of a barrel of flour costs 1 dollar. What will a whole barrel cost?

13. A quart of cream costs 30 cents. What will a pint cost?

14. A pint of milk costs 4 cents. What will a quart cost? What will 7 quarts cost?

REVIEW: DIVISION AND MULTIPLICATION

Divide by 6:

1.	216	174	288	516	258	324	456
2.	828	648	918	720	756	702	594
3.	5448	4812	3636	1830	2448	4254	3048

4. Use 3 as a divisor. Use 2.

Multiply by 6:

5.	306	705	904	807	515	814	719	612
6.	284	358	945	427	675	444	365	856

Give products and quotients rapidly:

	A	*B*	*C*	*D*	*E*
1.	6 × 7	8 × 10	7 × 10	8 × 6	8 × 11
2.	72 ÷ 6	42 ÷ 7	48 ÷ 8	60 ÷ 6	70 ÷ 7
3.	7 × 8	7 × 12	6 × 8	7 × 9	8 × 7
4.	49 ÷ 7	56 ÷ 8	54 ÷ 6	64 ÷ 8	80 ÷ 8
5.	7 × 6	6 × 11	8 × 9	8 × 12	6 × 9
6.	84 ÷ 7	48 ÷ 6	56 ÷ 7	96 ÷ 8	66 ÷ 6
7.	6 × 10	7 × 11	6 × 12	8 × 8	7 × 7
8.	42 ÷ 6	77 ÷ 7	72 ÷ 8	63 ÷ 7	88 ÷ 8

1. Add to each product and each quotient 1; 2; 3; 4; 5; 6; 7; 8; 9.

2. Subtract each product and each quotient from 100, or any other number.

Drill on parts 2 and 3 of exercise on page 79.

READING AND WRITING NUMBERS

1. Read:

909 4404 7632 37,560 72,583 87,396

2. Write in figures:

Five thousand. Fifty thousand.
Sixty-four thousand. Nine thousand eighty.
Ten thousand. Five thousand five hundred.
Fifty thousand five hundred.
Sixty-seven thousand eight hundred.
Forty-five thousand three hundred three.
Ten thousand one hundred ten.

DICTATION EXERCISE

1. $14 + 7, \times 8, \div 4, + 6, \div 5, \times 6 + 3 \div 5 = ?$
2. $19 - 7, \times 2, \div 8, + 7, \times 4, \div 8, + 6 = ?$
3. $40 \div 8, \times 7, \div 5, \times 6, + 3, \div 5, - 9 = ?$
4. $16 \div 4, \times 5, + 8, \div 7, \times 6, \div 8, + 9 = ?$
5. $28 \div 7, \times 8, + 4, \div 6, \times 5, + 2, \div 8 - 1 = ?$

NOTE. Similar exercises should be dictated daily.

Multiply the numbers in Exercise VI, page 11, by 2; 3; 4; 5.

Multiply the numbers in exercise on page 26 by 2; 3; 4; 5.

Divide the numbers in exercise on page 26 by 2; 3; 4; 5.

ADDITION *Oral and Written*

Add:

1.	53	37	12	29	53	7	68	43	28	90
	17	19	88	5	87	47	77	6	78	36
	34	28	76	34	3	86	84	78	96	51
	68	92	49	68	65	95	99	69	2	75
	27	37	37	85	49	58	2	44	47	37
	9	20	82	16	38	27	13	58	60	42

2.	572	326	40	253	278	3	827	292
	496	76	845	600	815	935	578	854
	954	82	909	8	727	66	222	526
	74	513	67	56	269	627	516	984

SUBTRACTION *Oral and Written*

1. What is the minuend? The subtrahend?
2. How do you prove or test your answer?

Subtract, and test:

3.	208	209	300	854	936	401	518	724
	15	37	30	62	54	80	37	52
4.	607	926	709	408	325	633	436	337
	255	473	279	137	182	251	260	175

5. $337 - 54$ $217 - 37$ $468 - 73$ $428 - 68$
6. $327 - 77$ $338 - 65$ $176 - 92$ $453 - 61$
7. $338 - 172$ $446 - 274$ $459 - 189$ $646 - 264$

Find differences between

8. 569 and 382 290 and 660 765 and 370
9. 779 and 487 395 and 873 945 and 562
10. 389 and 193 472 and 730 521 and 351

MULTIPLICATION: TABLE OF 9'S

1. Count by 9's to 108.
2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

9	4	12	7	3	10

× 9

1	6	0	11	8	2	5

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1 to each product. Increase each product by 2; 3; 4; 5; 6; 7; 8; 9.

6. Multiply, and subtract 1 from each product. Decrease each product by 2; 3; 4; 5; 6; 7; 8.

7. Write 2; 3; 4; 5; 6; 7; 8 in the center space and multiply as before.

Multiply these numbers by 9:

8.	13	19	25	31	37	43	59	65
9.	84	14	15	22	28	34	45	53
10.	204	805	102	306	713	467	629	959
11.	120	340	642	328	254	516	178	432

12. Use 2; 3; 4; 5; 6; 7; 8 as multipliers.

PROBLEMS *Oral*

1. What is the cost of 9 yards of elastic at 3 cents a yard? What change ought you to receive, if you give the clerk a 50-cent piece?

2. How many gallons of oil in 9 5-gallon cans?

3. Seven 5-cent car fares are how much less than 50 cents?

4. Each of the 8 rooms in a school raised 9 dollars to buy pictures for the building. What was paid for them?

5. How many oranges in 9 dozen?

DIVISION: TABLE OF 9'S

1. Count by 9's to 108. Count back by 9's from 108 to 0.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

36	9	63	90	45	18
		÷9			
72	99	54	27	81	108

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to the quotients.

5. Divide, and subtract 1 from each quotient.

6. Write 3 in the center space and divide as before.

DIVIDING BY 9

1. $9\overline{)189}$ $549 \div 9$ $9\overline{)810}$ $279 \div 9$ $9\overline{)459}$
2. $9\overline{)819}$ $918 \div 9$ $9\overline{)963}$ $504 \div 9$ $9\overline{)198}$
3. $9\overline{)405}$ $207 \div 9$ $9\overline{)954}$ $801 \div 9$ $9\overline{)603}$
4. $\frac{1872}{9}$ $\frac{5418}{9}$ $\frac{6363}{9}$ $\frac{8136}{9}$ $\frac{5427}{9}$ $\frac{2718}{9}$ $\frac{1881}{9}$ $\frac{7245}{9}$

Divide by 9:

5. 117 225 333 441 126 234 342 468 135
6. 351 477 144 252 198 396 414 216 261
7. Use 3 as a divisor.

PROBLEMS *Oral*

1. How many cords of wood, at 9 dollars a cord, can be bought for 63 dollars?
2. Into how many 9-inch pieces can you cut a stick 54 inches long?
3. The expenses of a camping party were 72 dollars, and each one's share was 9 dollars. How many people were in the party?
4. An agent sold 36 washing machines. He sold 9 a day. How many days was he selling them?
5. How many 9-cent handkerchiefs can you buy for 108 cents?

FINDING NINTHS

1. Find $\frac{1}{9}$ of the numbers in the rows in Drill Exercise on page 85. Find $\frac{1}{3}$.
2. 4 is $\frac{1}{9}$ of — 5 is $\frac{1}{9}$ of — 6 is $\frac{1}{9}$ of — 12 is $\frac{1}{9}$ of —
   1 is $\frac{1}{9}$ of — 2 is $\frac{1}{9}$ of — 3 is $\frac{1}{9}$ of — 10 is $\frac{1}{9}$ of —
   7 is $\frac{1}{9}$ of — 8 is $\frac{1}{9}$ of — 9 is $\frac{1}{9}$ of — 11 is $\frac{1}{9}$ of —
3. Use $\frac{1}{6}$; $\frac{1}{8}$; $\frac{1}{8}$; $\frac{1}{4}$; $\frac{1}{2}$; $\frac{1}{5}$; $\frac{1}{7}$ in place of $\frac{1}{9}$.

DIVIDING BY 9: REMAINDERS

1. $9\overline{)23}$ $9\overline{)61}$ $9\overline{)89}$ $9\overline{)19}$ $9\overline{)92}$ $9\overline{)26}$ $9\overline{)51}$ $9\overline{)75}$

2. $83 \div 9$ $35 \div 9$ $69 \div 9$ $13 \div 9$ $57 \div 9$ $43 \div 9$ $29 \div 9$

3. $\frac{84}{9}$ $\frac{21}{9}$ $\frac{30}{9}$ $\frac{74}{9}$ $\frac{37}{9}$ $\frac{44}{9}$ $\frac{34}{9}$ $\frac{78}{9}$ $\frac{66}{9}$ $\frac{40}{9}$

Divide by 9:

4. 87 68 33 25 67 55 76 62 59 94

5. Use 3; 2; 4; 6; 8; 5; 7 as divisors.

PROBLEMS *Oral and Written*

1. A cow gives 5 quarts of milk in the morning and 7 quarts at night. How many quarts in a week?

2. If this milk is sold for 8 cents a quart, how much is received each day?

3. A dealer buys stoves for 18 dollars and sells them for 23 dollars. How much has he made when he has sold 7?

4. David worked 9 weeks for 6 dollars a week, and Stephen worked 7 weeks for 8 dollars a week. Which received the more money? How much more?

5. A bag of sugar weighing 8 pounds cost 52 cents. What was the cost a pound?

6. What change does the storekeeper return when you give him 3 25-cent pieces to pay for 7 yards of 9-cent cloth?

7. The uniforms for a baseball nine cost 54 dollars. What did each uniform cost?

8. Bought 9 grapefruit at the rate of 3 for a quarter. What was the cost?

9. How many apples will you have left out of 35, if you give 4 to each of 8 boys?

DRILL EXERCISE

NOTE. See how many of these products and quotients the pupils can give in two minutes.

	A	*B*	*C*	*D*	*E*
1.	6 × 6	9 × 10	8 × 11	9 × 6	7 × 9
2.	48 ÷ 6	42 ÷ 7	48 ÷ 8	81 ÷ 9	84 ÷ 7
3.	7 × 6	8 × 10	6 × 7	9 × 9	6 × 9
4.	77 ÷ 7	36 ÷ 6	49 ÷ 7	56 ÷ 8	72 ÷ 9
5.	8 × 9	6 × 12	8 × 6	7 × 9	6 × 8
6.	64 ÷ 8	54 ÷ 9	42 ÷ 6	88 ÷ 8	72 ÷ 6
7.	6 × 9	8 × 7	9 × 11	7 × 10	9 × 12
8.	72 ÷ 8	63 ÷ 9	70 ÷ 7	54 ÷ 6	56 ÷ 7
9.	7 × 11	7 × 8	6 × 10	8 × 8	7 × 7
10.	96 ÷ 8	63 ÷ 7	66 ÷ 6	80 ÷ 8	60 ÷ 6
11.	9 × 8	7 × 12	9 × 7	8 × 12	6 × 11
12.	99 ÷ 9	63 ÷ 7	108 ÷ 9	54 ÷ 9	90 ÷ 9

1. Add to each product and each quotient 1; 2; 3; 4; 5; 6; 7; 8; 9; 10.

2. Subtract each product and each quotient from 100, or any given number.

Multiply each number in Exercise VI, page 11, by 2; 3; 4; 5; 6.

Multiply the numbers in exercise on page 79 by 2; 3; 4; 5; 6.

Divide the numbers in exercise on page 79 by 2; 3; 4; 5; 6.

Drill on exercise on page 26.

Drill on parts 2 and 3 of exercise on page 79.

MEASURE OF WEIGHT

Oral and Written

1. Learn:

16 ounces = 1 pound (lb.)

Pupils should fix this relation by weighing sand or other convenient material.

2. How many ounces in 2 pounds? In 5 pounds? In 4 pounds? In 3 pounds?

3. How many ounces in half a pound? In a quarter of a pound? In three quarters of a pound?

4. How many ounces in one eighth of a pound? In three eighths? In five eighths? In seven eighths?

5. When a pound costs 24 cents, 8 ounces will cost —— cents, 4 ounces will cost —— cents, 2 ounces will cost —— cents.

6. Twenty ounces is —— pound —— ounces.

7. How many ounces in 1 pound 8 ounces? In 2 pounds 6 ounces? In 3 pounds 4 ounces?

8. At 5 cents an ounce, what will a pound of cucumber seed cost?

9. What must you pay for 1 pound 4 ounces of butter at 28 cents a pound?

10. How many 8-ounce boxes of candy can be put up from 5 pounds?

11. How many ounce packages of beet seed can be put up from $2\frac{1}{4}$ pounds?

12. How many pounds in 48 ounces?

13. How many quarter-pound prints are there in 3 pounds of print butter?

DRILL EXERCISES

Oral

1.

27 is	— × 9 or 9 × —	9 is	— × 9 or 9 × —	54 is	— × 9 or × 9 —
63 is		36 is		72 is	
108 is		18 is		81 is	
45 is		99 is		90 is	

2.

9 is $\frac{1}{7}$ of 81	9 is $\frac{1}{7}$ of 63	9 is $\frac{1}{7}$ of 54
9 is $\frac{1}{7}$ of 45		9 is $\frac{1}{7}$ of 36
9 is $\frac{1}{7}$ of 18	9 is $\frac{1}{7}$ of 72	9 is $\frac{1}{7}$ of 27

3.

7 is	$\frac{1}{9}$ of —	11 is	$\frac{1}{9}$ of —	8 is	$\frac{1}{9}$ of —
9 is		4 is		3 is	
2 is		1 is		5 is	
6 is		12 is		10 is	

4.

9 is $\frac{1}{3}$ of —	9 is $\frac{1}{2}$ of —	9 is $\frac{1}{4}$ of —
9 is $\frac{1}{9}$ of —		9 is $\frac{1}{5}$ of —
9 is $\frac{1}{6}$ of —	9 is $\frac{1}{7}$ of —	9 is $\frac{1}{8}$ of —

5. Count to 100 by 9's, beginning with 9; with 1; with 2; with 3; with 4; with 5; with 6; with 7; with 8.

6. Count back by 9's from 100; from 98; from 97; from 96; from 95; from 94; from 93; from 92.

REVIEW: DIVIDING AND MULTIPLYING BY 7

Divide by 7:

1.	280	497	147	420	273	546	392	462
2.	6335	4956	2863	5628	6314	2849	4228	4256

Multiply by 7:

3.	509	208	764	806	295	647	627	485
4.	123	234	345	456	567	678	789	890

READING AND WRITING NUMBERS

1. Read:

18,307 12,557 54,019 10,815 63,108

2. Write in figures:

Sixteen thousand four hundred eight.
Thirty-six thousand nine hundred sixty-four.
Fifty thousand five hundred.
Fifty thousand fifty.
Sixty-six thousand one hundred forty.

DICTATION EXERCISE

1. $42 \div 7, + 3, \times 6, - 4, \div 5, \times 9 = ?$
2. $11 + 9, - 2, \div 9, \times 5, + 4, \div 7, + 8 = ?$
3. $20 \div 5, \times 9, \div 6, + 3, \times 8, - 6, \div 6, - 3 = ?$
4. $38 + 7, \div 9, \times 7, - 3, \div 8, \times 7, + 8, \div 9 = ?$
5. $9 \times 7, - 3, \div 6, + 5, - 3, \times 4, + 6, \div 9, - 3 = ?$
6. $18 \div 9, \times 7, + 6, \div 5, \times 6, \div 3, + 5, - 6 = ?$

NOTE. Dictate similar work daily.

Drill on any portion of Exercises VI, VII, VIII on pages 11 and 12, and on exercise on page 79, according to needs of pupils.

ADDITION *Oral and Written*

Add:

1.	45	49	34	29	27	39	80	12	37	75
	29	67	76	53	86	28	8	40	14	19
	68	19	28	64	59	75	88	56	2	25
	19	56	15	87	43	46	20	84	80	47
	28	78	43	52	22	16	2	19	17	63
	53	22	19	49	73	28	22	25	60	39

2.

429	172	264	245	258	967	392	498
503	84	800	670	153	244	550	327
405	189	7	397	20	149	327	953
784	5	259	82	8	225	178	30
316	604	241	247	176	238	403	7

SUBTRACTION *Oral and Written*

Subtract:

1.

567	453	728	238	427	947	536	547
173	262	474	153	384	373	284	254

2.

253	362	786	494	984	782	987	684
149	128	248	237	546	235	548	336

3. $517 - 247$ $549 - 299$ $645 - 283$ $853 - 362$
4. $683 - 244$ $365 - 127$ $765 - 239$ $483 - 236$
5. From 743 take 362. Take 218 from 384.
6. From 887 take 297. Take 337 from 553.

Find the difference between

7. 307 and 125 247 and 684 617 and 807 864 and 227
8. 341 and 171 309 and 830 762 and 938 662 and 135

MULTIPLICATION: TABLE OF 10'S

1. Count by 10's to 120.
2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

4	12	7	3	10	1	
		× 10				
6	0	11	8	2	5	9

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1; 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1; 2; 3; 4; 5; 6; 7; 8; 9 from each product.

7. Write 2; 3; 4; 5; 6; 7; 8; 9 in the center space and multiply as before.

MULTIPLYING BY 10

1. What is the cost of 10 balls, when one costs 6 cents? 10 cents? 3 cents? 7 cents? 2 cents? 11 cents? 1 cent? 4 cents? 8 cents? 12 cents? 5 cents? 9 cents?

2. Find the cost of 2 articles at the above prices. Of 4. Of 8. Of 3. Of 6. Of 9. Of 5. Of 7.

3. $10 \times 4 =$ $10 \times 5 =$ $10 \times 7 =$ $10 \times 12 =$

4. When you multiply 4 by 10, what comes after 4 in the product?

5. What comes after 5 in the product, when you multiply 5 by 10?

6. If to 7 you annex a 0, what number have you? What have you done to 7?

7. What must be annexed to 3 to make it ten times as great? To 8? To 9? To 10? To 12?

Annexing a 0 to any whole number multiplies it by 10.

DRILL EXERCISE

Multiply these numbers by 10; by 100.

1. 27 34 49 58 79 29 55 96 21 53

2. 19 88 37 44 75 67 93 84 58 36

3. Multiply the numbers above by 5. By 3. By 7. By 2. By 4. By 6. By 9. By 8.

4. How many cents in 1 dime? 4 dimes? 8 dimes? 12 dimes? 5 dimes? 11 dimes? 9 dimes?

5. How many cents in 1 dollar? 5 dollars? 6 dollars? 10 dollars? 12 dollars? 8 dollars? 7 dollars? 3 dollars? 11 dollars? 2 dollars? 4 dollars? 9 dollars?

DIVISION: TABLE OF 10'S

1. Count by 10's to 120. Count back by 10's from 120 to 0.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

10	40	100	80	50	20
		÷ 10			
120	70	90	60	30	110

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to the quotients.

5. Divide, and subtract 1 from each quotient.

6. Write 2; 5 in the center space and divide as before.

DIVIDING AND MULTIPLYING BY 10 AND 100

1. What is $\frac{1}{10}$ of 40? Divide 40 by 10.

2. What is $\frac{1}{10}$ of 70? Divide 70 by 10.

3. What is $\frac{1}{10}$ of 120? Divide 120 by 10.

4. Take away the cipher from 40. What have you done to 40?

5. Take away the cipher from 120? What have you done to 120?

6. What effect, then, is produced by taking away a cipher from the right of a whole number?

7. Annex two 0's to 4. What have you done to 4?

8. Take away two 0's from 400. What have you done to 400?

9. By what do you multiply 3 when you annex one cipher? Two ciphers? Three ciphers?

10. By what do you divide 3000 when you take away one cipher? Two ciphers? Three ciphers?

Every cipher taken away from the right of a whole number divides it by 10.

11.	$140 \div 10$	$\frac{1}{10}$ of 480	$1500 \div 100$	$\frac{1}{100}$ of 1900
12.	$20 \div 10$	$\frac{1}{10}$ of 360	$2700 \div 100$	$\frac{1}{100}$ of 2800
13.	$90 \div 10$	$\frac{1}{10}$ of 980	$4600 \div 100$	$\frac{1}{100}$ of 5700
14.	$100 \div 10$	$\frac{1}{10}$ of 860	$8900 \div 100$	$\frac{1}{100}$ of 9800
15.	$340 \div 10$	$\frac{1}{10}$ of 1240	$15{,}600 \div 100$	$\frac{1}{100}$ of 27,600

16. How many dimes in 220 cents? 1200 cents?

17. How many dollars in 200 cents? 4200 cents? 6900 cents? 9000 cents? 11,800 cents?

18. How many dollars in 120 dimes? 1500 dimes? 3780 dimes? 5000 dimes? 12,200 dimes?

19. How many packages of cereal, at 10 cents a package, can you buy for 120 cents? 40 cents? 100 cents? 20 cents? 90 cents? 30 cents? 60 cents? 80 cents? 10 cents? 50 cents? 110 cents? 70 cents?

20. How many 2-cent stamps can be bought?

21. How many 5-cent stamps?

FINDING TENTHS

1. Find $\frac{1}{10}$ of each of the numbers in the rows in Drill Exercise on page 95.

2. Find $\frac{1}{5}$; $\frac{1}{2}$.

3.

11 is $\frac{1}{10}$ of ——	12 is $\frac{1}{10}$ of ——	4 is $\frac{1}{10}$ of ——
3 is $\frac{1}{10}$ of ——	2 is $\frac{1}{10}$ of ——	9 is $\frac{1}{10}$ of ——
6 is $\frac{1}{10}$ of ——	8 is $\frac{1}{10}$ of ——	5 is $\frac{1}{10}$ of ——
7 is $\frac{1}{10}$ of ——	10 is $\frac{1}{10}$ of ——	1 is $\frac{1}{10}$ of ——

4. Use $\frac{1}{5}$ in place of $\frac{1}{10}$. Use $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{9}$; $\frac{1}{7}$.

DIVIDING BY 10: REMAINDERS

$$10\overline{)73} \qquad 7\tfrac{3}{10}$$

1. $48 \div 10$ $32 \div 10$ $19 \div 10$ $75 \div 10$ $38 \div 10$

2. $10\overline{)15}$ $10\overline{)34}$ $10\overline{)12}$ $10\overline{)87}$ $10\overline{)71}$ $10\overline{)98}$

3. $10\overline{)52}$ $10\overline{)29}$ $10\overline{)42}$ $10\overline{)95}$ $10\overline{)57}$ $10\overline{)83}$

4. $\frac{85}{10}$ $\frac{26}{10}$ $\frac{35}{10}$ $\frac{97}{10}$ $\frac{51}{10}$ $\frac{72}{10}$ $\frac{49}{10}$ $\frac{62}{10}$ $\frac{33}{10}$ $\frac{56}{10}$

5. Use 2; 3; 4; 5; 6; 7; 8; 9 as divisors.

Drill on any portions of Exercises VI, VII, VIII, pages 11 and 12, and on exercise on page 79, according to needs of pupils.

PROBLEMS *Oral and Written*

1. A card containing 3 dozen buttons is sold for 8 cents. What will 12 dozen buttons cost?

2. At 8 cents a quart, what is the cost of 2 4-quart pails of blueberries?

3. A bushel of wheat weighs 60 pounds. What will a peck weigh?

4. How many nickels are equal to 3 quarters?

5. How many quart boxes of berries can you get from a peck measure that is half full?

6. What will a gallon and a half of milk cost at 7 cents a quart?

7. There are 84 trees in a park. Three fourths of them are maples. How many maple trees are there?

8. A house lot is worth $120. What are 6 such lots worth?

9. Divide 259 into 7 equal parts.

10. Twenty dollars is $\frac{1}{10}$ of what a boy earned in a year. What were his earnings for the year?

Drill on Exercises I, II, and III on page 115, and on Exercises V, VI, and VII on page 116.

DRILL EXERCISES *Oral*

1. 30 is / 60 is / 90 is / 120 is } — × 10 or 10 × —; 10 is / 70 is / 40 is / 80 is } — × 10 or 10 × —; 20 is / 110 is / 50 is / 100 is } — × 10 or 10 × —

2. 10 is $\frac{1}{?}$ of 50; 10 is $\frac{1}{?}$ of 60; 10 is $\frac{1}{?}$ of 20
10 is $\frac{1}{?}$ of 90; 10 is $\frac{1}{?}$ of 30; 10 is $\frac{1}{?}$ of 100
10 is $\frac{1}{?}$ of 40; 10 is $\frac{1}{?}$ of 70; 10 is $\frac{1}{?}$ of 80

3. 8 is / 4 is / 7 is / 10 is } $\frac{1}{10}$ of —; 2 is / 11 is / 9 is / 3 is } $\frac{1}{10}$ of —; 12 is / 6 is / 1 is / 5 is } $\frac{1}{10}$ of —

4. 10 is $\frac{1}{6}$ of —; 10 is $\frac{1}{4}$ of —; 10 is $\frac{1}{8}$ of —
10 is $\frac{1}{9}$ of —; 10 is $\frac{1}{7}$ of —; 10 is $\frac{1}{10}$ of —
10 is $\frac{1}{2}$ of —; 10 is $\frac{1}{3}$ of —; 10 is $\frac{1}{5}$ of —

5. Count to 100 by 10's, beginning with 10; with 1; with 2; with 3; with 4; with 5; with 6; with 7; with 8; with 9.

6. Count back by 10's from 100; from 99; from 98; from 97; from 96; from 95; from 94; from 93; from 92; from 91.

DRILL EXERCISE: FINDING PARTS OF NUMBERS

Oral and Written

40		64
56		88
16	$\frac{1}{8}$	24
72		96
32		8
80		48

1. Find $\frac{1}{8}$ of the numbers in the columns.
2. Use $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$ in the center space.
3. Use $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{2}$.
4. How many eighths make 1?
5. If 6 years is $\frac{1}{8}$ of my age, how old am I?
6. A boy earns 24 dollars a month and saves $\frac{3}{8}$ of it. How many dollars does he save?
7. Mr. Bacon had 32 peach trees. Frost killed $\frac{3}{4}$ of them. How many did he lose?
8. Add $\frac{7}{8}$ of 16 and $\frac{1}{2}$ of 10.
9. When potatoes sell for 80 cents a bushel, what will a peck cost?
10. Take $\frac{5}{8}$ of 40 from 28.
11. A bicycle cost 28 dollars, and was sold for $\frac{3}{4}$ the cost. What was the selling price?
12. Bought a chair for 24 dollars, and a table for $\frac{1}{2}$ as much. What did I pay for both?
13. John raised 56 bushels of potatoes. He sold $\frac{5}{8}$ of them at a dollar a bushel. What did he receive for them?
14. In a school of 40 pupils, $\frac{1}{8}$ are absent on account of sickness. How many are present?
15. When cherries are sold for 80 cents a peck, what is the price of one quart? Of 5 quarts?
16. I had 24 dollars. I bought a coat with $\frac{2}{3}$ of it. What did the coat cost?

DRILL IN DIVISION AND MULTIPLICATION

Divide by 8:

1.	1664	3240	4872	6416	2456	4064	5624	7256
2.	368	592	272	504	192	448	656	224
3.	416	296	528	352	704	664	576	736

4. Divide by 4. By 2.

Multiply by 8:

5.	120	181	250	314	615	412	805	704
6.	864	445	278	649	873	348	576	987

READING AND WRITING NUMBERS

1. Write five numbers of five figures each. Read them aloud. Ask your teacher to read them for the class to write on the board.

2. Read, 124,368. We have what in the thousands' group? What in the units' group?

3. Read:

216,350	570,400	391,208	508,386
320,400	567,389	506,600	130,018

ADDITION *Oral and Written*

Add:

1.	42	57	19	48	38	84	68	19	68	24
	57	86	56	5	84	35	77	38	52	96
	62	9	39	55	65	8	84	68	74	57
	34	75	27	84	9	76	29	2	80	63
	59	92	49	67	27	58	5	76	6	25
	71	42	6	98	96	43	64	43	45	45
	20	4	50	74	8	17	86	85	27	60

2.

412	327	215	496	342	145	345	225
567	245	364	589	487	716	427	197
769	60	700	476	765	918	719	238
18	387	8	259	329	287	163	356
6	168	50	183	84	49	7	167

SUBTRACTION *Oral and Written*

Subtract:

1.

592	247	684	352	850	575	276	770	424	985
354	119	359	139	338	347	138	446	109	537

2. $774 - 358$ $482 - 153$ $986 - 329$ $554 - 129$

3. $707 - 374$ $768 - 375$ $624 - 373$ $938 - 495$

4. From 865 take 427. Take 291 from 823.

5. From 590 take 364. Take 180 from 533.

6. From 560 take 234. Take 271 from 912.

Find the difference between:

7. 563 and 135 948 and 758 104 and 300 143 and 406

8. 492 and 127 308 and 124 244 and 590 234 and 608

9. 642 and 119 427 and 817 322 and 680 318 and 808

MULTIPLICATION: TABLE OF 11'S

1. Count by 11's to 132.

2. Learn:

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

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

12	7	3	10	1	6
		× 11			
0	11	8	2	5	9	4

4. Use the number in the center space as the multiplier.

5. Multiply, and add 1; 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 1; 2; 3; 4; 5; 6; 7; 8; 9 from each product.

7. Use 2; 3; 4; 5; 6; 7; 8; 9; 10 in the center space and proceed as before.

PROBLEMS *Oral*

1. Five rows of chairs, 11 in a row, will seat how many people?

2. If you have 11 rows of blocks and 11 blocks in a row, how many blocks have you in all?

3. Willie has 11 cents, John has twice as many, and Henry has 3 times as many. How many has John? How many has Henry? How many have Willie, John, and Henry together? $6 \times 11 =$ ——.

4. A market gardener sold 11 dozen bunches of celery every day for 12 days. How many dozen bunches did he sell in all?

DIVISION: TABLE OF 11'S

1. Count by 11's to 132. Count back by 11's from 132 to 0.

2. Learn:

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

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

77	11	88	22	99	33
		÷ 11			
110	44	121	55	132	66

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to the quotients.

5. Divide, and subtract 1 from each quotient.

PROBLEMS *Oral*

1. Paid 77 cents for 11 yards of ribbon. What was the rate per yard?

2. The rent of a store for 11 weeks was 110 dollars. At this rate, what would be the rent for the twelfth week?

3. It cost 132 dollars to buy sweaters and shoes for a football eleven. How much was spent for each man?

FINDING ELEVENTHS

1. Find $\frac{1}{11}$ of the numbers in the rows in Drill Exercise on page 103.

2. 4 is $\frac{1}{11}$ of — 3 is $\frac{1}{11}$ of — 11 is $\frac{1}{11}$ of —
   12 is $\frac{1}{11}$ of — 2 is $\frac{1}{11}$ of — 1 is $\frac{1}{11}$ of —
   5 is $\frac{1}{11}$ of — 6 is $\frac{1}{11}$ of — 9 is $\frac{1}{11}$ of —
   7 is $\frac{1}{11}$ of — 8 is $\frac{1}{11}$ of — 10 is $\frac{1}{11}$ of —

3. In place of $\frac{1}{11}$ use $\frac{1}{7}$; $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{9}$; $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$.

DIVIDING BY 11: REMAINDERS

Divide each of the following numbers by 11, giving quotients and remainders:

1. 12 45 17 14 35 16 48 19 39 13
2. 93 21 68 25 75 58 87 90 65 42
3. $\frac{84}{11}$ $\frac{69}{11}$ $\frac{51}{11}$ $\frac{85}{11}$ $\frac{38}{11}$ $\frac{42}{11}$ $\frac{76}{11}$ $\frac{50}{11}$ $\frac{71}{11}$ $\frac{29}{11}$
4. 11)62 11)40 11)56 11)63 11)72 11)54 11)81
5. $112 \div 11$ $105 \div 11$ $122 \div 11$ $140 \div 11$ $115 \div 11$
6. Use 10; 9; 8; 7; 6; 5; 4; 3; 2 as divisors.

DRILL EXERCISES

Oral

1. 22 is / 55 is / 88 is / 121 is } — × 11 or 11 × —
   66 is / 132 is / 11 is / 77 is } — × 11 or 11 × —
   44 is / 110 is / 99 is / 33 is } — × 11 or 11 × —

2. 11 is $\frac{1}{7}$ of 22 11 is $\frac{1}{7}$ of 110 11 is $\frac{1}{7}$ of 99 11 is $\frac{1}{7}$ of 121
   11 is $\frac{1}{7}$ of 77 11 is $\frac{1}{7}$ of 33
   11 is $\frac{1}{7}$ of 55 11 is $\frac{1}{7}$ of 44 11 is $\frac{1}{7}$ of 88 11 is $\frac{1}{7}$ of 66

3. 1 is, 6 is, 8 is, 3 is } $\frac{1}{11}$ of —

11 is, 5 is, 10 is, 12 is } $\frac{1}{11}$ of —

2 is, 7 is, 4 is, 9 is } $\frac{1}{11}$ of —

4. 11 is $\frac{1}{8}$ of —
11 is $\frac{1}{5}$ of —
11 is $\frac{1}{9}$ of —
11 is $\frac{1}{4}$ of —

11 is $\frac{1}{3}$ of —
11 is $\frac{1}{7}$ of —

11 is $\frac{1}{11}$ of —
11 is $\frac{1}{6}$ of —
11 is $\frac{1}{10}$ of —
11 is $\frac{1}{2}$ of —

5. Count to 100 by 11's, beginning with 11; with 1; with 2; with 3; with 4; with 5; with 6; with 7; with 8; with 9; with 10.

6. Count back by 11's from 100; from 99; from 98; from 97; from 96; from 95; from 94; from 93; from 92; from 91.

DRILL EXERCISE: FINDING PARTS OF NUMBERS

Oral and Written

18		63
45		108
72	$\frac{1}{9}$	36
99		90
27		9
54		81

1. Find $\frac{1}{9}$ of the numbers in the columns.

2. Use $\frac{2}{9}$; $\frac{4}{9}$; $\frac{5}{9}$; $\frac{7}{9}$; $\frac{8}{9}$ in the center space.

3. Use $\frac{1}{3}$; $\frac{2}{3}$.

4. From $\frac{4}{9}$ of 18 take $\frac{1}{3}$ of 12.

5. What must you add to $\frac{7}{9}$ of 54 to make 50?

6. A baseball team played 27 games. It lost $\frac{2}{3}$ of them. How many games did it lose? How many did it win?

7. Into how many ninths can anything be divided?

8. If 7 is $\frac{1}{9}$, what is the whole?

9. A farm consists of 90 acres. $\frac{1}{3}$ of it is pasture. How many acres are pasture?

10. Eight dollars were paid for a horse's bridle. This was $\frac{1}{9}$ of what the saddle cost. What was paid for the saddle?

11. What is the sum of $\frac{2}{3}$ of 24 and $\frac{2}{9}$ of 36?

12. Paid 54 dollars for a bicycle. Sold it for $\frac{5}{9}$ of what I paid. For how much did I sell it?

13. In riding 45 miles, Mr. Goodwin uses 3 gallons of gasoline in his automobile. How many miles can he ride with one gallon?

14. I had 72 dollars. I spent $\frac{8}{9}$ of it for coal. What did the coal cost me?

15. If 9 dollars is $\frac{1}{9}$ of my money, how many dollars have I?

EXERCISE

Divide by 9:

1.	8127	6336	7254	2745	8172	4518	5436	1881
2.	828	324	873	747	648	504	585	738

3. Divide by 3:

Multiply by 9:

4.	121	140	171	130	804	605	308	507
5.	315	756	495	774	812	531	828	349

Multiply each number in Exercise VI, page 11, by 2; 3; 4; 5; 6; 7; 8.

Multiply the numbers in exercise on page 79 by 2; 3; 4; 5; 6; 7; 8.

Divide the numbers in exercise on page 79 by 2; 3; 4; 5; 6; 7; 8.

ADDITION *Written*

Add:

1.	296	154	242	580	436	158	309	217
	715	237	318	805	731	627	576	175
	614	361	138	580	819	525	164	346
	719	504	273	850	208	432	320	184
	112	217	354	58	153	462	706	824

2.	1528	3400	4725	1582	4263	8462
	2436	2600	3162	1673	2765	5036
	1927	1783	8470	7241	18	7123
	1242	1257	3620	3062	415	8431
	1786	6408	1833	4008	3021	1725

3. Add three thousand seven hundred sixty to four hundred eighty-seven.

SUBTRACTION *Written*

Subtract:

1.	6080	5040	9060	7050	8030	4070
	2436	3517	2134	4322	3216	2331

2.	7283	6153	8265	6473	8355	9683
	4854	1234	4536	2649	5628	4837

3. Subtract six hundred fifty-two from one thousand eighty.

READING AND WRITING NUMBERS

1. Write 5 numbers of 4 figures each. Read them.
2. Write 5 numbers of 5 figures each. Read them.
3. Write 5 numbers of 6 figures each. Read them.

NOTE. Numbers of 4, 5, and 6 figures should be dictated to the class.

MULTIPLICATION: TABLE OF 12'S

1. Count by 12's to 144.

2. Learn:

$1 \times 12 = 12$	$5 \times 12 = 60$	$9 \times 12 = 108$
$2 \times 12 = 24$	$6 \times 12 = 72$	$10 \times 12 = 120$
$3 \times 12 = 36$	$7 \times 12 = 84$	$11 \times 12 = 132$
$4 \times 12 = 48$	$8 \times 12 = 96$	$12 \times 12 = 144$

DRILL EXERCISE

3. Multiply the number in the center space by each number in the rows.

7	3	10	1	6	0

$\times 12$

11	8	4	9	5	2	12

4. Use the number in the center space as the multiplier.

5. Multiply, and add 2; 3; 4; 5; 6; 7; 8; 9 to each product.

6. Multiply, and subtract 2; 3; 4; 5; 6; 7; 8; 9 from each product.

7. Write 2; 3; 4; 5; 6; 7; 8; 9 in the center space and multiply as before.

8. How many pencils in 7 dozen? 3 dozen? 9 dozen? 1 dozen? 11 dozen? 5 dozen? 8 dozen? 2 dozen? 10 dozen? 6 dozen? 4 dozen? A gross (12 dozen)?

DIVISION: TABLE OF 12'S

1. Count by 12's to 144. Count back by 12's from 144 to 0.

2. Learn:

$12 \div 12 = 1$	$60 \div 12 = 5$	$108 \div 12 = 9$
$24 \div 12 = 2$	$72 \div 12 = 6$	$120 \div 12 = 10$
$36 \div 12 = 3$	$84 \div 12 = 7$	$132 \div 12 = 11$
$48 \div 12 = 4$	$96 \div 12 = 8$	$144 \div 12 = 12$

DRILL EXERCISE

3. Divide each number in the rows by the number in the center space.

144	96	48	132	84	36
		÷12			
120	72	24	108	60	12

4. Divide, and add 1 to each quotient. Divide, and add 2; 3; 4; 5; 6; 7; 8; 9 to each quotient.

5. Divide, and subtract 1 from each quotient.

6. Write 2; 4; 3; 6 in the center space and divide as before.

PROBLEMS *Oral*

1. How long will it take to save 96 dollars at the rate of 12 dollars a month?

2. A building is 108 feet high. Each story is 12 feet high. How many stories are there?

3. How many dozen pens in a gross? (A gross is 144.)

4. If an electric car runs 12 miles an hour, how many hours will it take to travel from one city to another, 84 miles away?

5. How many years in 132 months?

FINDING TWELFTHS

1. Find $\frac{1}{12}$ of the numbers in the rows in Drill Exercise on page 109. Find $\frac{1}{6}$; $\frac{1}{4}$; $\frac{1}{3}$; $\frac{1}{2}$.

2.

9 is $\frac{1}{12}$ of —	8 is $\frac{1}{12}$ of —	10 is $\frac{1}{12}$ of —
12 is $\frac{1}{12}$ of —	3 is $\frac{1}{12}$ of —	1 is $\frac{1}{12}$ of —
7 is $\frac{1}{12}$ of —	2 is $\frac{1}{12}$ of —	6 is $\frac{1}{12}$ of —
4 is $\frac{1}{12}$ of —	5 is $\frac{1}{12}$ of —	11 is $\frac{1}{12}$ of —

3. In place of $\frac{1}{12}$ use $\frac{1}{6}$; $\frac{1}{3}$; $\frac{1}{9}$; $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{7}$; $\frac{1}{11}$.

DIVIDING BY 12: REMAINDERS

Give quotients and remainders:

1.	$13 \div 12$	$90 \div 12$	$33 \div 12$	$66 \div 12$	$45 \div 12$
2.	$56 \div 12$	$65 \div 12$	$76 \div 12$	$88 \div 12$	$100 \div 12$
3.	$12\overline{)34}$	$12\overline{)42}$	$12\overline{)70}$	$12\overline{)50}$	$12\overline{)49}$	$12\overline{)81}$
4.	$12\overline{)18}$	$12\overline{)64}$	$12\overline{)29}$	$12\overline{)37}$	$12\overline{)80}$	$12\overline{)90}$

5. Use 11; 10; 9; 8; 7; 6; 5; 4; 3; 2 as divisors.

DRILL EXERCISES

Oral

1.

36 is	— × 12 or 12 × —	96 is	— × 12 or 12 × —	120 is	— × 12 or 12 × —
84 is		12 is		72 is	
132 is		108 is		144 is	
24 is		48 is		60 is	

2.

12 is $\frac{1}{7}$ of 60	12 is $\frac{1}{7}$ of 24	12 is $\frac{1}{7}$ of 48
12 is $\frac{1}{7}$ of 120	12 is $\frac{1}{7}$ of 72	12 is $\frac{1}{7}$ of 96
12 is $\frac{1}{7}$ of 144	12 is $\frac{1}{7}$ of 132	12 is $\frac{1}{7}$ of 36
12 is $\frac{1}{7}$ of 108	12 is $\frac{1}{7}$ of 84	

3.

8 is 4 is 10 is 2 is } $\frac{1}{12}$ of —	1 is 7 is 5 is 9 is } $\frac{1}{12}$ of —	3 is 12 is 6 is 11 is } $\frac{1}{12}$ of —

4.

12 is $\frac{1}{6}$ of —	12 is $\frac{1}{7}$ of —	12 is $\frac{1}{4}$ of —
12 is $\frac{1}{2}$ of —	12 is $\frac{1}{10}$ of —	12 is $\frac{1}{8}$ of —
12 is $\frac{1}{9}$ of —	12 is $\frac{1}{5}$ of —	12 is $\frac{1}{12}$ of —
12 is $\frac{1}{3}$ of —	12 is $\frac{1}{11}$ of —	

5. Count to 100 by 12's, beginning with 12; with 1; with 2; with 3; with 4; with 5; with 6; with 7; with 8; with 9; with 10; with 11.

6. Count back by 12's from 100; from 99; from 98; from 97; from 96; from 95; from 94; from 93; from 92; from 91.

DRILL EXERCISES

Give products. Work rapidly.

	A	*B*	*C*	*D*	*E*
1.	4×8	6×6	12×6	6×9	12×8
2.	7×7	8×9	11×10	12×9	11×12
3.	8×6	10×11	8×4	7×6	8×8
4.	9×9	6×8	9×6	7×9	9×4
5.	6×7	7×9	8×12	4×9	7×12
6.	12×12	8×7	12×11	7×8	11×11
7.	9×7	6×12	12×7	9×12	6×9

Give quotients. Work rapidly.

	A	*B*	*C*	*D*	*E*
1.	42 ÷ 7	63 ÷ 7	56 ÷ 8	72 ÷ 9	84 ÷ 7
2.	63 ÷ 9	144 ÷ 12	81 ÷ 9	48 ÷ 6	49 ÷ 7
3.	32 ÷ 8	72 ÷ 12	56 ÷ 7	110 ÷ 11	48 ÷ 8
4.	72 ÷ 9	36 ÷ 9	72 ÷ 6	32 ÷ 4	54 ÷ 6
5.	110 ÷ 10	84 ÷ 7	132 ÷ 11	56 ÷ 7	108 ÷ 12
6.	56 ÷ 8	63 ÷ 9	42 ÷ 6	54 ÷ 9	96 ÷ 8
7.	132 ÷ 12	64 ÷ 8	84 ÷ 12	121 ÷ 11	54 ÷ 9

Multiply and divide the numbers in exercise on page 79 by 2; 3; 4; 5; 6; 7; 8; 9.

Name two numbers whose product is :

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1.	14	54	80	72	16	44	36	22
2.	56	144	21	132	40	110	20	63
3.	48	55	70	120	45	28	66	99
4.	27	64	30	49	77	40	24	100

SUBTRACTION

Written

Subtract :

1.	8050	3040	5020	7060	4030	9060	7070	3090
	3527	1726	4218	5546	2827	835	535	888
2.	9312	5563	6283	7754	8326	4242	5351	6442
	3605	1625	3744	817	918	2424	2629	5525
3.	52650	24530	10890	18260	81060	72070		
	4345	5122	3508	3743	16047	28066		

DRILL EXERCISE: FINDING PARTS OF NUMBERS

Oral and Written

20		90
50		120
80	$\frac{1}{10}$	10
110		40
30		70
60		100

1. Find $\frac{1}{10}$ of the numbers in the columns.

2. Use $\frac{3}{10}$; $\frac{7}{10}$; $\frac{9}{10}$ in the center space.

3. Use $\frac{1}{5}$; $\frac{2}{5}$; $\frac{3}{5}$; $\frac{4}{5}$. Use $\frac{1}{2}$.

4. How many are $\frac{1}{10}$ of 40 + $\frac{1}{5}$ of 20 + $\frac{1}{2}$ of 10?

5. How many dollars does a boy save who earns 20 dollars a month, if he puts $\frac{2}{5}$ of it in the bank?

6. Into how many tenths can a dollar be divided? anything?

7. If $\frac{1}{10}$ of a farmer's sheep are 10, how many has he in all?

8. John earned 80 cents. He spent $\frac{3}{10}$ of it for a ball. How many cents had he left?

9. During the month of June it rained $\frac{1}{5}$ the time. How many rainy days were there? How many fair days?

10. When 20 is $\frac{1}{5}$, what are five fifths?

11. What is the difference between $\frac{7}{10}$ of 90 and $\frac{4}{5}$ of 60?

12. Add $\frac{1}{10}$ of 100, $\frac{1}{5}$ of 100, and $\frac{1}{2}$ of 100.

13. What must be added to $\frac{4}{5}$ of 20 to make 25?

14. Of a flock of 40 pigeons, $\frac{3}{5}$ are fantails. How many are fantails?

15. A wood carver earned $60 in one month, and $\frac{1}{5}$ more the next month. What were his earnings the second month?

Drill on exercises on pages 115 and 116.

TABLE OF MONTHS IN A YEAR

January	31 days	July	31 days
February	28 days	August	31 days
March	31 days	September	30 days
April	30 days	October	31 days
May	31 days	November	30 days
June	30 days	December	31 days

1. How many months in a year? Name them.

2. How many months have 30 days? Name them.

3. Name the months that have 31 days. How many?

4. What month has 28 days?

5. Add the number of days in all the months. How many days in a year?

6. Once in four years February has 29 days. The years in which February has 29 days are *leap years*. How many days has a leap year?

This old rhyme will help you to remember the number of days in the months:

Thirty days hath September,
April, June, and November,
All the rest have thirty-one,
Save February alone,
To which we twenty-eight assign,
Till leap year gives it twenty-nine.

7. The year 1908 was a leap year. When is the next leap year?

8. At $10 a month, what is the rent of a house from January 1 to July 1?

REVIEW EXERCISES: MULTIPLICATION AND DIVISION

I

	A	*B*	*C*	*D*	*E*
1.	2×3	$8 \div 2$	3×9	$36 \div 4$	4×10
2.	5×2	$9 \div 3$	2×8	$18 \div 2$	5×4
3.	4×3	$28 \div 4$	3×11	$15 \div 5$	3×2
4.	3×7	$24 \div 3$	4×8	$16 \div 4$	4×5
5.	2×12	$8 \div 4$	3×12	$30 \div 3$	2×5
6.	2×7	$12 \div 2$	2×10	$48 \div 4$	4×6
7.	4×11	$15 \div 3$	3×6	$22 \div 2$	3×4

II

1.	5×5	$30 \div 5$	7×3	$12 \div 6$	7×8
2.	6×4	$28 \div 7$	5×7	$55 \div 5$	5×10
3.	5×12	$60 \div 6$	7×2	$30 \div 6$	6×9
4.	6×6	$42 \div 7$	6×11	$40 \div 5$	7×5
5.	7×10	$63 \div 7$	7×7	$42 \div 6$	6×3
6.	5×9	$72 \div 6$	6×8	$77 \div 7$	7×12

III

1.	8×2	$24 \div 8$	9×12	$108 \div 9$	8×11
2.	9×7	$18 \div 9$	8×7	$64 \div 8$	9×5
3.	10×9	$60 \div 10$	10×4	$63 \div 9$	8×12
4.	9×6	$40 \div 8$	8×6	$80 \div 8$	10×6
5.	8×3	$36 \div 9$	9×11	$80 \div 10$	9×10
6.	9×2	$30 \div 10$	8×8	$81 \div 9$	10×5

IV

1.	10×10	$110 \div 10$	12×12	$132 \div 11$	11×8
2.	12×5	$55 \div 11$	11×4	$72 \div 12$	12×7
3.	11×6	$48 \div 12$	12×8	$110 \div 11$	11×9
4.	12×3	$22 \div 11$	11×11	$108 \div 12$	12×2
5.	10×12	$132 \div 12$	12×10	$77 \div 11$	11×3

V

1.	6 ÷ 2	2 × 4	20 ÷ 4	5 × 3	20 ÷ 5
2.	12 ÷ 3	4 × 9	16 ÷ 2	2 × 9	40 ÷ 4
3.	32 ÷ 4	3 × 3	27 ÷ 3	4 × 4	6 ÷ 3
4.	21 ÷ 3	2 × 11	14 ÷ 2	3 × 8	12 ÷ 4
5.	10 ÷ 5	4 × 2	36 ÷ 3	2 × 6	24 ÷ 2
6.	20 ÷ 2	3 × 5	10 ÷ 2	4 × 7	24 ÷ 4
7.	44 ÷ 4	4 × 12	18 ÷ 3	3 × 10	33 ÷ 3

VI

1.	25 ÷ 5	5 × 6	36 ÷ 6	6 × 2	18 ÷ 6
2.	21 ÷ 7	7 × 11	50 ÷ 5	5 × 11	49 ÷ 7
3.	45 ÷ 5	6 × 5	56 ÷ 7	6 × 12	24 ÷ 6
4.	54 ÷ 6	7 × 6	60 ÷ 5	6 × 10	70 ÷ 7
5.	35 ÷ 5	7 × 4	66 ÷ 6	5 × 8	48 ÷ 6
6.	35 ÷ 7	6 × 7	14 ÷ 7	7 × 9	84 ÷ 7

VII

1.	16 ÷ 8	8 × 4	45 ÷ 9	9 × 4	90 ÷ 9
2.	27 ÷ 9	9 × 9	56 ÷ 8	8 × 9	40 ÷ 10
3.	20 ÷ 10	9 × 3	72 ÷ 9	10 × 3	96 ÷ 8
4.	54 ÷ 9	8 × 5	70 ÷ 10	9 × 8	90 ÷ 10
5.	32 ÷ 8	10 × 2	72 ÷ 8	10 × 8	99 ÷ 9
6.	50 ÷ 10	8 × 10	88 ÷ 8	10 × 7	48 ÷ 8

VIII

1.	100 ÷ 10	10 × 11	120 ÷ 12	11 × 12	88 ÷ 11
2.	66 ÷ 11	11 × 5	44 ÷ 11	12 × 6	84 ÷ 12
3.	144 ÷ 12	12 × 4	120 ÷ 10	11 × 7	99 ÷ 11
4.	36 ÷ 12	11 × 10	60 ÷ 12	12 × 11	24 ÷ 12
5.	121 ÷ 11	12 × 9	33 ÷ 11	11 × 2	96 ÷ 12

PART II

READING AND WRITING NUMBERS

A unit is a single thing; as 1, 1 pencil, 1 cent.

A number is one or more units; as 1, 5, 3 pens, 8 men.

Arithmetic treats of numbers.

Reading numbers is numeration.

Writing numbers is notation.

Our system of notation is based on the principle that ten units of any order make one unit of the next higher order. This is called a decimal system; the word *decimal* coming from the Latin word *decem*, which means *ten*.

The following table shows the method of notation and numeration.

	Millions' Group			Thousands' Group			Units' Group		
NAMES OF PLACES	Hundred-millions	Ten-millions	Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Units
ORDER OF PLACES	9th	8th	7th	6th	5th	4th	3d	2d	1st

The group beyond millions is the billions' group. It is rarely used in ordinary work.

NUMERATION

1. Read 657.

This number is made up of 6 hundreds, 5 tens, 7 ones, and is read six hundred fifty-seven.

657 is really six hundred fifty-seven units or ones, but we are not accustomed to use the name of the group in reading units. We do use the group name, however, in all cases except units.

Never use the word *and* to connect the parts of whole numbers.

When a number consists of more than three figures, we separate it by commas into periods of three figures each, beginning at the right. Thus, 4632 — 4,632.

Then we read each group by itself, giving the name of the group.

4,632 is read four thousand six hundred thirty-two.

2. Read 3754826.

Separating into periods of three figures each, we have 3,754,826. That is, we have three in the millions' group, seven hundred fifty-four in the thousands' group, eight hundred twenty-six in the units' group, and we read, three million seven hundred fifty-four thousand eight hundred twenty-six.

Read these numbers, first telling what is in each group:

3.	76450	180766	2482653
4.	87003	306482	13075801
5.	10608	950307	845402630
6.	32087	307508	106759340
7.	50500	606000	202347605

NOTATION

1. Write in figures, eighty-four thousand forty-two.

Thousands' Group			Units' Group		
	8	4	0	4	2

Here we have 84 in the thousands' group, and 42 in the units' group. There being nothing in the hundreds' place, we indicate the fact by a 0. Our number, then, expressed in figures is 84,042.

Note that whenever any part of a group is lacking, we fill its place with a cipher.

Express in figures:

2. Six thousand eighty-seven.

3. Thirty-four thousand seven hundred fifty.

4. One hundred twenty thousand two hundred five.

5. Fifty-six million two hundred twenty thousand fifty-six.

6. Seven hundred sixty-four million three hundred eighty-four thousand seven hundred.

7. One hundred sixty-seven million two hundred twenty-one thousand.

8. Thirty-five million four hundred fifty thousand one hundred.

Note. Practice in reading numbers, and in writing numbers from dictation and from numbers written in words on the blackboard, should be given until pupils become proficient. Numbers to be added or subtracted should be dictated frequently.

ROMAN NUMERALS

We have two systems of writing numbers — the one you know, and the Roman system. The one you know is called the Arabic system because it came to us from the Arabs. The Roman method came from the Romans.

The Roman method of writing numbers uses the following seven letters, each of which has a fixed value:

Letters	I	V	X	L	C	D	M	Roman
Values	1	5	10	50	100	500	1000	Arabic

The letters are not commonly used in writing numbers, because the Arabic system is so much more simple. Roman numerals are used in a few cases, such as indicating the hours on a clock, in numbering the chapters of a book, in writing years on memorial tablets, and so forth.

By combining the above seven letters, any number may be written.

1 is written I. 11 = 10 + 1, and is written XI.
2 is written II. 12 = 10 + 2, and is written XII.
3 is written III. 13 = 10 + 3, and is written ——.
4 is written IV. 14 = 10 + 4, and is written XIV.
5 is written V. 15 = 10 + 5, and is written ——.
6 is written VI. 16 = 10 + 6, and is written ——.
7 is written VII. 17 = 10 + 7, and is written ——.
8 is written VIII. 18 = 10 + 8, and is written ——.
9 is written IX. 19 = 10 + 9, and is written ——.
10 is written X. 20 = 10 + 10, and is written XX.

1. Write 21. 21 = 20 + 1, and is written XXI.
2. Write 22, 23, 24, 25, 26, 27, 28, 29.

$30 = 10 + 10 + 10$, and is written ——.

3. Write the numbers from 31 to 39.

$40 = 50 - 10$, and is written XL.

4. Write the numbers from 41 to 49.

5. 50 is written L. Write the numbers from 51 to 59.

$60 = 50 + 10$, and is written ——.

6. Write the numbers from 61 to 69.

$70 = 50 + 20$, and is written ——.

7. Write the numbers from 71 to 79.

$80 = 50 + 30$, and is written ——.

8. Write the numbers from 81 to 89.

$90 = 100 - 10$, and is written XC.

9. Write the numbers from 91 to 99.

10. 100 is written ——. Write 200; 300; 400.

11. 500 is written ——. Write 600; 700; 800; 900.

12. 1000 is written ——. Write 2000; 3000.

13. Read these numbers:

XIV	LXXI	XXXIII	LXII	XVIII
XXVIII	LXXXIV	XIII	CIX	XXIV
XLI	XXIX	XIX	XCIX	XLV

Write in Roman numerals:

1. Your age.
2. The hour of the day.
3. The number of the month of the year.
4. The day of the month.
5. The number of days in a week.
6. The number of days in the present month.
7. The number of weeks in a year.
8. The number of this page.

ADDITION *Written*

The process of uniting two or more numbers into one number is *addition*. The result is the *sum*.

Read the numbers in the following groups, and find the sum of each group.

	A	*B*	*C*	*D*	*E*
1.	18	375	6024	66742	38659
	56	856	1876	70694	7682
	94	904	1542	47365	930
	29	760	9763	8040	27
	37	358	1839	17	142
	44	291	5760	35624	3684
	53	97	6752	27856	59806
2.	68	753	34	78	17694
	9	8	1957	891	290876
	34	56	8	27642	485
3.	47	627	459	87	2087
	76	8	7	34705	99
	9	407	7648	655	247953
	34	96	75	8173	876

Note in the above exercises that units are always placed under units, tens under tens, hundreds under hundreds, etc. This arrangement is necessary, as we can add only things of like kinds.

4. Add: thirty-five, forty-seven, one hundred eighteen, two hundred sixty.

5. $347 + 602 + 853 + 150 + 8 = ?$

6. $306 + 60 + 128 + 9 + 500 = ?$

ADDITION: SIGHT EXERCISE

1. $42+29=$ —. This means $42+20+9$. $42+20=62$. $62+9=71$. Think 42, 62, 71.

Add at sight:

2.	$36+45$	$38+24$	$18+26$	$17+35$	$64+18$
3.	$52+19$	$65+26$	$37+54$	$45+27$	$28+67$
4.	$47+26$	$48+37$	$64+29$	$46+25$	$27+25$
5.	$54+36$	$79+21$	$38+45$	$39+47$	$29+46$
6.	$28+58$	$36+49$	$29+58$	$37+46$	$39+49$

7.	76	86	66	29	36	45	88	76	83	68
	24	44	56	92	39	77	26	49	27	47
8.	19	27	35	29	85	44	82	67	75	46
	49	67	48	87	19	76	58	33	48	39

PROBLEMS *Written*

1. A grocer sold 78 pounds of sugar to one customer, 56 pounds to a second customer, 25 pounds to a third customer, and 60 pounds to a fourth customer. How many pounds did he sell in all?

2. What was the total length of a piece of cloth which was cut up into the following pieces: 14 yards, 28 yards, 19 yards, 7 yards, and 36 yards?

3. In one lot of flour there were 148 barrels, in a second lot 219 barrels, and 167 barrels in a third lot. How many barrels in the three lots?

4. In one week a man traveled 74 miles, 29 miles, 104 miles, 88 miles, 35 miles, and 67 miles. How many miles did he travel in all?

5. A butcher sold 240 pounds of meat on Monday, 167 pounds on Tuesday, 329 pounds on Wednesday, 256 pounds on Thursday, 96 pounds on Friday, and 447 pounds on Saturday. What were his total sales for the week?

6. $647 + $59 + $350 + $423 + $508 = how many dollars?

7. In one school there are 347 girls and 288 boys. In another school there are 453 boys and 517 girls. How many boys in both schools? How many girls? How many pupils in both schools?

8. John raised 264 chickens in one year, and the next year 86 more than in the first year. How many did he raise in the second year?

9. The following represents the number of tons of coal sold by a firm in one week:

Kind	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Furnace	65	87	46	59	67	36
Stove	38	49	27	44	39	32
No. 1 Nut	27	39	19	28	31	17
No. 2 Nut	19	27	18	17	26	15
Soft	89	76	69	57	42	63

a. Find total sales for each day.

b. Find total sales for the week.

c. Find number of tons of each kind sold during the week.

d. Find total sales of all kinds during the week.

e. Are your answers to *b* and *d* the same?

UNITED STATES MONEY

A cent is $\frac{1}{100}$ of a dollar. A dime is $\frac{1}{10}$ of a dollar.

In writing dollars and cents together, we use a point called a decimal point, to separate the dollars and the cents. Thus, 3 dollars and 17 cents is written \$3.17.

In the first place at the right of the decimal point we write the number of dimes as tenths of a dollar. In the second place we write the number of cents less than ten as hundredths of a dollar.

If there are no dimes we write a 0 in the tens' place. Thus, 1 dollar and 8 cents is written \$1.08. \$2.45 is read either two dollars and forty-five cents, or two and forty-five hundredths dollars.

In reading dollars and cents together we always use the word *and* to connect the dollars and cents.

1. Read:

\$2.15	\$16.24	\$8.09	\$9.40	\$5.87
\$10.07	\$0.62	\$0.06	\$0.30	\$3.20

2. Express in figures:

Thirty-seven cents.	Four dollars and sixteen cents.
Five cents.	One dollar and sixty cents.
Fifty cents.	Eight dollars and nine cents.
Sixty-four cents.	Ten dollars and four cents.
Ten cents.	Sixty dollars and sixty cents.

ADDITION: UNITED STATES MONEY

Add:

1. \$1.57
   2.08
   5.40
   \$.

Remember to separate the cents from the dollars in the sum by writing a decimal point directly under the decimal points in the numbers added. Write the dollar sign in the sum.

	A	*B*	*C*	*D*	*E*
2.	$3.57	$10.87	$0.67	$0.39	$0.09
	4.96	3.08	1.25	.09	.08
	5.03	2.60	4.98	1.50	.07
3.	$0.43	$0.21	$0.30	$1.07	$0.60
	.11	.14	.03	.07	6.06
	.32	.06	3.00	.70	60.60
	.06	.05	8.00	2.05	.06

Notice in the above examples that the decimal points are written one under another. This brings dimes under dimes, and cents under cents. Why is this arrangement necessary?

PROBLEMS *Written*

1. A box of nectarines cost $3.24. It was sold for $2.05 more than it cost. What was it sold for?

2. A fruit dealer buys bananas at $0.16 a dozen, and sells them so as to gain $0.09 a dozen. What does he sell them for a dozen?

3. A man made deposits in the savings bank as follows: January, $20.75; February, $16.09; March, $20.08; April, $18.00; May, $25.50. Find the total deposits.

4. Mr. Jones bought a hat for $2.50 and a suit for $17.50. What was the amount of his bill?

5. I paid $3.50 for shoes, $4.75 for rubber boots, and $0.05 for shoe lacings. How much did I pay for all?

6. $0.37 + $8.70 + $95 + $342 = ?

7. Express 859 cents as dollars and cents.

SUBTRACTION

The process of taking one number from another number to find what remains is *subtraction.*

1. Take 28 from 35.

35 minuend
28 subtrahend
7 remainder

The number from which something is taken is the *minuend.*

The number taken away is the *subtrahend.*

The number left after taking the subtrahend from the minuend is the *remainder* or *difference.*

2. How can you test the accuracy of your work in subtraction?

3. From 825 take 247.

Minuend 825 = 8 hundreds + 2 tens + 5 units
= 7 hundreds + 11 tens + 15 units
Subtrahend 247 = 2 hundreds + 4 tens + 7 units
Remainder = 5 hundreds + 7 tens + 8 units,
or 578.

Here we take one of the 2 tens in the minuend and put it with the 5 units, making 15 units. 7 units from 15 units leaves 8 units. As we cannot take 4 tens from 1 ten, we take one of the 8 hundreds and put it with the 1 ten, making 11 tens. 4 tens from 11 tens leaves 7 tens. 2 hundreds from 7 hundreds leaves 5 hundreds. Our remainder is 578.

825
247
578

We always do this work mentally. We say, 7 from 15, 8; 4 from 11, 7; 2 from 7, 5; remainder, 578.

4. From 352 take 147. Take 451 from 953.
5. From 735 take 268. Take 309 from 870.
6. From 643 take 184. Take 538 from 806.

7. From 800 take 247.

800 = 7 hundreds, 9 tens, 10 units
247 = 2 hundreds, 4 tens, 7 units
5 hundreds, 5 tens, 3 units, or 553.

Here we take one of the 8 hundreds and think it as 9 tens and 10 units. We say 7 from 10, 3; 4 from 9, 5; 2 from 7, 5; remainder, 553.

8. From 716 take 288. Take 376 from 768.

9. From 327 take 169. Take 432 from 800.

Find differences:

10. 287 − 129 833 − 266 800 − 165 623 − 326

11. 834 − 376 763 − 608 400 − 207 584 − 295

12.

387	540	760	987	873	500	600	512
129	351	392	799	290	317	64	215

13. From 500 take each number: 5; 50; 55; 105; 150.

SUBTRACTION: SIGHT EXERCISES

1. 80 − 52 = ? This means 80 − 50 − 2. 80 − 50 = 30. 30 − 2 = 28. Think 80, 30, 28.

2. 45 − 27 36 − 19 84 − 55 73 − 36 65 − 18

3. 78 − 29 46 − 27 73 − 44 95 − 76 87 − 49

4. 63 − 37 32 − 17 85 − 27 87 − 38 73 − 27

5.

43	94	71	88	62	53	73	92	64	85
25	38	43	59	48	26	35	55	35	29

6.

66	73	84	95	61	86	55	67	81	93
48	45	36	49	36	47	39	29	27	37

NOTE. Drill of this kind should be given frequently until the sum and the difference of any two numbers of two figures each can be given instantly.

PROBLEMS *Oral and Written*

1. Twenty-six sparrows were on the lawn. Seven flew away. How many were left?

2. James picked 30 quarts of plums, and sold 18 quarts. How many quarts had he left?

3. Forty-two boys were playing in the school yard. Sixteen went home. How many were left?

4. How many years since the Boston Tea Party in 1773?

5. There are 53 eggs in a box. How many will be left after 4 dozen are sold?

6. A man earned $538 and spent $359. How much had he left?

7. 760 bushels of wheat − 493 bushels of wheat = ?

8. From 700 barrels of apples 467 barrels were sold. How many barrels were left?

9. One book contains 432 pages. Another contains 249 pages. How many more pages in one book than the other?

10. Mr. Wyman has a bank account of $392. He wishes to make the amount $537. How much must he add to his account?

11. Mr. Carroll raised 800 bushels of potatoes in two years. The first year he raised 374 bushels. How many bushels did he raise the second year?

12. A house cost a man $6387. He lost $598 when he sold it. For how much was it sold?

13. A grain dealer sold 3784 bales of hay in one winter, and 2856 bales the second winter. How many more bales did he sell the first winter than the second?

SUBTRACTION: UNITED STATES MONEY

1. Subtract:

$8.27 Remember to separate the cents from the
2.45 dollars in the remainder by a decimal point.
$ Write the dollar sign in the answer.

2.	$3.36	$4.30	$2.87	$5.80	$6.43
	1.58	1.76	1.98	3.60	3.58
3.	$0.62	$0.50	$0.80	$0.08	$1.00
	.24	.24	.15	.02	.29
4.	$12.60	$10.00	$10.00	$16.08	$80.00
	3.70	2.87	.88	5.50	.80
5.	$104.80	$110.07	$120.00	$150.00	$108.09
	29.15	40.60	12.25	.08	10.80

PROBLEMS *Written*

1. I had $5. I spent $2.30. How much had I left?

2. A boy earned $0.75, and then bought a ball for $0.50. How much money had he then?

3. Three boys earned together $0.50. The first received $0.15, the second $0.20, and the third ——.

4. I earned $8.06, and spent $3.46. How much had I left?

5. How much is left from a 2-dollar bill after buying a cap for 80 cents?

6. $10 is how much more than $6.08?

7. I had $8.50 in my purse. I bought a book for $0.83, an umbrella for $1.50, and paid $0.30 for car fare. How much had I left?

MISCELLANEOUS PROBLEMS *Oral*

1. Joe had 35 cents, and earned 19 more. How many did he then have?

2. Sam earned 35 cents, and spent 19 for a ball. How many had he left?

3. I had 24 rose bushes. I threw away 6, and bought 9 more. How many had I then?

4. In a garden there are 5 rows of currant bushes, 4 in a row, and twice as many blackberry bushes. How many blackberry bushes?

5. Four times 8 and 3 times 8 are how many?

6. How many weeks in 45 days?

7. My watch loses 1 minute an hour. How many minutes does it lose in a day?

8. Take 18 from $\frac{1}{2}$ of 50.

9. Warren makes a score of 28 in playing ring toss. Julia makes a score $\frac{3}{4}$ as large. What is Julia's score?

10. In a boys' club 16 boys are learning to seat chairs; $\frac{1}{4}$ as many and 3 more are cobbling shoes. How many are cobbling shoes?

11. Fred gives 5 marbles for 2 foreign stamps. How many marbles will he give for 10 stamps?

12. Louise buys 3 5-cent boxes of crackers and 2 2-cent postage stamps. What change does she get from a quarter dollar?

13. There are 30 girls on the playground. $\frac{1}{2}$ of them are playing London Bridge, 9 are playing ball, and the rest are in the swings. How many in the swings?

14. How much more than 50 cents will 7 8-cent tops cost?

FACTORS *Oral*

Numbers multiplied together to produce a product are called factors of the product. Thus, 8 and 3 are factors of their product, 24.

1. What two numbers multiplied together will give 42? 56? 84? 63? 54? 72? 32? 45? 96? 27?

2. Name two factors that will make 40; 28; 21; 48; 108; 42; 60; 99; 18; 49.

Some numbers are made up of two equal factors. Thus, $25 = 5 \times 5$.

3. Name the two equal factors of 4; 16; 64; 9; 36; 81; 49; 100; 144; 121.

Numbers may be made up of more than two factors. $2 \times 3 \times 4$ means that the product of 2 and 3 is to be multiplied by 4.

4. $2 \times 3 \times 7 =$
5. $5 \times 5 \times 4 =$
6. $6 \times 2 \times 5 =$
7. $8 \times 4 \times 2 =$
8. $4 \times 4 \times 3 =$
9. $2 \times 2 \times 2 \times 3 =$
10. $2 \times 3 \times 2 \times 3 =$
11. $2 \times 3 \times 4 \times 5 =$
12. $3 \times 4 \times 1 \times 2 =$
13. $7 \times 1 \times 2 \times 2 =$

When factors are multiplied together, it makes no difference in what order they are used. Thus, $7 \times 8 = 56$, and $8 \times 7 = 56$.

14. $3 \times 4 \times 5 =$ — $5 \times 4 \times 3 =$ — $4 \times 3 \times 5 =$ —
$4 \times 5 \times 3 =$ — $5 \times 3 \times 4 =$ — $3 \times 5 \times 4 =$ —

Separate each number into as many groups of two factors as you can. Thus, $12 = 2 \times 6$, 3×4.

15.	16	18	20	24	30	36
16.	40	48	60	72	80	100
17.	28	32	56	42	64	88

MULTIPLICATION

The process of combining several equal numbers into one number is *multiplication.*

Multiply 37 by 4. This means combine 4 37's into one number.

37 multiplicand	One of the equal numbers is the
4 multiplier	*multiplicand.* This is the number
148 product	to be multiplied.

The number which shows how many times the multiplicand is to be taken is the *multiplier.*

The result of the multiplication is the *product.*

The sign of multiplication is $\times$, and is read *times* or *multiplied by.*

Numbers are divided according to their use into two classes, — abstract and concrete.

A number is abstract when it is not used in connection with any particular thing. Three, 6, 7 are abstract numbers.

A number is concrete when it is used in connection with some particular thing. Three men, 6 books, 7 pencils are concrete numbers.

In a multiplication the multiplier is always abstract, for it simply tells how many times the multiplicand is to be taken.

The multiplicand may be either abstract or concrete. Thus,

8	8 books	The product always takes its
6	6	name from the multiplicand.
48	48 books	

1. Multiply 24 by 10.

```
 24
 10
---
240
```

2. Multiply 24 by 20.

```
 24
 20
---
480
```

Multiply:

3.	32	26	45	52	64	75	84
	30	50	60	70	80	90	40

4. Multiply 43 by 22.

22 = 20 + 2. Then 20 times 43 + 2 times 43 = 22 times 43.

```
 43
 22
---
 86 =  2 times 43
860 = 20 times 43
---
946 = 22 times 43
```

In practice we omit the 0 in the second partial product, and perform the work in this way:

```
 43
 22
---
 86
86
---
946
```

Remember to write the first figure in each partial product directly under the figure used as the multiplier.

You can test your work by multiplying 22 by 43.

Multiply:

1. 24 by 15	**6.** 62 by 27	**11.** 75 by 28	**16.** 242 by 15
2. 18 by 23	**7.** 36 by 34	**12.** 82 by 44	**17.** 134 by 26
3. 25 by 17	**8.** 58 by 75	**13.** 79 by 35	**18.** 265 by 52
4. 34 by 18	**9.** 76 by 58	**14.** 94 by 39	**19.** 316 by 74
5. 46 by 21	**10.** 47 by 35	**15.** 88 by 33	**20.** 524 by 36

What is the product of

1. 123 and 24?	**4.** 537 and 32?	**7.** 706 and 45?
2. 244 and 31?	**5.** 245 and 28?	**8.** 362 and 27?
3. 281 and 49?	**6.** 256 and 74?	**9.** 408 and 36?

PROBLEMS *Oral*

1. Susan is 14 years old. She has spent 5 years in the grammar school and 3 years in the primary school. How old was she when she entered the primary school?

2. Mrs. Mills paid $12 for materials for a dress, and paid the dressmaker $2 a day for 4 days. What did the dress cost?

3. A woman bought a string of gold beads for $14. She gave in payment a watch worth $5, $2 in money, and some old gold. What was the old gold worth?

4. What will $\frac{1}{2}$ dozen of oranges and 4 apples cost at 3 cents apiece?

5. Seven girls together paid 30 cents for pinks and 40 cents for roses. What did each girl pay?

6. Every 4 weeks a man pays 16 dollars for his board and 8 dollars for his room. How much is this a week for board and room?

7. Howard had 25 cents. He spent 10 and then earned 8 more. How many had he then?

8. A grocer buys butter for 28 cents a pound and sells it for 32 cents. How much does he gain on a pound? On 6 pounds?

9. A farmer sold a load of wood for $6, and 3 sheep at $5 each. What did he receive for all?

10. Edward has $17. How much more does he need to buy a bicycle worth $25?

11. After buying 2 pairs of shoes at $4 each, Mr. Webster had $35 left. How much money had he at first?

1. Multiply 342 by 207.

$207 = 200 + 7$. Then 200 times 342 + 7 times 342 = 207 times 342.

342	
207	
2394 =	7 times 342
68400 =	200 times 342
70794 =	207 times 342

Proof, 207 multiplied by 342 = ?

In practice we shorten our work as follows:

342
207
2394
684
70794

Multiply:

2. 364 by 105	7. 427 by 306	12. 625 by 406	17. 487 by 608
3. 718 by 203	8. 583 by 504	13. 375 by 208	18. 535 by 604
4. 406 by 502	9. 305 by 880	14. 404 by 790	19. 964 by 307
5. 675 by 220	10. 583 by 350	15. 764 by 380	20. 549 by 330
6. 840 by 320	11. 760 by 380	16. 590 by 560	21. 860 by 450

PROBLEMS *Written*

1. There are 144 pencils in a box. How many in 2 boxes? In 12 boxes?

2. If one desk costs 24 dollars, what will 5 cost? What will 25 cost?

3. There are 38 acres in a farm. How many acres in 7 such farms? In 17 such farms?

4. A man walks 42 miles a week. How far does he walk in 8 weeks? In 38 weeks?

5. A grocer buys 56 tubs of butter, each containing 35 pounds. How many pounds does he buy?

6. Sixty-three gallons of molasses are bought for 36 cents a gallon. What is the cost?

PROBLEMS *Written*

1. A gardener sold 24 dozen heads of lettuce. How many heads did he sell?

2. How many ounces in 367 pounds?

3. How many words on a page of 29 lines, if there are 13 words in a line?

4. A library has 325 books in one row. How many books in 20 rows?

5. A mile is 5280 feet. How many feet in 20 miles?

6. A woman had 11 summer boarders. Each paid $8 a week. How much did she receive in a week? How much did she receive in 5 weeks?

7. Mr. Andrews cut from his farm 45 tons of hay. He sold it for $22 a ton. How much did he receive for it?

8. How much will 18 house lots cost at $225 apiece?

9. A roll of carpet contains 75 yards. There are 160 rolls on the floor of the storeroom. How many yards of carpet in the room?

10. The multiplicand is 3402. The muliplier is 63. What is the product?

11. A contractor hired 16 men, and paid each man 2 dollars a day. They work 24 days. What did he pay them?

12. A farmer gathered 48 bushels of potatoes from each of 18 rows. How many bushels in all?

13. A baker sells 64 loaves of bread a day. How many loaves does he sell in 30 days?

14. Mr. Merrill has 17 cows and 25 times as many hens. How many hens has he?

MULTIPLICATION: UNITED STATES MONEY

Multiply:

1. $3.25 × 17

Remember to separate the cents from the dollars in the product by a decimal point. Write the dollar sign in the product.

	A	*B*	*C*	*D*	*E*
2.	$4.86 × 16	$5.47 × 15	$4.08 × 18	$7.60 × 24	$9.85 × 24
3.	$1.40 × 36	$0.86 × 23	$0.45 × 18	$1.09 × 26	$5.50 × 34
4.	$0.08 × 9	$0.07 × 8	$0.56 × 25	$3.50 × 48	$8.29 × 56
5.	$12.37 × 17	$15.04 × 29	$10.40 × 38	$40.08 × 28	$15.09 × 45

PROBLEMS *Written*

1. My geography cost $1.12. How much would 9 cost?

2. My music reader cost $0.64. How much would 48 cost?

3. How much did a clothier pay for one-half dozen caps at $0.35 apiece?

4. Cotton cloth is 8 cents a yard. How much will 27 yards cost?

5. Crackers are 25 cents a pound. The grocer bought 12 pounds. How much did he pay for them?

6. Flour is $7.75 a barrel. How much will 27 barrels cost?

7. A woman bought 16 yards of silk. It was $1.24 a yard. How much did she pay for it?

8. Coal is $6.85 a ton. How much will 14 tons cost?

9. Mr. Smith owns 87 acres of land. One acre is worth $8.25. What is it all worth?

10. Mrs. Mason bought 12 yards of dress goods at 72 cents a yard. How much did she pay for it?

DIVISION

The process of finding how many times one number is contained in another number, or of finding one of the equal parts of a number, is *division.*

The number to be divided is the *dividend.*

The number by which we divide is the *divisor.*

The result of the division is the *quotient.*

The sign of division is $\div$, and is read *divided by.*

When placed between two numbers, it means that the number before the sign is to be divided by the number after the sign. $21 \div 3$ is read 21 divided by 3.

$3\overline{)21}$ and $\frac{21}{3}$ are other ways of expressing the same thing.

divisor $3\overline{)21}$ dividend

7 quotient

The dividend corresponds to the product in multiplication. The divisor and the quotient are the factors of the dividend. Therefore we can always test the accuracy of our work in division by finding the product of the divisor and quotient. $56 \div 7 = 8$. $7 \times 8 = 56$.

In case there is a remainder in our division, we must add it to the product to get the dividend.

$59 \div 7 = 8$, and 3 remainder. $7 \times 8, + 3 = 59$.

DRILL TABLE IN SHORT DIVISION

	A	*B*	*C*	*D*	*E*
1.	2)56	2)346	2)2530	2)48372	2)376584
2.	2)73	2)561	2)8739	2)37647	2)189425
3.	3)54	3)675	3)4536	3)35865	3)743544
4.	3)49	3)841	3)7432	3)92376	3)653872
5.	4)60	4)956	4)3272	4)80328	4)956432
6.	4)37	4)375	4)5837	4)37095	4)673721
7.	5)75	5)805	5)6035	5)90055	5)753280
8.	5)53	5)673	5)3927	5)84607	5)760089
9.	6)96	6)822	6)3720	6)70236	6)379806
10.	6)64	6)903	6)7299	6)43200	6)600397
11.	7)98	7)644	7)5852	7)83349	7)532980
12.	7)62	7)533	7)6032	7)87350	7)607020
13.	8)72	8)600	8)8608	8)93072	8)876688
14.	8)54	8)902	8)3073	8)58415	8)593217
15.	9)99	9)873	9)7029	9)54540	9)457362
16.	9)56	9)534	9)8764	9)32700	9)307000
17.	10)90	10)770	10)5060	10)68000	10)706090
18.	10)74	10)843	10)7638	10)84732	10)957368
19.	11)66	11)319	11)3597	11)29513	11)809787
20.	11)53	11)658	11)6390	11)73928	11)532834
21.	12)84	12)336	12)8496	12)77400	12)960084

PROBLEMS *Oral and Written*

1. If 8 books cost $24, what will one cost?

SOLUTION. One book will cost $\frac{1}{8}$ of $24, or $3.

2. At $3 each, how many books can be bought for $24?

SOLUTION. As many books as 3 is contained times in 24. That is, 8.

3. Three tons of hay cost 60 dollars. How much was this a ton?

4. A furniture dealer paid $72 for 6 tables. What did he pay for one?

5. At $7 a ton, how many tons of coal can be bought for $154?

6. An electric car runs 104 miles in 8 hours. How many miles does it go in 1 hour?

7. How many 5-pound boxes of candy can be made from 735 pounds?

8. There are 576 barrels of flour in 4 cars. How many barrels to a car?

9. In 6 months a man earned $720. How much was this a month?

10. Two hundred sixteen packages of cereal were shipped in 9 boxes. How many packages to a box?

11. It takes a train 6 hours to go from Boston to New York, a distance of 234 miles. How many miles does the train go an hour?

12. How many weeks will it take to save $324 if $9 are saved every week?

13. How many 10-pound packages can be made from 360 pounds of coffee?

LONG DIVISION

1. Divide 315 by 7.

Short Division	Long Division
	45
7)315	7)315
45	28
	35
	35

The only difference between long division and short division is that in long division all the numbers used are expressed in figures. Long division is generally used when the divisor is more than 12.

2. Divide 368 by 16.

```
  23
16)368
  32
  48
  48
```

16 in 36, 2 times. Write 2 in the quotient over 6.

Multiply 16 by 2 and write the product, 32, under 36.

Subtract 32 from 36. The remainder is 4. Bring down the 8.

16 in 48, 3 times. Write 3 in the quotient over 8.

Multiply 16 by 3, and write the product, 48, under 48. There is no remainder.

Proof: $16 \times 23 = 368$

Always test your work in division.

	Steps in this Division	Steps in Every Division
First.	Divide 36 by 16.	Divide.
Second.	Write 2 in quotient.	Write quotient figure.
Third.	Multiply 16 by 2.	Multiply.
Fourth.	Subtract 32 from 36.	Subtract.
Fifth.	Bring down 8.	Bring down next figure.

NOTE. The technical explanation of long division is purposely omitted. The principle of long division is identical with that of short division. The best results will be secured by teaching the process without a full explanation, necessarily confusing to immature minds. Long division is the hardest of the fundamental processes to learn, and can be made clear only by abundant practice on the blackboard before the class.

Do not allow pupils to make tables of multiples of the divisors. This is a weakening practice and easily becomes a habit. Attack the process of long division from the outset as merely an extension of the process of short division.

Divide:

	A	*B*	*C*	*D*	*E*
1.	180 ÷ 15	182 ÷ 14	240 ÷ 15	208 ÷ 16	169 ÷ 13
2.	168 ÷ 14	325 ÷ 25	288 ÷ 12	330 ÷ 15	315 ÷ 21
3.	396 ÷ 18	195 ÷ 15	312 ÷ 24	374 ÷ 17	256 ÷ 16
4.	336 ÷ 16	216 ÷ 18	400 ÷ 16	299 ÷ 23	308 ÷ 22
5.	312 ÷ 14	294 ÷ 21	324 ÷ 27	432 ÷ 36	286 ÷ 22
6.	294 ÷ 21	336 ÷ 21	882 ÷ 21	672 ÷ 21	527 ÷ 31
7.	533 ÷ 41	793 ÷ 61	765 ÷ 51	697 ÷ 41	994 ÷ 71
8.	396 ÷ 33	624 ÷ 52	480 ÷ 32	462 ÷ 42	672 ÷ 32
9.	375 ÷ 25	600 ÷ 25	255 ÷ 17	861 ÷ 41	768 ÷ 24
10.	775 ÷ 31	308 ÷ 22	800 ÷ 25	900 ÷ 75	576 ÷ 18

PROBLEMS *Written*

1. How many dozen in a box of 180 oranges?

2. A freight train runs 22 miles an hour. In how many hours will it run 264 miles?

3. At $15 a ton, how many tons of hay can be bought for $240?

4. Twenty-four bicycles cost $552. What was the cost of one?

5. In 14 days a boy delivered 588 papers. How many was this a day?

6. How many acres of land can be bought for $728, if one acre is worth $52?

7. How many rolls of ribbon of 25 yards each can be made from 775 yards?

MISCELLANEOUS PROBLEMS *Oral*

1. Martin has 25 marbles and his brother 15. How many has each after Martin gives 8 to his brother?

2. Dora had 49 cents in the school savings bank. The next week she put in 16 cents. How many had she then?

3. How much must you pay for 2 15-cent collars?

4. How many 15-cent collars can you buy with 75 cents?

5. What is left from 25 cents after buying a pound and a half of sugar at 6 cents a pound?

6. How many are 5×3 and 2×6?

7. The school session is 3 hours in the morning and 2 hours in the afternoon. How many hours of school in a week?

8. Mr. Holt works 8 hours a day for the first 4 days in a week, and 5 hours on each of the last two days. How many hours in all?

9. How many dozen buttons in a box of 108?

10. What will a pound and a quarter of butter cost at 32 cents a pound?

11. On each visit a district nurse spends 2 5-cent car fares, and twice as much for supplies. How much will she spend in 3 visits?

12. A baseball nine played 25 games. It lost 7 and tied 5. How many games did it win?

13. There are 47 pupils in one schoolroom, and 9 less in another. How many pupils in the second room?

14. In grade seven there are 60 pupils and in grade eight there are $\frac{3}{4}$ as many. How many in grade eight?

LONG DIVISION

1. Divide 727 by 30.

$$30\overline{)727}\quad 24\tfrac{7}{30}$$

60

127

120

7

The remainder is 7. Indicate its division by writing it over the divisor thus, $\frac{7}{30}$, and annex it to the quotient.

Proof: $30 \times 24, +7 = ?$

	A	*B*	*C*	*D*
2.	935 ÷ 20	874 ÷ 20	659 ÷ 20	523 ÷ 20
3.	856 ÷ 30	541 ÷ 30	729 ÷ 30	464 ÷ 30
4.	583 ÷ 40	769 ÷ 40	931 ÷ 40	508 ÷ 40
5.	862 ÷ 50	1817 ÷ 50	2267 ÷ 50	3349 ÷ 50
6.	2143 ÷ 60	2586 ÷ 60	4339 ÷ 60	5853 ÷ 60
7.	1829 ÷ 70	3087 ÷ 70	4493 ÷ 70	5837 ÷ 70
8.	2188 ÷ 80	2892 ÷ 80	3683 ÷ 80	7394 ÷ 80
9.	2291 ÷ 90	5978 ÷ 90	6862 ÷ 90	7527 ÷ 90

DIVISORS AND DIVIDENDS ENDING IN 0

Compare quotients in these groups:

90 ÷ 30	80 ÷ 20	160 ÷ 40	560 ÷ 80
9 ÷ 3	8 ÷ 2	16 ÷ 4	56 ÷ 8

When the dividend and divisor both end in 0, we can shorten our work by dropping a 0 from both dividend and divisor. Thus, $3\cancel{0})96\cancel{0}$.

32

	A	*B*	*C*	*D*
1.	720 ÷ 60	960 ÷ 60	680 ÷ 40	960 ÷ 20
2.	7250 ÷ 50	3960 ÷ 40	9360 ÷ 30	8470 ÷ 70
3.	3400 ÷ 200	7500 ÷ 300	7600 ÷ 400	9000 ÷ 500
4.	8400 ÷ 600	9100 ÷ 700	9600 ÷ 800	10,800 ÷ 900

PROBLEMS *Written*

1. How many 100-pound bags of coal in a load of 3500 pounds?

2. A bag of fertilizer weighs 50 pounds. How many bags can be made up from 3000 pounds?

3. How many barrels will be required for 27,600 pounds of sugar, if each barrel holds 300 pounds?

4. How many 220-pound barrels of corn meal will it take to fill a bin that holds 12,100 pounds?

5. A carload of apples weighs 30,000 pounds. How many barrels are there, reckoning 150 pounds to a barrel?

6. How many tons in a carload of 60,000 pounds of coal? 2000 pounds are 1 ton.

EXERCISE IN COMPARING NUMBERS *Oral*

1. Compare 2 and 12. Thus, 2 is $\frac{1}{6}$ of 12; 12 is 6 times 2. Compare 3 and 12. 4 and 12. 6 and 12.

2. Apples are 3 for 5¢. What is the cost of a dozen? A half dozen? A dozen and a half?

3. What is the cost of a dozen bananas, when 2 cost 5¢? What is the cost of half a dozen? A dozen and a half?

4. I can buy 3 grapefruit for a quarter of a dollar. How much must I pay for a dozen? A half dozen?

5. Three oranges are sold for 10 cents. What is the price of a dozen? A half dozen? A dozen and a half?

6. When apples are 3 for 5¢, bananas 2 for 5¢, grapefruit 3 for 25¢, and plums 4 for 5¢, how many of each kind can I buy for 25¢? For 50¢? For a dollar?

LONG DIVISION

1. Divide 14,616 by 36.

$$\begin{array}{r} 406 \\ 36\overline{)14616} \\ \underline{144} \\ 216 \\ \underline{216} \end{array}$$

144 from 146 leaves a remainder of 2. Bring down the next figure, 1. As 36 is not contained in 21, write a cipher in the quotient and bring down the next figure, 6.

Divide:

	A	*B*	*C*
2.	3434 ÷ 34	8888 ÷ 44	7224 ÷ 24
3.	8463 ÷ 21	6489 ÷ 63	4410 ÷ 42
4.	2550 ÷ 25	5304 ÷ 51	16,884 ÷ 84
5.	18,422 ÷ 61	18,847 ÷ 47	21,629 ÷ 43
6.	14,616 ÷ 72	21,306 ÷ 53	15,655 ÷ 31
7.	18,564 ÷ 91	16,263 ÷ 54	13,332 ÷ 33
8.	47,188 ÷ 94	13,325 ÷ 65	22,102 ÷ 73
9.	16,128 ÷ 32	32,805 ÷ 81	28,060 ÷ 92

10. How many times is 15 contained in 2640?

11. What is the quotient of 1728 divided by 24?

12. Dividend 828; divisor 36; quotient ——.

13. If 700 is divided into 25 equal parts, what will one part be?

14. What is one of the 18 equal parts of 630?

15. What is $\frac{1}{16}$ of 3264?

16. A man earned $294 in 14 weeks. How much did he receive a week?

17. How many desks at $24 each can be bought for $504?

18. How many pounds in 192 ounces?

DRILL IN DIVISION

Divide:

	A	*B*	*C*
1.	735 ÷ 32	718 ÷ 22	902 ÷ 53
2.	936 ÷ 41	810 ÷ 34	853 ÷ 35
3.	897 ÷ 22	960 ÷ 72	620 ÷ 42
4.	628 ÷ 25	850 ÷ 62	985 ÷ 24
5.	762 ÷ 52	981 ÷ 45	716 ÷ 54
6.	1296 ÷ 31	1396 ÷ 23	3427 ÷ 43
7.	1420 ÷ 32	2253 ÷ 34	2406 ÷ 32
8.	1563 ÷ 22	1827 ÷ 53	3753 ÷ 62
9.	2716 ÷ 61	1736 ÷ 43	1576 ÷ 22
10.	3425 ÷ 53	2652 ÷ 31	989 ÷ 44
11.	6987 ÷ 32	7482 ÷ 34	8435 ÷ 35
12.	7920 ÷ 25	5196 ÷ 23	9288 ÷ 43
13.	9883 ÷ 24	3900 ÷ 26	5861 ÷ 27
14.	8912 ÷ 42	8306 ÷ 37	9801 ÷ 65
15.	9834 ÷ 46	9000 ÷ 41	9734 ÷ 83
16.	17,324 ÷ 53	18,561 ÷ 44	39,804 ÷ 62
17.	21,213 ÷ 62	20,950 ÷ 34	11,800 ÷ 36
18.	19,234 ÷ 45	19,537 ÷ 45	26,932 ÷ 55
19.	13,842 ÷ 24	23,341 ÷ 63	45,329 ÷ 84
20.	17,924 ÷ 35	38,400 ÷ 72	54,000 ÷ 76

PROBLEMS *Written*

1. 80 pounds of coal are burned in a kitchen range in a day. How many days will a ton last? (A ton is 2000 pounds.)

2. A family uses 75 pounds of ice in a week. How long will it take to use 1000 pounds?

3. What is one of the 12 equal parts of 744?

4. Mr. Edwards, the florist, used 540 roses in making 45 bouquets. How many roses in a bouquet?

5. Eight hundred forty pounds of raisins are packed in 35 boxes. How many pounds in a box?

6. A bushel of oats weighs 32 pounds. How many bushels are there in a load of 1440 pounds?

7. If 576 trees are set in 18 rows, how many trees are there in a row?

8. An ocean steamer goes 25 miles an hour. How long will it take to go 1200 miles?

9. 37 is the multiplicand and 925 is the product. What is the multiplier?

10. Divide 1368 dollars among 24 persons.

11. How long will a barrel of sugar (300 lb.) last a family that uses 25 pounds a week?

DIVISION: UNITED STATES MONEY

1. Divide \$9.56 by 4.

4)\$9.56 Remember to separate the dollars from the cents in the quotient by a decimal point.

2. \$4.38 ÷ 2
3. \$13.20 ÷ 4
4. \$5.01 ÷ 3
5. \$1.86 ÷ 6
6. \$1.26 ÷ 7
7. \$0.84 ÷ 7
8. \$3.05 ÷ 5
9. \$8.82 ÷ 9
10. \$12.87 ÷ 9
11. \$14.40 ÷ 12
12. \$25.20 ÷ 8
13. \$28.56 ÷ 7
14. 9)\$57.78
15. 6)\$25.56
16. 5)\$18.50
17. 12)\$0.60
18. 12)\$14.40
19. 12)\$1.44
20. 12)\$17.28
21. 12)\$172.80
22. 15)\$172 80
23. 10)\$2.50
24. 10)\$25.60
25. 16)\$2.56
26. \$20.88 ÷ 24
27. \$71.75 ÷ 25
28. \$11.70 ÷ 18

PROBLEMS *Written*

1. Four watermelons cost $1.80. What is the price of one?

2. Eight crates of currants cost $28.80. How much did one crate cost?

3. Mr. Johnson bought 7 pigs for $24.50. What did one cost him?

4. Nine stoves are sold for $258.75. What is one sold for?

5. Lawrence paid $1.75 for 5 doves. How much did one cost him?

6. I bought 3 pairs of shoes for $7.50. What was the price of one pair?

7. Raymond saved $162.75 in five years. How much did he save a year?

8. Twelve acres of farm land sold for $112.80. What was one acre sold for?

9. Edith bought a set of books. There were 14 in the set. She paid $4.48. What was the value of a single book?

10. $\frac{1}{8}$ of $18 + $\frac{1}{12}$ of $0.84 = ?$

11. $\frac{1}{9}$ of $5.40 − $\frac{1}{9}$ of $0.72 = ?$

12. Twenty-three yards of Panama cloth cost $17.25. How much is it a yard?

13. Eighty-three pupils graduated from a school. They bought class pins costing $70.55. What did each pay for his pin?

DRILL EXERCISE

Oral and Written

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
1.	19	30	71	93	78	29	91	58	84	47
2.	62	11	38	61	28	72	56	31	46	96
3.	50	87	12	20	54	63	32	45	59	60
4.	92	39	79	13	21	44	55	70	89	100
5.	37	48	53	77	14	22	64	85	33	88
6.	99	52	69	43	81	15	23	66	57	90
7.	51	40	76	34	82	65	16	24	73	95
8.	86	35	42	94	67	75	98	17	25	80
9.	27	41	68	97	83	36	74	49	18	26

1. Increase each of the numbers in the table by any number from 1 to 12.

2. Decrease each of the numbers by any number from 1 to 12.

3. Find the sum of each row. Find the sum of each column.

4. Subtract each number from 100.

5. Give the sum and the difference of each number in the table and any given number between 12 and 100.

6. Multiply each number by any number from 2 to 12.

7. Divide each number by any number from 2 to 12.

NOTE. Frequent drill should be given in counting by the various digits from 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, to 100, and in counting back from 100, 99, 98, 97, 96, 95, 94, 93, 92, 91. The combinations of the multiplication and division tables must be reviewed until their absolute mastery is secured.

PROBLEMS *Oral*

1. Harrison is 13 years old and his father is 40 years old. What is the difference between their ages?

2. Out of 20 sessions of school Mildred was absent 4 and tardy 2. How many sessions was she present at the opening of school?

3. Each of Mary's three brothers gives her 10 cents. How many 5-cent dolls can she buy?

4. Raymond has 2 brothers and twice as many sisters. How many children are there in the family?

5. It takes 3 buttons for the front of a coat, twice as many for the sleeves, and 7 for a vest. How many buttons in all?

6. A dozen pencils cost 60 cents. What was the price of 1? Of 5?

7. A dozen eggs at 3 cents apiece will cost how much less than 50 cents?

8. Mrs. Howe takes a quart of milk in the morning and 2 quarts at night. How many quarts does she take in a week and 3 days?

9. Mrs. Watkins takes a quart of milk on 4 days of the week, and 2 quarts on the other days. How many quarts in all?

10. The class has 10 words in spelling a day. How many words in two weeks?

11. At the park Gladys spent 10 cents for ice cream, and twice as much on the roller coaster. How many 5-cent roller coaster rides did she have?

NOTE. The following problems should be studied by the teacher with the pupils before their solution is attempted. All new words and terms should first be fully explained. The underlying principles should be illustrated, if necessary, by simple oral problems given by the teacher. At this stage of the pupils' progress it is a mistake to attempt the solution of many problems in one lesson. The analysis of subsequent groups of problems should be continued until pupils acquire the power of grasping the conditions stated.

MISCELLANEOUS PROBLEMS *Written*

1. A commercial school bought 8 typewriters at 85 dollars apiece. How much was paid for them?

2. A pail of lard weighs 5 pounds. How many pounds in 6 crates of 12 pails each?

3. Dairy butter was packed in 10-pound tubs. How many pounds in 725 tubs?

4. The cloth for a dress cost 15 dollars, the trimmings 2 dollars and a half, buttons 85 cents, lining 75 cents, and the dressmaker charged me 8 dollars for her work. What did the whole dress cost me?

5. There are $640 worth of bicycles in a store. Each is worth $28. How many bicycles in the store?

6. Fourteen barrels of salt weigh 3920 pounds. How much does one barrel weigh?

7. What is one of the 37 equal parts of 8695?

8. A grocer paid $352 for 16 barrels of sugar. What was this a barrel?

9. There were 242 children present at school Monday and 19 more Tuesday. How many were present Tuesday?

10. How many sessions of school in 14 weeks?

11. A schoolroom has 6 windows. Each window has 18 panes of glass. How many panes in all the windows?

12. A boy earned $30.75 in 5 weeks. How much did he earn in one week?

13. Oliver turned the handle of his ice-cream freezer 720 times. How long did it take to freeze the cream, if he made 45 turns a minute?

14. A flour mill shipped 40,768 pounds of flour. If a barrel holds 196 pounds, how many barrels were there?

15. Two numbers added together make 700. One number is 258. What is the other number?

16. A farmer on the prairies bought 29 plows. They were $20 apiece. How much did they cost him?

17. A farm cost $14,112. It was $84 an acre. How many acres did it contain?

18. A car was loaded with salt weighing 35,000 pounds. How many barrels were there, if a barrel weighs 280 pounds?

19. An electric car has 16 seats that seat 2 persons each, and 6 seats that seat 3 persons each. How many persons will the car seat?

20. A man lives 25 miles from New York. How many round trips can he make from his home on a mileage book of 1000 miles?

21. A railroad train runs 690 miles in 15 hours. How many miles is this an hour?

22. There are 42 gallons of oil in a barrel. How many gallons in 37 barrels?

23. Sixty-five barrels of flour weigh 12,740 pounds. How much does one barrel weigh?

24. A house rents for $12.75 a month. How much does the owner receive a year?

25. A Kansas farmer bored six oil wells on his farm. The table gives the yield in barrels for each month.

	April	May	June	July	August	Sept.	Totals
Well No. 1	7200	6780	6930	6840	7290	6930	
Well No. 2	4930	4950	5310	5220	4770	4500	
Well No. 3	5860	5400	4770	4950	4570	4860	
Well No. 4	6840	7380	6930	6750	6480	6760	
Well No. 5	3870	4770	4860	3960	4770	3780	
Well No. 6	5490	6750	5850	6000	5580	5940	
Totals							

a. Find the total number of barrels produced by each well in the six months.

b. Find the total number of barrels produced by all the wells in the six months.

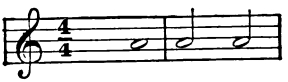
c. Find the average yield a month of each well in the six months. The average yield means the yield of each well, if all produced the same quantity. It is found by dividing the total yield of each well by the number of months.

d. Find the total number of barrels produced by all the wells each month.

e. Find the total amount of the monthly productions.

f. Find the average number of barrels produced each month.

FRACTIONS: HALVES



1. In music a whole note is equal in value to how many half notes?

2. If a whole note has four beats, how many beats has a half note? A whole note and a half note?

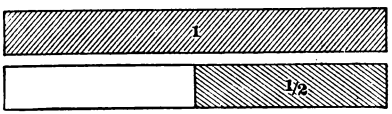
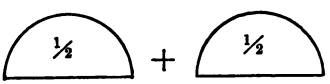


Figure *B* is divided into two equal parts. When anything is divided into two equal parts, we call each part one half, and we write it $\frac{1}{2}$.

To find one half of anything is to find one of its two equal parts.

3. 

$= -$ $\frac{1}{2} + \frac{1}{2} = -$ halves, or —

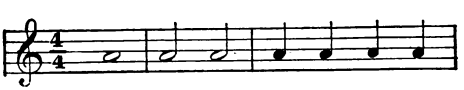
4. 1 apple + $\frac{1}{2}$ apple = — $1 + \frac{1}{2} = -$ $\frac{1}{2} + 2 = -$

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

6. $1 - \frac{1}{2} = -$ $\frac{1}{2} - \frac{1}{2} = -$ $1\frac{1}{2} - 1 = -$ $1\frac{1}{2} - \frac{1}{2} = -$

7. $6\frac{1}{2} - 2\frac{1}{2} = -$ $4\frac{1}{2} - 4 = -$ $3\frac{1}{2} - 1\frac{1}{2} = -$

FRACTIONS: HALVES AND FOURTHS

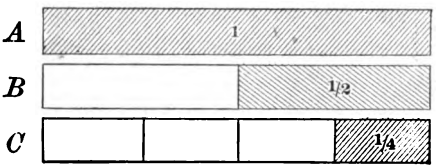


1. In music a whole note is equal in value to how many quarter notes?

2. A half note is equal to how many quarter notes? A half note and a quarter note are equal to —— quarter notes.

3. If a whole note has four beats, how many beats has a quarter note? Two quarter notes? Three quarter notes? A whole note and a quarter note? A half note and a quarter note? A half note and two quarter notes?

4. Into how many equal parts is figure *C* divided? Each part is called one fourth, and is written $\frac{1}{4}$.



5. How many fourths make 1? How many fourths make $\frac{1}{2}$?

6. $\frac{1}{2}$ is — fourths. $\frac{1}{2} = \frac{?}{4}$ $\frac{1}{4}$ is $\frac{1}{2}$ of —

7. $\frac{1}{\text{apple}} + \frac{1}{\text{apple}} = \frac{?}{\text{apples}}$ $\frac{1}{\text{fourth}} + \frac{1}{\text{fourth}} = \frac{?}{\text{fourths}}$

$\frac{1}{4} + \frac{1}{4} =$ —

8. $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} =$ —, or — $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} =$ — $\frac{3}{4} + \frac{1}{4} =$ —

9. $\frac{1}{2} = \frac{?}{4}$ $\frac{1}{2} + \frac{1}{4} =$ — $\frac{1}{2} + \frac{1}{4} + \frac{1}{4} =$ —

10. 4 fourths − 1 fourth = — $\frac{4}{4} - \frac{1}{4} =$ — $1 - \frac{1}{4} =$ —

11. $\frac{4}{4} - \frac{3}{4} =$ — $1 - \frac{3}{4} =$ — $1\frac{1}{2} - \frac{1}{4} =$ — $1\frac{3}{4} - \frac{1}{2} =$ —

12. $\frac{3}{4} - \frac{3}{4} =$ — $\frac{3}{4} - \frac{1}{4} =$ — $\frac{1}{2} - \frac{1}{4} =$ — $\frac{3}{4} - \frac{1}{2} =$ —

13. $2 + \frac{1}{4} =$ — $2\frac{1}{4} + \frac{1}{4} =$ — $2\frac{1}{2} + \frac{1}{4} =$ — $1\frac{1}{2} + 1\frac{1}{4} =$ —

14. $6\frac{1}{4} + 2\frac{1}{4} =$ — $3\frac{1}{2} + 1\frac{1}{4} =$ — $1\frac{1}{4} + 1\frac{1}{4} =$ — $2\frac{1}{4} + \frac{1}{2} =$ —

15. $3\frac{1}{2} - \frac{1}{4} =$ — $5\frac{1}{2} - 1\frac{1}{4} =$ — $2\frac{3}{4} - \frac{1}{2} =$ — $5\frac{3}{4} - 1\frac{1}{2} =$ —

16. 1 quarter of a dollar + 1 half of a dollar + 1 quarter of a dollar = —.

17. $\frac{1}{4} + \frac{1}{2} + \frac{1}{4} =$ —

18. Compare 1 and 2. Thus, 1 is $\frac{1}{2}$ of 2; 2 is twice 1.

19. Compare 1 and $\frac{1}{2}$; 1 and $\frac{1}{4}$; $\frac{1}{4}$ and $\frac{3}{4}$; $\frac{1}{2}$ and $\frac{1}{4}$.

20. Hazel bought $\frac{1}{2}$ yd. of blue ribbon and $\frac{1}{4}$ yd. of green ribbon. How much did she buy?

21. One fourth of a barrel of apples spoiled. What part was good?

22. Robert earned one half a dollar. He bought a cap for one quarter dollar. How much money had he left?

23. A grocer sold $2\frac{1}{2}$ dozen eggs to one customer and $1\frac{1}{2}$ dozen to another customer. How many dozen in all?

24. Sarah gave $\frac{1}{4}$ of her candy to her brother and $\frac{1}{2}$ to her sisters. How much had she left for herself?

25. Mrs. Waite bought $4\frac{1}{2}$ lb. of butter on Tuesday and $2\frac{1}{4}$ lb. on Saturday. How many pounds on both days?

26. A cook used $\frac{3}{4}$ lb. of powdered sugar and $2\frac{1}{4}$ lb. of granulated sugar. How many pounds in all?

27. There are $5\frac{1}{2}$ yards of cloth in Jennie's skirt and $1\frac{1}{4}$ yards less in her jacket. How many yards in her jacket?

FINDING PARTS OF NUMBERS *Oral*

To find $\frac{1}{4}$ of a number is to find one of its four equal parts.

1. What is one of the four equal parts of 32? What are three of the four equal parts of 32?

2. If 8 is the whole number of John's doves, what is $\frac{1}{4}$ of them? If 2 is $\frac{1}{4}$ of what he has, how many has he?

3. First give $\frac{1}{4}$, then $\frac{3}{4}$, of these numbers:

24 28 32 36 40 48 60 80 100

4. What is $\frac{1}{2}$ of the numbers?

5. Four chairs cost \$12. What will one cost? Three?

6. How much will $\frac{3}{4}$ lb. of cheese cost at 20 cents a pound?

7. Susie has 24 dahlias in her garden and Ellen has $\frac{1}{2}$ as many. How many has Ellen?

8. What is the cost of $\frac{1}{4}$ lb. of 60-cent tea?

9. Take $\frac{1}{2}$ of 20 from $\frac{3}{4}$ of 20.

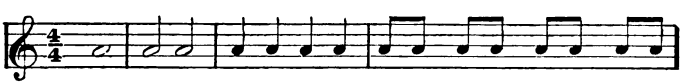
10. Twelve trees are $\frac{1}{4}$ of my orchard. How many trees in the orchard?

11. A man traveled 576 miles in 4 days. How many miles was this a day? How many miles would he travel in 3 days?

12. $15 is $\frac{1}{4}$ of my money. How much have I?

13. Oscar raised 80 chickens and sold $\frac{3}{4}$ of them. How many had he left?

FRACTIONS: HALVES, FOURTHS, EIGHTHS



1. A whole note is equal in value to how many half notes? To how many quarter notes? To how many eighth notes?

2. A half note = — quarter notes, or — eighth notes.

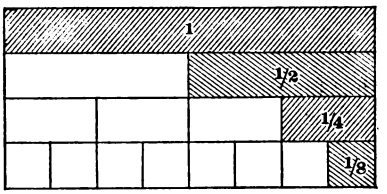
3. A quarter note = — eighth notes.

4. A whole note + an eighth note = — eighth notes.

5. A half note + an eighth note = — eighth notes.

6. A quarter note + an eighth note = — eighth notes.

7. If a whole note has 4 beats, a half note has — beats, and a quarter note has — beat. How many eighth notes to a beat?



When anything is divided into eight equal parts, each part is called one eighth, and is written $\frac{1}{8}$.

8. How many eighths make 1? $1 = \frac{?}{8}$

9. How many fourths make 1? $1 = \frac{?}{4}$

10. How many halves make 1? $1 = \frac{?}{2}$ $1 = \frac{?}{2}$, or $\frac{?}{4}$, or $\frac{?}{8}$

11. How many fourths make a half? $\frac{1}{2} = \frac{?}{4}$

12. How many eighths make a half? $\frac{1}{2} = \frac{?}{8}$

13. How many eighths make a fourth? $\frac{1}{4} = \frac{?}{8}$

14. $\frac{1}{2} = \frac{?}{4}$, or $\frac{?}{8}$

15. $\frac{1}{2}$ is —— fourths. $\frac{1}{4}$ is one half of ——.

16. $\frac{1}{4}$ is —— eighths. $\frac{1}{8}$ is one half of ——.

17. $\frac{1}{2}$ is —— eighths. $\frac{1}{8}$ is one fourth of ——.

18. What must you add to $\frac{1}{2}$ to make one?

19. What must you add to $\frac{1}{4}$ to make $\frac{1}{2}$?

20. What must you add to $\frac{1}{4}$ to make one? To $\frac{3}{4}$?

21. $1 = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + ?$ $1 = \frac{1}{8} + \frac{?}{8}$

22. $1 - \frac{3}{8} = ?$ $? + \frac{5}{8} = 1$ $1 - \frac{1}{8} = ?$ 1 is $\frac{7}{8} + ?$

23. $\frac{2}{8} + \frac{3}{8} = —$ $\frac{1}{8} + \frac{7}{8} = —$ $\frac{3}{8} + \frac{4}{8} = —$ $\frac{5}{8} + \frac{2}{8} = —$

24. $\frac{1}{4} + \frac{1}{8} = ?$ As we can add only things of like kinds, we must think of $\frac{1}{4}$ as $\frac{2}{8}$: then $\frac{2}{8} + \frac{1}{8} = —$.

25. $\frac{3}{8} + \frac{1}{4} = —$ $\frac{1}{2} + \frac{3}{8} = —$ Think $\frac{1}{2}$ as $\frac{?}{8}$.

26. $\frac{1}{2} + \frac{1}{4} = —$ $\frac{1}{2} + \frac{1}{8} = —$ $\frac{1}{4} + \frac{1}{2} = —$ $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = —$

27. $\frac{1}{4} - \frac{1}{8} = —$ $\frac{1}{2} - \frac{1}{8} = —$ $\frac{5}{8} - \frac{1}{4} = —$ $\frac{7}{8} - \frac{1}{2} = —$

28. $1 - \frac{1}{4} = —$ $1 - \frac{1}{2} = —$ $1 - \frac{1}{8} = —$ $1 - \frac{5}{8} = —$

29. $2 - \frac{3}{8} = —$ $2\frac{1}{4} - \frac{1}{8} = —$ $3\frac{1}{2} - 1\frac{1}{8} = —$ $1\frac{1}{2} - \frac{3}{8} = —$

30. $4\frac{1}{4} - 4\frac{1}{8} = —$ $5\frac{3}{4} - 2\frac{3}{8} = —$ $\frac{3}{4} - \frac{5}{8} = —$ $1\frac{3}{8} - 1\frac{1}{4} = —$

FINDING PARTS OF NUMBERS *Oral.*

1. Find the indicated parts of the number in the upper space.

24							
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	

NOTE. Use any multiple of 8 in the upper space.

2. Into how many eighths can an orange be divided? A dollar? Anything?

3. If one eighth of my age is 6 years, how old am I?

4. There are 56 pupils in a school. $\frac{1}{8}$ are absent. How many are present?

5. If 8 is $\frac{1}{4}$ of a number, what is the whole number?

6. I had 28 dollars. After spending $\frac{1}{2}$ of it, how much had I left?

7. A farmer had 28 sheep. After selling $\frac{3}{4}$ of them, how many had he left?

8. Three eighths of 64 dollars are how many dollars?

9. What is $\frac{1}{4}$ of 20? 20 is $\frac{1}{4}$ of what?

10. What is $\frac{1}{8}$ of a farm of 40 acres?

11. If $\frac{1}{8}$ of a farm is 40 acres, what is the whole farm?

12. After Mr. Mason sold $\frac{5}{8}$ of his farm, what part had he left? He had 48 acres originally. How many acres had he left?

13. What is $\frac{5}{8}$ of 96 bushels of wheat?

14. Mr. Atkins lost $\frac{7}{8}$ of his 72 orange trees by frost. How many did he lose?

15. Find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{8}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$ of these numbers:

712	784	880	904	808	744	896	800
896	888	728	576	992	608	768	696

FRACTIONS

One or more of the equal parts of a unit is called a *fraction*.

The two numbers used in writing a fraction are called its *terms*.

The number below the line tells the number of equal parts into which the unit has been divided. It is called the *denominator*. Thus, in the fraction $\frac{3}{4}$ the 4 tells that something has been divided into 4 equal parts.

The number above the line tells the number of equal parts taken. It is called the *numerator*. Thus, in $\frac{3}{4}$ the 3 tells that we have taken 3 of the equal parts into which the unit has been divided.

Read each of these fractions, telling first what the denominator shows, and then what the numerator shows: $\frac{1}{2}$; $\frac{1}{3}$; $\frac{1}{4}$; $\frac{2}{3}$; $\frac{5}{6}$; $\frac{3}{8}$; $\frac{4}{9}$; $\frac{7}{10}$.

NOTE. In teaching fractions two things should be kept continually in mind by the teacher. First, the fraction must always be treated as if it were a whole number. Second, the denominator simply names the fraction and tells us with what things we are working. When these two facts are thoroughly fixed in the pupil's mind, the imagined difficulty of handling fractions disappears in all abstract work. The difficulties of problem work will then be limited wholly to mastering conditions of statement.

PROBLEMS *Oral and Written*

1. A postman goes over his route in $4\frac{1}{4}$ hours in the morning and in $3\frac{1}{2}$ hours in the afternoon. How many hours does he work in a day?

2. He walks $9\frac{1}{4}$ miles in the morning and $7\frac{3}{8}$ miles in the afternoon. How many miles in the whole day?

3. On Monday he delivers 175 letters, 15 magazines, and 18 packages in the morning, and 98 letters, 7 magazines, and 19 packages in the afternoon. How many pieces of mail in all?

4. His bag weighs $35\frac{3}{4}$ pounds when he leaves the office in the morning, and $7\frac{1}{2}$ pounds when he returns. What is the weight of the mail delivered?

5. On Tuesday he delivers 200 letters in the morning, and $\frac{3}{4}$ as many in the afternoon. How many in the afternoon?

6. On Wednesday he delivers 272 letters in 8 hours. How many letters does he average an hour?

7. His salary is $900 a year. How much does he receive a month?

8. A bag of flour is $\frac{1}{8}$ of a barrel (196 lb.). What does a bag of flour weigh?

9. At 4 cents a pound, what is a bag of flour worth?

10. When flour is $6 a barrel, how much must I pay for a bag?

11. What is the price of a barrel of flour at the rate of 85 cents a bag?

12. Bread flour is $7.75 a barrel and pastry flour $7.40 a barrel. Mrs. Wentworth buys a barrel of bread flour and half a barrel of pastry flour. How much will the grocer return from 2 10-dollar bills?

13. Cloth is $1.20 a yard. How much will $\frac{3}{4}$ of a yard cost?

14. Bought $\frac{1}{4}$ of a box of oranges for $0.75. What is a box worth?

READING AND WRITING NUMBERS

Express in words:

1.	776,008	871,000	405,308	1,578,864
2.	500,400	300,853	807,900	2,053,601
3.	760,804	270,046	905,068	5,287,632
4.	406,400	203,030	570,096	8,006,035

Express in figures:

1. Seventy-seven thousand twenty-seven.
2. Fifty thousand five hundred.
3. Ninety-six thousand eight hundred three.
4. Four hundred six thousand ninety-one.
5. Eight hundred eight thousand eighty.
6. Six hundred thirty thousand fifty-four.
7. Three million four hundred twenty-seven thousand nine hundred fifty-four.
8. Twelve million seventy-eight thousand seven hundred.
9. Sixty million four hundred six thousand one hundred forty.
10. Three hundred sixty-five million fifty thousand five hundred six.

DICTATION EXERCISE

1. $9 - 6, \times 9, - 2, + 5, \times 7, + 5, \div 4, \div 2, - 5 = ?$
2. $7 + 8, + 6, \div 3, - 4, \times 6, - 3, \div 5, \times 9, - 6, \div 7 = ?$
3. $16 \div 4, \times 5, + 8, \div 7, \times 9, + 2, - 10, \div 7, - 4 = ?$
4. $9 + 5, \div 7, \times 8, \div 4, - 3, + 7, - 6, \times 11 = ?$
5. $11 - 2, \times 9, - 9, \div 8, \times 4, \div 6, + 2, \times 4, \div 8 = ?$

NOTE. Exercises must be given rapidly to be effective. Dictate similar exercises daily.

ADDITION

	A	*B*	*C*	*D*	*E*
1.	57	9	3085	256	7083
	8	875	6	27963	647358
	43	38	478	8	59087
	9	752	67	4876	1888
	56	8	5807	54	97
2.	67	642	1349	26452	678496
	42	361	1708	32035	198473
	59	758	2798	48796	357624
	38	864	7086	57609	398008
	76	900	9009	38562	740814
	54	871	6848	97840	341896

3. A clerk in the post office stamped 582 letters for Chicago, 724 letters for Europe, 398 letters for New York, and 2860 letters for other places. How many letters did he stamp?

4. A boy bought a bicycle for $37.50 and sold it for $8.75 more than he paid. How much did he get for it?

5. A house cost me $2885. I wish to sell it to make $750. What must I ask for it?

6. Edgar earned in one week $5.09, in another, $4.80, in another, $4.03, in another, $5.27. At the end of the four weeks how much had he earned?

7. A newsboy earned 80 cents in one week. The next week he earned 25 cents more than in the first week. The third week he earned as much as in the first two weeks. How much did he earn in the three weeks?

SUBTRACTION

Subtract:

	A	*B*	*C*	*D*	*E*
1.	\$92.34	\$134.67	\$347.82	\$158.04	\$379.68
	17.89	67.82	134.96	17.28	247.92
2.	\$487.63	\$400.80	\$587.68	\$437.67	\$408.75
	348.72	80.76	204.09	118.78	210.50
3.	\$460.50	\$500.00	\$597.38	\$842.39	\$937.84
	128.68	169.32	39.75	576.22	621.98

DRILL EXERCISE

Written

	A	*B*	*C*	*D*	*E*
1.	\$25.20	\$277.20	\$882.00	\$1940.40	\$1008.80
2.	403.20	50.40	302.40	907.20	1587.60
3.	1386.00	453.60	75.60	352.80	810.40
4.	2016.00	1164.80	504.00	100.80	378.00
5.	554.40	1411.20	1663.20	529.20	126.00
6.	810.40	831.60	2116.80	1814.40	252.00
7.	1612.80	1808.40	2721.60	226.80	604.80
8.	1134.00	2217.60	201.60	705.60	1360.80
9.	756.00	176.40	680.40	1209.60	2419.20
10.	151.20	630.00	1058.40	1512.00	2494.80

1. Find the sum of each row.

2. Find the sum of each column.

3. What must be added to each of the numbers in any given row to make \$3000?

4. Multiply any of the numbers by any given number.

5. Divide any of the numbers by 30, 35, 42, 45, 54, 56, 63.

PROBLEMS *Oral*

1. A chair cost 7 dollars and a desk 6 times as much. What did both cost?

2. Eight hats cost 32 dollars. What will 5 cost?

3. A farmer sold 5 pigs at 6 dollars each. He then paid the grocer 23 dollars. How much had he left?

4. After buying 4 yards of tape at 9 cents a yard, Marion has 7 cents left. How much had she at first?

5. Three quarts of milk at 7 cents a quart, and $\frac{1}{2}$ of a pound of 60-cent tea, will cost how much?

6. Tom picked some cherries "on halves." He sold his share to Mrs. Green for 54 cents at 9 cents a quart. How many quarts did he pick?

7. Henry gathered 5 quarts of nuts. He sold them at 8 cents a quart, and spent the money for oranges at 4 cents apiece. How many did he buy?

8. A bicycle worth 10 dollars and 17 dollars in money were given for 9 books. What was each book worth?

9. A boy collected 12 dollars for a florist. He received 7 cents for every dollar he collected. How much did he get for his work?

10. Four tons of hay cost 72 dollars. How much was that a ton?

11. How many more than 25 are $\frac{3}{4}$ of 48?

12. Herbert buys 2 electric-car tickets for 5 cents. How many does he get for a dollar?

13. William buys oranges for 20 cents a dozen, and sells them 2 for 5 cents. How much does he make?

14. Louise paid 35 cents for a doll and $\frac{1}{5}$ as much for some ribbon. How much did she pay for both?

DRILL TABLE: FINDING PARTS OF NUMBERS

Use frequently for rapid work.

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*
1.	6	12	2	16	4	24	18	14	10	22	8	20
2.	12	24	4	32	8	48	36	28	20	44	16	40
3.	24	48	8	64	16	96	72	56	40	88	32	80
4.	36	72	12	96	24	144	108	84	60	132	48	120
5.	9	18	3	24	6	36	27	21	15	33	12	30
6.	18	36	6	48	12	72	54	42	30	66	24	60
7.	27	54	9	72	18	108	81	63	45	99	36	90
8.	15	30	5	40	10	60	45	35	25	55	20	50
9.	30	60	10	80	20	120	90	70	50	110	40	100
10.	21	42	7	56	14	84	63	49	35	77	28	70
11.	33	66	11	88	22	132	99	77	55	121	44	110

By rows and columns find the indicated parts of the numbers in the table:

Row 1	Column *E*	$\frac{1}{2}$.
Row 2	Column *K*	$\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{2}$.
Row 3	Column *D*	$\frac{1}{8}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{2}$.
Row 4	Column *F*	$\frac{1}{12}$; $\frac{5}{12}$; $\frac{7}{12}$; $\frac{11}{12}$; $\frac{1}{6}$; $\frac{5}{6}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{2}$.
Row 5	Column *A*	$\frac{1}{3}$; $\frac{2}{3}$.
Row 6	Column *B*	$\frac{1}{6}$; $\frac{5}{6}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{2}$.
Row 7	Column *G*	$\frac{1}{9}$; $\frac{2}{9}$; $\frac{4}{9}$; $\frac{5}{9}$; $\frac{7}{9}$; $\frac{8}{9}$; $\frac{1}{3}$; $\frac{2}{3}$.
Row 8	Column *I*	$\frac{1}{5}$; $\frac{2}{5}$; $\frac{3}{5}$; $\frac{4}{5}$.
Row 9	Column *L*	$\frac{1}{10}$; $\frac{3}{10}$; $\frac{7}{10}$; $\frac{9}{10}$; $\frac{1}{5}$; $\frac{2}{5}$; $\frac{3}{5}$; $\frac{4}{5}$; $\frac{1}{2}$.
Row 10	Column *H*	$\frac{1}{7}$; $\frac{2}{7}$; $\frac{3}{7}$; $\frac{4}{7}$; $\frac{5}{7}$; $\frac{6}{7}$.
Row 11	Column *J*	$\frac{1}{11}$; $\frac{2}{11}$; $\frac{3}{11}$; $\frac{4}{11}$; $\frac{5}{11}$; $\frac{6}{11}$; $\frac{7}{11}$; $\frac{8}{11}$.

MISCELLANEOUS PROBLEMS *Written*

1. There are 24 rows of trees in a peach orchard and 36 trees in a row. How many peach trees in the orchard?

2. A woman bought 7 cards of buttons at 13 cents a card. How much did she pay for them?

3. An excursion train of 8 cars carried 65 people in each car. How many people went on the excursion?

4. A boy sold 8 doves at 25 cents apiece. How much did he receive for them?

5. What is the gain in buying a dozen eggs at 2 cents apiece and selling at 38 cents a dozen?

6. There are 75 bushels of corn in a bin. How many are left after 27 bushels are sold?

7. There are 180 yards of silk in a piece. How many dress patterns of 12 yards each can be cut from it?

8. A wagon loaded with coal weighs 4450 pounds. The wagon weighs 950 pounds. What is the weight of the coal?

9. There are 196 pounds of flour in a barrel. How many pounds in 12 barrels?

10. How many bushels of wheat are there in 28,500 pounds, if a bushel weighs 60 pounds?

11. A cotton mill employs 863 people. This is 87 more than last year. How many people last year?

12. In 1900 a man earned \$648 and saved \$50; in 1901 he earned \$519 and saved \$49; in 1902 he earned \$720 and saved \$138; in 1903 he earned \$685 and saved \$104; in 1904 he earned \$734 and saved \$157. How much did he earn in the five years? What were his total savings?

DRILL IN MULTIPLICATION

Multiply:

1. 764 by 640	2. 873 by 804	3. 476 by 342
4. 395 by 730	5. 567 by 906	6. 584 by 555
7. 472 by 820	8. 744 by 307	9. 762 by 428
10. 687 by 460	11. 653 by 606	12. 876 by 246
13. 539 by 350	14. 492 by 708	15. 643 by 374
16. 12,060 by 56	17. 60,042 by 93	18. 35,647 by 67
19. 40,807 by 49	20. 72,008 by 57	21. 74,839 by 59
22. 60,712 by 84	23. 49,307 by 87	24. 65,725 by 85
25. 80,309 by 97	26. 80,609 by 98	27. 43,872 by 96
28. 50,062 by 66	29. 90,909 by 87	30. 54,648 by 86

DRILL IN DIVISION

Find quotients:

1. 564 ÷ 37	2. 823 ÷ 76	3. 694 ÷ 282
4. 987 ÷ 83	5. 508 ÷ 28	6. 927 ÷ 165
7. 670 ÷ 59	8. 941 ÷ 46	9. 286 ÷ 238
10. 9037 ÷ 26	11. 8072 ÷ 55	12. 7083 ÷ 352
13. 7120 ÷ 35	14. 3756 ÷ 94	15. 4938 ÷ 404
16. 4732 ÷ 27	17. 2769 ÷ 45	18. 6493 ÷ 227
19. 6935 ÷ 56	20. 3465 ÷ 73	21. 7243 ÷ 224
22. 84,738 ÷ 92	23. 57,922 ÷ 86	24. 48,374 ÷ 164
25. 426,358 ÷ 39	26. 198,072 ÷ 49	27. 459,862 ÷ 175
28. 362,305 ÷ 48	29. 574,895 ÷ 24	30. 362,108 ÷ 256

MISCELLANEOUS PROBLEMS *Written*

1. I paid $6.48 for 9 small maple trees. What did I pay for each one?

2. How many plows, at $15 each, can be bought for $375?

3. How many pencils in 18 boxes, if there are 6 dozen in a box?

4. Mr. Dean raised 85 bushels of corn in one year and 57 bushels more the second year. How many bushels did he raise in both years?

5. An auctioneer sold 35 cows for $840. How much was one cow sold for?

6. One acre of a farm is worth $92. How much would the farmer receive for the whole farm of 56 acres?

7. A keg of nails weighs 108 pounds. How many kegs in a carload of 17,820 pounds?

8. A carboy of spring water holds 5 gallons. How many gallons in 24 carboys?

9. A lot of 28 rugs sold for $2264. What did each rug sell for?

10. A candy factory bought 928 lb. of almonds, 372 lb. of walnuts, 716 lb. of pecans, 649 lb. of filberts, 478 lb. of pistachios. How many pounds of nuts did it buy?

11. A grocer bought 56 barrels of sugar for $784. How much did he pay a barrel?

12. On a farm 952 bushels of wheat were raised. There were 34 acres. How many bushels were raised on an acre?

13. A man rents a house for 16 dollars a month and a stable for $7. How much does he get in one month? In 15 months?

14. My house is worth $450 more than I paid for it. If it cost 3780 dollars, how much is it worth now?

15. How much does one bicycle cost when 18 cost $990?

MULTIPLYING BY MIXED NUMBERS

Numbers like $1\frac{1}{2}$, $2\frac{2}{3}$, $2\frac{1}{5}$, that is, numbers made up of a whole number and a fraction, are called *mixed numbers*.

Multiply 24 by $2\frac{3}{4}$. This means 2 times 24 + $\frac{3}{4}$ of 24.

$$\begin{array}{r} 24 \\ 2\frac{3}{4} \\ \hline 18 = \frac{3}{4} \text{ of } 24 \\ 48 = 2 \text{ times } 24 \\ \hline 66 = 2\frac{3}{4} \text{ times } 24 \end{array}$$

Multiply: *Oral and Written*

	A	*B*	*C*	*D*
1.	10 by $2\frac{1}{5}$	14 by $1\frac{1}{7}$	8 by $3\frac{3}{4}$	20 by $2\frac{1}{4}$
2.	24 by $1\frac{1}{8}$	12 by $2\frac{1}{6}$	12 by $2\frac{2}{3}$	15 by $1\frac{2}{5}$
3.	15 by $1\frac{1}{3}$	16 by $3\frac{1}{2}$	36 by $1\frac{1}{9}$	20 by $2\frac{3}{10}$
4.	12 by $1\frac{3}{4}$	20 by $2\frac{1}{5}$	16 by $2\frac{1}{2}$	20 by $2\frac{1}{2}$
5.	16 by $1\frac{1}{4}$	18 by $1\frac{4}{9}$	28 by $1\frac{1}{7}$	32 by $1\frac{1}{8}$
6.	36 by $3\frac{2}{9}$	120 by $3\frac{2}{3}$	54 by $4\frac{2}{9}$	40 by $6\frac{3}{4}$
7.	48 by $4\frac{2}{3}$	64 by $4\frac{3}{8}$	60 by $5\frac{5}{6}$	72 by $5\frac{1}{6}$
8.	32 by $2\frac{3}{4}$	42 by $2\frac{3}{7}$	45 by $8\frac{3}{5}$	64 by $7\frac{3}{4}$
9.	50 by $4\frac{3}{5}$	27 by $6\frac{5}{9}$	72 by $3\frac{5}{8}$	36 by $5\frac{2}{3}$
10.	48 by $5\frac{5}{6}$	80 by $3\frac{7}{8}$	63 by $7\frac{8}{9}$	54 by $7\frac{5}{6}$

Find the cost of:

1. $1\frac{1}{2}$ pounds of cheese at 16 cents a pound.
2. $1\frac{3}{4}$ of a pound of tea at 60 cents a pound.
3. 1 dozen packages of gelatine at 2 for 10 cents.
4. $1\frac{3}{4}$ pounds of crackers at 12 cents a pound.
5. $1\frac{5}{8}$ pounds of spice at 40 cents a pound.
6. $2\frac{1}{2}$ gallons of kerosene at 14 cents a gallon.
7. $6\frac{1}{4}$ pounds of meal at 4 cents a pound.

PROBLEMS *Oral and Written*

FROM A GROCERY PRICE LIST

Cheese, 16¢ lb.	Butter, 36¢ lb.	Potatoes, 80¢ bu.
Sugar, 5½¢ lb.	Eggs, 34¢ doz.	Cal. beans, 15¢ qt.
Vinegar, 25¢ gal.	Oranges, 40¢ doz.	Kerosene oil, 14¢ gal.
Tea, 50¢ lb.	Sirup, $1.40 gal.	Matches, 20¢ ½ gr.

Find cost of:

1. 2 gal. vinegar
2. $1\frac{1}{2}$ lb. tea
3. 12 lb. sugar
4. 2 qt. kerosene oil
5. $\frac{1}{2}$ doz. eggs
6. $1\frac{1}{2}$ doz. oranges
7. $1\frac{1}{4}$ lb. butter
8. 1 qt. sirup
9. $1\frac{5}{8}$ lb. cheese
10. 1 bu. Cal. beans
11. $\frac{1}{2}$ pk. potatoes
12. 1 gr. matches

13. A grocer brings 10 lb. sugar, 5 gal. oil, 1 pk. potatoes, $1\frac{1}{2}$ doz. eggs, $\frac{1}{2}$ lb. cheese. What is the cost of all?

14. Frank bought 2 boxes sardines at $12\frac{1}{2}$¢, $\frac{1}{2}$ lb. crackers @ 10¢, $\frac{7}{8}$ lb. cheese @ 16¢, and 6 bananas @ 20¢ a dozen. How much did he pay?

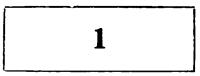
15. Mrs. Waite bought for her dinner $5\frac{1}{2}$ lb. roast beef @ 18¢, 2 lb. sweet potatoes @ 5¢, $\frac{1}{2}$ pk. spinach @ 20¢, $\frac{1}{2}$ doz. oranges @ 30¢. How much did the dinner cost?

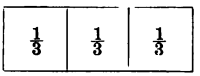
16. Radishes are 2 bunches for 5¢; bananas, 3 for 5¢; oranges, 4 for 10¢. Find the cost of a dozen of each.

17. In January I paid 50¢ a dozen for eggs; $\frac{3}{5}$ as much for a pound of butter; $\frac{1}{2}$ as much for a pound of coffee; twice as much for a bag of flour. What was the price of butter a pound? Of coffee? Of a bag of flour?

18. Make up similar problems from price lists found in the daily paper.

FRACTIONS: THIRDS *Oral*





1. Into how many parts is the lower figure at the left divided?

2. How do the parts compare in size? When anything is divided into three equal parts, each part is called one **third**, and is written $\frac{1}{3}$.

3. Into how many thirds can a circle be divided? A square?

4. $\frac{1}{\text{pencil}} + \frac{1}{\text{pencil}} = \frac{?}{\text{pencils}}$ $\frac{1}{\text{third}} + \frac{1}{\text{third}} = \frac{?}{?}$ $\frac{1}{3} + \frac{1}{3} =$ ——

5. $1 =$ —— thirds $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} =$ —— $\frac{3}{3} - \frac{1}{3} =$ —— $1 - \frac{1}{3} =$ ——

6. $1 - \frac{2}{3} =$ —— $2 - \frac{1}{3} =$ —— $4 - \frac{2}{3} =$ —— $1\frac{2}{3} - \frac{1}{3} =$ ——

7. $3\frac{1}{3} - 2\frac{1}{3} =$ —— $4\frac{2}{3} - 1\frac{1}{3} =$ —— $6\frac{2}{3} - 2\frac{2}{3} =$ ——

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

9. $3\frac{1}{3} + 3\frac{1}{3} + 3\frac{1}{3} =$ —— $6\frac{2}{3} + 2 + 3\frac{1}{3} =$ ——

FRACTIONS: THIRDS AND SIXTHS *Oral*

FIGURE 1

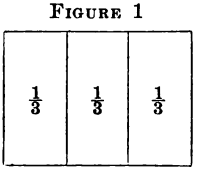
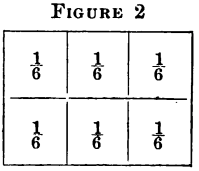


FIGURE 2



1. Into how many equal parts is figure 2 divided? What is each part called? How many sixths make 1?

2. How many sixths make $\frac{1}{2}$? How many sixths make $\frac{1}{3}$?

3. $1 = \frac{?}{\text{sixths}}$ $\frac{1}{2} = \frac{?}{6}$ $\frac{1}{3} = \frac{?}{6}$

4. $\frac{1}{6}$ is $\frac{1}{2}$ of —— $\frac{1}{3}$ is 2 times $\frac{1}{?}$

5. $\frac{1}{\text{sixth}} + \frac{1}{\text{sixth}} = \frac{1}{6} + \frac{1}{6} =$

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

7. $\frac{1}{3} + \frac{1}{6} =$ Think of $\frac{1}{3}$ as $\frac{?}{6}$. Why?

8. $\frac{5}{6} - \frac{1}{6} =$ $1 - \frac{1}{6} =$ One is how many sixths?

9. One is how many times $\frac{1}{6}$? $\frac{1}{6}$ is $\frac{1}{6}$ of —

10. $1 - \frac{5}{6} =$ $3\frac{1}{3} - \frac{1}{6} =$ $4\frac{1}{3} - 2\frac{1}{6} =$ $3\frac{5}{6} - 1\frac{1}{3} =$

11. $1\frac{1}{3} + 1\frac{1}{6} =$ $3\frac{1}{6} + 1\frac{1}{3} =$ $1\frac{2}{3} + \frac{1}{6} =$ $4\frac{5}{6} + \frac{1}{6} =$

12. $2 - \frac{1}{3} =$ $2 - \frac{1}{6} =$ $3 - \frac{1}{3} =$ $3 - \frac{1}{6} =$

13. $2 - \frac{2}{3} =$ $2 - \frac{5}{6} =$ $\frac{1}{3} - \frac{1}{6} =$ $\frac{2}{3} - \frac{1}{6} =$

14. 6 is $\frac{1}{6}$ of — 3 is $\frac{1}{6}$ of — 3 is $\frac{1}{3}$ of —

15. If the whole of your money is 12 cents, $\frac{1}{2}$ of it must be —— cents.

16. If $\frac{1}{2}$ your money is 12 cents, the whole, or two halves, must be —— cents.

17. If the whole of your money is 12 cents, $\frac{1}{3}$ of it must be —— cents.

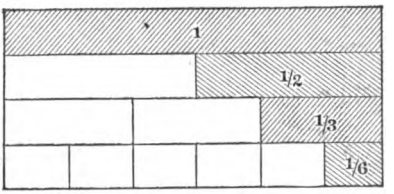
18. If $\frac{1}{3}$ of your money is 12 cents, the whole, or three thirds, must be —— cents.

19. If the whole of your money is 12 cents, $\frac{1}{6}$ of it must be —— cents.

20. If $\frac{1}{6}$ of your money is 12 cents, the whole, or six sixths, must be —— cents.

COMPARISON OF HALVES, THIRDS, AND SIXTHS

Oral



1. How many halves are equal to the whole of anything?
2. How many thirds?
3. How many sixths?
4. How many sixths make a half?
5. How many sixths make a third?
6. How many sixths make two thirds?
7. $\frac{1}{2}+\frac{1}{2}=?$ $\frac{1}{2}-\frac{1}{2}=?$ $1-\frac{1}{2}=?$
8. $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}=?$ $\frac{2}{3}-\frac{1}{3}=?$ $1-\frac{2}{3}=?$
9. $\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}=?$ $\frac{5}{6}-\frac{1}{6}=?$ $1-\frac{1}{6}=?$
10. $\frac{1}{2}+\frac{1}{3}=?$ $\frac{1}{2}-\frac{1}{3}=?$ $\frac{2}{3}+\frac{1}{3}=$ — $\frac{2}{3}-\frac{1}{2}=$ —
11. $\frac{1}{2}+\frac{1}{6}=?$ $\frac{1}{2}-\frac{1}{6}=?$ $2\frac{1}{2}-1\frac{1}{6}=$ — $2\frac{1}{2}-1\frac{1}{3}=$ —
12. $\frac{1}{3}+\frac{1}{6}=?$ $\frac{1}{3}-\frac{1}{6}=?$ $5\frac{2}{3}+\frac{1}{6}=$ — $2\frac{2}{3}+3\frac{1}{6}=$ —
13. What must you add to $\frac{1}{6}$ to make $\frac{5}{6}$? To make 1?
14. What must be taken from 1 to leave $\frac{1}{3}$?
15. $\frac{1}{2}+\frac{1}{3}+\frac{1}{6}=$ — $2\frac{2}{3}+\frac{1}{6}+\frac{1}{6}=$ —
16. Alice has a yard of ribbon. She cuts off $\frac{1}{6}$ of a yard. How much has she left?
17. The morning session of school is 3 hours. Recess is $\frac{1}{3}$ of an hour. How much time for lessons?
18. The afternoon session in the primary school is 2 hours, and there is a recess of $\frac{1}{6}$ of an hour. How long are the children in the schoolroom?

FINDING PARTS OF NUMBERS

Find the indicated parts of the number in the upper space.

		24		
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{2}{3}$	$\frac{5}{6}$

NOTE. Use any multiple of 6 in the upper space.

PROBLEMS *Oral*

1. Take $\frac{2}{3}$ of 24 from 25.

2. What is the sum of $\frac{1}{2}$ of 18 and $\frac{1}{6}$ of 18?

3. A man earns 12 dollars a week. What does he earn in a day? How much will he earn in 6 weeks?

4. At $4 a cord, what will $\frac{5}{6}$ of 12 cords of wood cost?

5. A horse cost $60. At the end of a year it was sold for $\frac{1}{6}$ more than it cost. What was it sold for?

6. Mr. Jenkins bought a cow for $60. He sold it for $\frac{5}{6}$ of what he paid. For how much was it sold?

7. Multiply $\frac{2}{3}$ of 15 by 6.

8. Jack has 54 marbles, and Fred has $\frac{5}{6}$ as many. How many marbles has Fred?

9. Harry sold 12 of his doves. This was $\frac{1}{6}$ of all he had. How many had he at first?

10. Will had 24 marbles. He lost $\frac{1}{6}$ of them. How many had he left?

11. Susie spent $\frac{1}{3}$ of her money for candy, and gave $\frac{1}{3}$ of her money to her brother. What part had she left? If she had 12 cents to start with, how many cents had she left?

FRACTIONS: THIRDS, NINTHS *Oral*

FIGURE 1

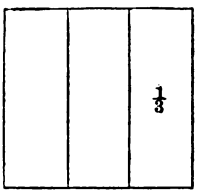
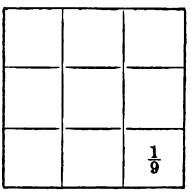


FIGURE 2



1. How do these two figures compare in size?

2. How many ninths are equal in value to the whole of anything?

3. How many ninths make $\frac{1}{3}$? $\frac{2}{3}$?

4. One third is how many ninths? $\frac{2}{3} = \frac{?}{9}$

5. $\frac{3}{9} + \frac{1}{9} = —$ $\frac{1}{3} + \frac{1}{9} = —$ Think the $\frac{1}{3}$ as $\frac{?}{9}$. Why?

6. $1\frac{1}{3} + 1\frac{1}{9} = —$ $2\frac{2}{3} + \frac{1}{9} = —$ $3\frac{2}{9} + 3\frac{1}{3} = —$ $2\frac{1}{9} + 1\frac{2}{3} = —$

7. $1 - \frac{1}{9} = —$ $1 - \frac{7}{9} = —$ $1\frac{1}{3} - 1\frac{1}{9} = —$ $2\frac{2}{3} - 1\frac{2}{9} = —$

Oral and Written

				36					
$\frac{1}{9}$	$\frac{2}{9}$	$\frac{1}{6}$	$\frac{8}{9}$	$\frac{5}{6}$	$\frac{5}{9}$	$\frac{1}{3}$	$\frac{7}{9}$	$\frac{2}{3}$	$\frac{4}{9}$

Find the indicated parts of the number in the upper space.

NOTE. Use any multiple of 18 in the upper space.

Find $\frac{1}{2}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{6}$; $\frac{5}{6}$; $\frac{1}{9}$; $\frac{2}{9}$; $\frac{4}{9}$; $\frac{5}{9}$; $\frac{7}{9}$; $\frac{8}{9}$ of these numbers:

558	738	918	666	846	594	792	702
648	828	576	936	756	864	612	882

PROBLEMS *Written*

1. In 9 months a man earned $540. What were his earnings for one month?

2. An automobile is run 135 miles with 9 gallons of gasolene. What distance will one gallon run it?

3. An automobile is run 135 miles a week. How many miles in 9 weeks?

4. One ninth of a wood lot is 18 acres. How many acres in the entire lot?

5. It took 162 tons of coal to run an engine for a year. The next year it took $\frac{8}{9}$ as much. How many tons the second year?

6. What is the sum of $\frac{2}{9}$ of 288 and $\frac{5}{6}$ of 282?

7. How many less than 100 are $\frac{7}{9}$ of 54?

8. From $\frac{2}{3}$ of 810 take $\frac{2}{9}$ of 630.

9. A bin contained 75 bushels of oats. After $\frac{2}{3}$ of them had been used, 60 bushels more were put in the bin. How many bushels were there then?

10. A horse cost $140; a bridle $13. A saddle cost $\frac{1}{9}$ as much as both horse and bridle. What did the saddle cost?

11. 6 is $\frac{1}{6}$ of —— 3 is $\frac{1}{6}$ of —— 3 is $\frac{1}{3}$ of ——

12. $\frac{1}{6}$ is $\frac{1}{?}$ of $\frac{1}{3}$. When $\frac{1}{3}$ of a yard of cloth costs 10 cents, $\frac{1}{6}$ of a yard will cost —— cents.

13. $\frac{1}{3}$ is —— times $\frac{1}{6}$. When $\frac{1}{6}$ of a yard of ribbon costs 4 cents, $\frac{1}{3}$ of a yard will cost how many cents?

14. If 5 is one of the three equal parts of a number, what is the number?

REVIEW: LIQUID MEASURE

1. Repeat the table of liquid measure.

2. 4 quarts = —— pints.

3. 5 quarts = —— pints.

4. $3\frac{1}{2}$ quarts = —— pints.

5. 9 pints = —— quarts and —— pint.

6. 12 pints = —— quarts.

7. 12 quarts = —— gallons.

8. 32 gallons are —— quarts.

9. $7\frac{1}{2}$ gallons are how many quarts?

10. $12\frac{1}{4}$ gallons are how many quarts?

11. 15 quarts are —— gallons and —— quarts.

12. 5 gallons, 3 quarts are —— quarts.

13. 2 quarts, 1 pint are —— pints.

14. A pint is —— of a quart, and —— of a gallon.

15. A quart is —— times a pint, or —— of a gallon.

16. A gallon is —— times a quart, and —— times a pint.

17. When a gallon of sirup costs $1.20, a quart will cost —— cents, and a pint will cost —— cents.

18. When milk is 4 cents a pint, a quart will cost —— cents, and a gallon —— cents.

19. 3 gallons, 2 quarts of sirup at 80 cents a gallon will cost how much?

20. At 24 cents a quart, 4 gallons, 3 quarts will cost how much?

REVIEW: DRY MEASURE

1. Repeat the table of dry measure.

2. 16 quarts are —— pecks.

3. 16 pecks are —— bushels.

4. 2 bushels are —— pecks, or —— quarts.

5. $2\frac{1}{2}$ pecks = —— quarts.

6. $2\frac{1}{2}$ bushels = —— pecks.

7. $1\frac{3}{8}$ pecks = —— quarts.

8. A quart is —— of a peck, or —— of a bushel.

9. A bushel is —— times a peck, or —— times a quart.

10. A peck is —— times a quart, or —— of a bushel.

11. When potatoes are 96 cents a bushel, a peck will cost —— cents, and a quart will cost —— cents.

12. When a peck of apples costs 40 cents, a bushel will cost ——, and a quart will cost ——.

13. 2 pecks, 5 quarts at 8 cents a quart will cost ——.

14. 2 bushels, 2 pecks at 30 cents a peck will cost ——.

15. 18 pecks at 6 cents a quart will cost ——.

16. 18 bushels at 12 cents a peck will cost ——.

17. How many quarts in $\frac{3}{4}$ of a peck?

18. How many pecks in $\frac{3}{4}$ of a bushel?

19. A market man buys $3\frac{3}{4}$ bushels of tomatoes, and sells 2 bushels, 3 pecks. How many pecks has he left? How many bushels?

20. At 48 cents a bushel, what will 2 bushels, 3 pecks of tomatoes cost?

21. How many times must you fill a 4-quart measure to get 1 bushel, 1 peck of potatoes?

22. How many bushels in 14 pecks?

23. How many quarts of apples in a box holding $1\frac{1}{2}$ bushels?

24. My basket holds $\frac{3}{4}$ of a peck. How many quarts is this?

25. A farmer sells a peck of beans for 45 cents. What will $1\frac{1}{2}$ bushels cost?

26. If you buy a bushel of peas for $1.20, for what must you sell them a peck in order to make 60 cents?

AVOIRDUPOIS OR WEIGHT MEASURE *Oral*

1. Learn:

16 ounces (oz.)	= 1 pound (lb.)
2000 pounds	= 1 ton (T.)

2. One half of a pound is —— ounces, $\frac{1}{4}$ of a pound is —— ounces, and $\frac{1}{8}$ of a pound is —— ounces.

3. How many ounces in $1\frac{1}{2}$ pounds? $1\frac{1}{4}$ pounds? $1\frac{1}{8}$ pounds? 2 pounds? $2\frac{1}{2}$ pounds? $2\frac{1}{4}$ pounds? $2\frac{1}{8}$ pounds?

4. When an ounce of coffee costs 2 cents, what will a pound cost?

5. At 3 cents an ounce, what will a quarter of a pound of cucumber seed cost?

6. Five pounds of candy will make —— 8-ounce packages, or —— 4-ounce packages.

7. How many half-pound packages of tea can be made from 2 pounds? How many quarter-pound packages?

8. When one pound of tea costs 48 cents, $\frac{1}{2}$ of a pound will cost —— cents, $\frac{1}{4}$ of a pound —— cents, and $\frac{1}{8}$ of a pound —— cents.

9. What part of a pound are 2 ounces? 4 ounces? 8 ounces? 1 ounce? 5 ounces? 15 ounces?

10. Twenty ounces = —— lb. and —— oz.

11. Twenty-four ounces = —— lb. and —— oz.

12. Thirty-two ounces = ——. 25 ounces = ——.

13. How many ounces in $\frac{3}{4}$ of a pound?

PROBLEMS *Written*

1. How many pounds of coal in $\frac{1}{2}$ a ton? In $\frac{1}{4}$ of a ton?

2. My coal is delivered in baskets holding a hundred pounds each. How many basketsful make a ton?

3. A box of flower seeds contains 368 ounce packets. How many pounds of seeds in the box?

4. What is the rate per pound when a $\frac{1}{2}$-ounce packet of flower seeds costs 5 cents?

5. How many 2-oz. packages can be made from 5 lb. of peppermints?

6. How many tons are 8000 pounds?

7. On ten freight cars I saw these figures printed as the capacity of the cars. What was the capacity of each car in tons?

20,000 lb. 28,000 lb. 30,000 lb. 38,000 lb. 32,000 lb.
24,000 lb. 18,000 lb. 36,000 lb. 50,000 lb. 60,000 lb.

8. A bushel of oats weighs 32 pounds. How many bushels in 2000 pounds of oats?

9. A bushel of corn weighs 56 pounds. How many bushels of corn will weigh a ton?

FRACTIONS: FIFTHS, TENTHS *Oral*

FIGURE 1

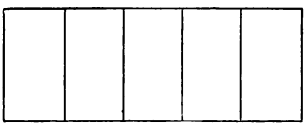
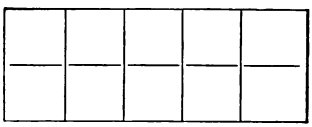


FIGURE 2



1. How do figures 1 and 2 compare in size?

2. How do the parts of figure 1 compare in size? What is each part called?

3. How do the parts of figure 2 compare in size? What is each part called?

4. How many fifths make 1? $1 = \frac{?}{5}$

5. $\frac{1}{\text{pear}} + \frac{1}{\text{pear}} = \frac{?}{\text{pears}}$ $\frac{1}{\text{fifth}} + \frac{1}{\text{fifth}} = \frac{?}{\text{fifths}}$

$\frac{1}{5} + \frac{1}{5} = —$

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

7. What must be added to $\frac{2}{5}$ to make 1? $\frac{1}{5} + ? = 1$

8. $1 - \frac{1}{5} = —$ $2 - \frac{3}{5} = —$ $\frac{3}{5} - \frac{2}{5} = —$ $\frac{4}{5} - \frac{4}{5} = —$

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

10. Dick sold $\frac{2}{5}$ of his marbles. What part had he left?

11. How many dimes make a dollar? How many tenths in a dollar?

12. How many tenths in a foot? In a mile? In anything?

13. $1 = \frac{?}{\text{tenths}}$ How many tenths in $\frac{1}{5}$? $\frac{1}{5}$ is — times $\frac{1}{10}$

14. $\frac{1}{10}$ is $\frac{1}{?}$ of $\frac{1}{5}$

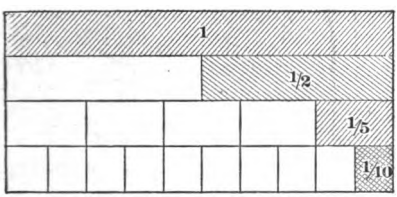
15. $\frac{1}{10}+\frac{3}{10}+\frac{5}{10}=$ — $\frac{1}{5}+\frac{1}{10}$ Think $\frac{1}{5}$ as $\frac{?}{10}$ Why?

16. $\frac{2}{5}+\frac{3}{10}=$ — $1\frac{2}{5}+2\frac{1}{10}=$ — $2\frac{7}{10}+1\frac{1}{5}=$ —
$1\frac{4}{10}+\frac{3}{5}=$ —

17. $1-\frac{1}{10}=$ — $\frac{1}{5}-\frac{1}{10}=$ — $\frac{4}{5}-\frac{3}{10}=$ — $\frac{2}{5}-\frac{3}{10}=$ —

18. $2\frac{4}{5}-\frac{7}{10}=$ — $2-\frac{3}{5}=$ — $2-\frac{6}{10}=$ — $\frac{3}{5}-\frac{6}{10}=$ —

FRACTIONS: HALVES, FIFTHS, TENTHS *Oral*



1. One is how many tenths?

2. One half is how many tenths?

3. One fifth is how many tenths?

4. $1=\frac{?}{10}$ $\frac{1}{2}=\frac{?}{10}$ $\frac{1}{5}=\frac{?}{10}$

5. $\frac{1}{2}+\frac{1}{10}=$ —— Think the $\frac{1}{2}$ as? Why?

6. $\frac{1}{2}-\frac{3}{10}=$ —— $\frac{1}{2}+\frac{3}{10}=$ —— $2\frac{1}{2}+1\frac{1}{10}=$ ——
$\frac{1}{5}-\frac{1}{10}=$ ——

7. $\frac{1}{2}+\frac{1}{5}=$ —— Think $\frac{1}{2}$ as $\frac{?}{10}$, and $\frac{1}{5}$ as $\frac{?}{10}$. Why?
Then $\frac{5}{10}+\frac{2}{10}=\frac{?}{10}$ $\frac{1}{2}-\frac{1}{10}=$ —— $\frac{1}{2}-\frac{1}{5}=$?

8. $\frac{1}{2}-\frac{2}{5}=$ —— $\frac{1}{2}+\frac{2}{5}=$?

9. $1-\frac{1}{2}=$ —— $1-\frac{1}{5}=$ —— $1-\frac{1}{10}=$ ——
$\frac{1}{2}-\frac{5}{10}=$ ——

10. $\frac{1}{2}+\frac{1}{5}+\frac{1}{10}=$ ——

11. What must be added to $\frac{1}{10}$ to make $\frac{1}{5}$?

12. What must be added to $\frac{1}{10}$ to make $\frac{1}{2}$?

13. What must be taken from $\frac{1}{2}$ to leave $\frac{1}{5}$?

14. What must be taken from $\frac{1}{2}$ to leave $\frac{3}{10}$?

FINDING PARTS OF NUMBERS

Oral and Written

30										
$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{3}{10}$	$\frac{1}{2}$	$\frac{3}{5}$	$\frac{7}{10}$	$\frac{2}{3}$	$\frac{2}{5}$	$\frac{9}{10}$	$\frac{4}{5}$

NOTE. Use any multiple of 30 in the upper space.

Find $\frac{1}{2}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{5}$; $\frac{2}{5}$; $\frac{3}{5}$; $\frac{4}{5}$; $\frac{1}{10}$; $\frac{3}{10}$; $\frac{7}{10}$; $\frac{9}{10}$ of these numbers:

150	270	420	600	750	300	450	360
180	240	840	900	720	870	930	570

PROBLEMS

1. Herbert and James received 80 cents for weeding a garden. Herbert, being the elder, kept $\frac{3}{5}$ of it. How much did each receive?

2. Out of 120 working days a workman was idle $\frac{2}{5}$ of the time. How many days was he out of work?

3. A side of beef weighed 280 pounds. The butcher sold $\frac{2}{5}$ of it in a day. How many pounds did he sell?

4. A barrel of sugar weighs 300 pounds. The grocer sells $\frac{1}{2}$ of it to Mr. Jackson and $\frac{1}{5}$ of it to Mr. Wilson. How many pounds does he sell to both men?

5. A man received $5400 by a will. He spent $\frac{3}{10}$ of it for an automobile. What did he pay for the automobile?

6. Multiply $\frac{3}{4}$ of 96 by $\frac{3}{5}$ of 30.

7. A man earned $100 and spent $\frac{1}{10}$ of it for books. How many dollars had he left?

8. Another man spent $100, which was $\frac{1}{10}$ of his money. How many dollars had he at first?

READING AND WRITING NUMBERS

Express in words:

1.	230,300	3,451,000	41,608,320	125,000,000
2.	806,506	5,876,040	32,182,506	827,643,925
3.	950,048	1,100,100	27,540,300	878,960,780
4.	715,005	4,672,200	50,906,327	760,342,054

Express in figures:

1. Eighty thousand eight hundred.
2. Eighty thousand eighty.
3. One thousand three hundred sixty-seven.
4. Six hundred sixty thousand eighty-five.
5. Nine hundred seventeen thousand seven hundred ninety.
6. One hundred one thousand one hundred one.
7. Fifty-seven million three hundred eighty-six thousand four hundred ninety-six.
8. One hundred four million six hundred five thousand eight hundred seven.
9. Nine million six hundred eighty-three.
10. Seven hundred million forty-five thousand sixty-six.

DICTATION EXERCISE

1. $16 + 4, \div 5, \times 7, + 2, \div 6, \times 9, + 3, \div 6, - 8 = ?$
2. $9 \times 8, + 9, \div 9, + 5, - 8, \times 4, \div 8, + 9, \times 7 = ?$
3. $11 - 5, \times 6, - 4, \div 8, \times 6, \div 4, \times 7, + 3, \div 9 = ?$
4. $9 \times 7, - 3, \div 6, \times 2, \div 4, \times 7, + 7, \div 6, + 9, - 7 = ?$
5. $6 \times 9, - 6, \div 8, + 8, - 5, \times 5, + 9, \div 6, + 7 = ?$

SPECIAL SALE AT A DEPARTMENT STORE

	Regular Price	Sale Price		Regular Price	Sale Price
Napkins (doz.)	$1.25	78¢	Handkerchiefs	17¢	12½¢
Towels	25¢	17¢	Shirt waists	$1.98	98¢
Crash	10¢	7½¢	Belts	50¢	25¢
Tray cloths	39¢	29¢	Veils	$1.00	79¢
Scarfs	75¢	59¢	Hosiery (pair)	50¢	3 for $1.00
Fringed covers	$2.75	$1.49	Gloves	$2.50	$1.19
Table damask	$1.25	89¢	Ribbon (yd.)	17¢	12¢
Sheets	85¢	69¢	Collars	25¢	2 for 25¢
Pillow cases	20¢	17¢	Neckties	98¢	75¢
Table covers	$2.00	$1.19	Bath towels	50¢	39¢

1. Find the difference between the regular price and the sale price on each article.

By attending this sale what can be saved on the following purchases?

2. 10 yd. crash

3. ½ doz. sheets

4. 3 yd. table damask

5. 2 shirt waists

6. 2 pr. gloves

7. ½ doz. handkerchiefs

8. 1½ doz. napkins

9. 2 collars

10. 6 towels

11. 4 bath towels

12. 3 neckties

13. 2 table covers

14. How much will 4 collars and 6 towels cost at the sale price?

15. Find cost of 6 pairs hosiery at the sale. What does 1 pair cost?

16. How many belts at the sale price can be bought for the cost of one at the regular price?

17. Mrs. Ray buys 2 neckties, 6 collars, and a pair of gloves. How much does she pay?

18. A dozen towels at the regular price will cost how much more than a dozen handkerchiefs at the sale price?

19. How much must I pay for 4 tray cloths, 2 bath towels, 1 pair of sheets, and 2 pairs of pillow cases?

20. Mrs. Parker buys 2 scarfs, 1 fringed cover, 1 pair of pillow cases. How much does she save by attending the sale?

21. How many yards of ribbon can Mrs. Harper buy with what she saves on 1 dozen towels?

22. Mrs. Lane buys a veil, a shirt waist, and 4 yards of ribbon. What change does she receive from a $5 bill?

DRILL IN ADDITION

Add:

	A	*B*	*C*	*D*	*E*
1.	39	349	2789	34,687	378,692
	93	856	9254	76,530	949,009
	79	763	3096	80,906	176,438
	58	987	2887	97,858	458,569
	64	732	7392	46,912	596,084
	96	408	8409	59,878	300,700
2.	7	8	609	8009	8080
	56	74	7	764	637,529
	38	628	3874	5	759
	9	6	96	37,089	48,007
	7	37	764	476	84
	84	864	1508	1897	276,307

DRILL IN SUBTRACTION

Subtract:

	A	*B*	*C*	*D*	*E*
1.	\$437.59	\$834.27	\$1000.00	\$964.28	\$847.35
	128.37	357.92	376.80	358.91	123.98
2.	\$123.45	\$234.56	\$345.67	\$456.78	\$567.89
	67.89	17.89	89.12	90.12	123.45
3.	\$789.01	\$890.12	\$901.23	\$1234.56	\$2000.00
	234.56	345.67	456.78	789.01	199.99

DRILL IN MULTIPLICATION

Multiply:

	A	*B*	*C*
1.	1240 by 83	4835 by 47	3642 by 74
2.	1506 by 48	2787 by 38	6582 by 94
3.	37,320 by 56	64,328 by 64	73,688 by 86
4.	70,687 by 34	92,512 by 73	59,427 by 59
5.	347 by 343	873 by 918	832 by 727
6.	624 by 555	395 by 266	807 by 768
7.	568 by 247	473 by 389	606 by 808

DRILL IN DIVISION

Divide:

	A	*B*	*C*
1.	3786 ÷ 55	5429 ÷ 78	3624 ÷ 165
2.	8375 ÷ 46	3185 ÷ 64	5382 ÷ 297
3.	9363 ÷ 88	7429 ÷ 87	2429 ÷ 186
4.	47,329 ÷ 63	83,407 ÷ 59	30,878 ÷ 376
5.	53,747 ÷ 74	93,252 ÷ 48	24,432 ÷ 155
6.	87,670 ÷ 92	25,638 ÷ 82	63,792 ÷ 389
7.	56,432 ÷ 88	317,420 ÷ 68	918,728 ÷ 475
8.	762,358 ÷ 69	524,180 ÷ 79	403,824 ÷ 558

MULTIPLYING BY MIXED NUMBERS *Oral*

Find:

	A	*B*	*C*	*D*
1.	$1\frac{1}{2}$ times 20	$2\frac{2}{3}$ times 6	$1\frac{3}{4}$ times 8	$1\frac{1}{5}$ times 15
2.	$2\frac{1}{3}$ times 9	$4\frac{2}{5}$ times 10	$2\frac{5}{6}$ times 12	$2\frac{1}{12}$ times 24
3.	$2\frac{2}{3}$ times 9	$2\frac{4}{5}$ times 20	$2\frac{3}{7}$ times 14	$4\frac{2}{3}$ times 12
4.	$1\frac{3}{4}$ times 12	$1\frac{3}{8}$ times 16	$1\frac{5}{9}$ times 18	$1\frac{4}{7}$ times 14
5.	$1\frac{5}{8}$ times 8	$1\frac{1}{11}$ times 22	$1\frac{2}{3}$ times 30	$2\frac{1}{6}$ times 30

Multiply: *Written*

1.	60 by $5\frac{1}{4}$	80 by $9\frac{5}{8}$	72 by $3\frac{5}{9}$	54 by $5\frac{5}{6}$
2.	75 by $2\frac{2}{5}$	150 by $3\frac{2}{3}$	120 by $2\frac{7}{8}$	368 by $6\frac{5}{8}$
3.	84 by $2\frac{5}{12}$	125 by $4\frac{4}{5}$	480 by $5\frac{5}{12}$	320 by $7\frac{3}{4}$
4.	85 by $5\frac{4}{5}$	120 by $3\frac{5}{6}$	244 by $8\frac{3}{4}$	171 by $7\frac{5}{9}$
5.	63 by $4\frac{5}{7}$	108 by $6\frac{5}{9}$	208 by $6\frac{3}{4}$	132 by $4\frac{3}{11}$

What is

1. $2\frac{4}{5}$ times 80 cents?
2. $12\frac{3}{4}$ times 180 barrels?
3. $16\frac{2}{3}$ times 660 dollars?
4. $8\frac{4}{5}$ times 400 gallons?
5. $5\frac{3}{8}$ times 320 bushels?
6. $5\frac{7}{8}$ times \$4.88?
7. $3\frac{4}{7}$ times \$231?
8. $2\frac{1}{9}$ times \$1.80?
9. $3\frac{3}{4}$ times \$12.08?
10. $2\frac{6}{7}$ times \$0.07?

Find the cost of:

1. $1\frac{3}{4}$ tons of hay at \$20 a ton.
2. $2\frac{5}{12}$ dozen chairs at \$36 per dozen.
3. $5\frac{3}{8}$ acres of land at \$40 an acre.
4. $9\frac{3}{4}$ bushels of corn at 60 cents a bushel.
5. $3\frac{5}{8}$ pounds of cheese at 16 cents a pound.

MISCELLANEOUS PROBLEMS *Written*

1. A bookseller buys 60 books at $1.20 each. What does he pay for them?

2. At $0.10 per yard, what will $12\frac{1}{2}$ yards cost?

3. Quinces are worth $1 per peck. What will $1\frac{3}{4}$ pecks cost?

4. When maple sirup sells at 16 cents a pint, what is the price per gallon?

5. At $0.08 per quart, what will $1\frac{1}{2}$ gallons of milk cost?

6. Three and three fourths bushels of corn will weigh how much, if a bushel weighs 56 pounds?

7. What must I pay for $12\frac{3}{4}$ pounds of butter at 32 cents per pound?

8. What will $4\frac{2}{3}$ yards of lace cost at $2.40 per yard?

9. When corn is worth 56 cents per bushel, what will $\frac{1}{4}$ of a bushel cost? $2\frac{3}{4}$ bushels?

10. At $5.60 per barrel, what will $4\frac{3}{4}$ barrels of flour cost?

11. Mr. Carrol sold $4\frac{3}{8}$ cords of wood at $6.40 per cord. How much did he receive for it?

12. Find cost of $3\frac{5}{8}$ tons of coal at $4.80 a ton.

13. Mrs. Maxwell bought $12\frac{5}{8}$ yards of cloth at $1.60 per yard. What did she pay for it?

14. What is $\frac{3}{4}$ of $10.20? $3\frac{5}{6} \times \$10.20 = ?$

15. A bushel of oats weighs 32 pounds. What will a peck weigh? $2\frac{3}{4}$ bushels? 4 quarts?

16. A box of 144 pens is sold for 36 cents. This is how many pens for a cent?

17. John bought 6 books at $1.15. He gave a $10 bill in payment. How much change did he receive?

18. $1538 + $465 = $—— $1307 − $342 = $——

19. There are 768 seats in a schoolhouse, 48 in a room. How many rooms in the building?

20. A man deposited in the bank at different times $967, $776, $1050. How much had he left after drawing out $449 and $878?

21. How many 29's are there in 696?

22. A horse cost $138 and a carriage $387.50. How much did both cost?

23. A barrel of flour weighs 196 pounds. How much will 208 barrels weigh?

24. A farmer raised 648 bushels of potatoes. 60 bushels he sold at once. A month later he sold 435 bushels. How many bushels had he left?

25. A commission merchant received at different times 87 tubs of butter, 127 tubs, 96 tubs, 49 tubs, and 75 tubs. He sold 39 tubs, 112 tubs, 57 tubs, and 109 tubs. How many tubs had he left?

26. A storekeeper paid $4.48 for 56 dolls. How much did he pay for one?

27. In a bale of cloth there were 83 pieces. In each piece there were 156 yards. How many yards in the bale?

28. I bought 38 acres of land at 65 dollars an acre. How much did I pay for it?

TABLE OF TIME MEASURE

1. Learn :

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)
365 days	= 1 year (yr.)

2. A clock ticks every second. How many times does it tick in a minute? In $\frac{1}{2}$ of a minute?

3. How many minutes in $\frac{1}{4}$ of an hour? In $\frac{3}{4}$ of an hour?

4. How many hours in $\frac{1}{3}$ of a day? In $\frac{2}{3}$ of a day?

5. If a man works 8 hours a day, how many hours are left for other purposes?

6. An automobile is driven a mile in 3 minutes. How many miles an hour is this?

7. How many times does the minute hand go around the clock in a day?

8. How many times does the hour hand go around the clock in a day?

9. How many minutes in a day?

10. How many seconds in an hour?

11. How many weeks in a summer vacation of 63 days?

12. How many weeks in the month of September?

13. How many weeks in the month of July?

14. How many days in 3 years?

MISCELLANEOUS PROBLEMS *Written*

1. How many 13's in 2769?

2. I bought a pair of shoes for $2.75, a pair of slippers for $0.85, and a dozen handkerchiefs at 15 cents apiece. Change from a 10-dollar bill?

3. How many dozen bunches of celery in 432 bunches?

4. Mr. Henderson agreed to pay $\frac{2}{5}$ the expense of running a boys' club for a year. The whole expense was $1465. What did Mr. Henderson pay?

5. A house bought for 4872 dollars was sold so as to gain $\frac{1}{8}$ of what it cost. How much was it sold for?

6. Find the sum, difference, product, and quotient of 39 and 507.

7. Mr. Jones paid 185 dollars for a horse, and twice as much for a carriage. How much did he pay for both?

8. After spending at different times $38, $172, $96, and $59, how much is left of $400?

9. A dealer sold 960 pounds of paper in 24 bundles. What did each bundle weigh?

10. A salesman received a salary of $1200 the first year, and $345 more the second year. How much did he earn in both years?

11. What is the cost of 15 yards of lace at 75 cents a yard?

12. Twelve trees were set out in the school grounds. Each tree cost $0.85, planting each tree $0.27, and wire netting for each $0.40. How much was paid out in all?

13. $25 \times 36 \times 406 =$ what?

LINEAR OR LONG MEASURE

1. Learn:

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
$16\frac{1}{2}$ feet	= 1 rod (rd.)
320 rods or 5280 feet	= 1 mile (mi.)

2. 5 feet 6 inches = —— inches.

3. 4 feet 7 inches are —— inches.

4. 45 feet are —— yards.

5. 32 feet are —— yards and —— feet.

6. Express 80 inches as feet.

7. Express 15 feet as inches.

8. 40 feet = —— inches.

9. $3\frac{1}{3}$ yards = —— feet.

10. $3\frac{1}{3}$ feet = —— inches.

11. Express 108 feet as yards.

12. Express 100 yards as inches.

13. Express 100 miles as feet.

14. How many feet in $\frac{3}{8}$ of a mile?

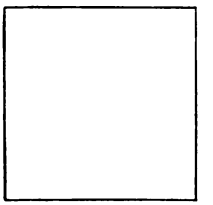
15. A county road is 28 miles long. How many rods long? How many feet long?

16. The mountain peak is 26,400 feet high. How many miles is this?

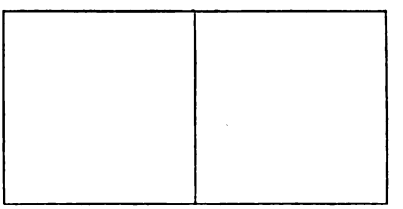
17. How many miles in 2560 rods?

SQUARE OR SURFACE MEASURE

Oral and Written



1. Draw a square 1 inch long and 1 inch wide. This is a *square inch.*



2. Draw another square beside it. This is an *oblong* or *rectangle.* It is —— inches long and —— inch wide, and contains —— square inches.

3. Draw an oblong made up of 4 inch squares placed in a row. How long is it? How wide is it? How many square inches does it contain?

4. On top of this row draw another row exactly like the first row. You now have an oblong —— inches long, and —— inches wide. It contains —— square inches.

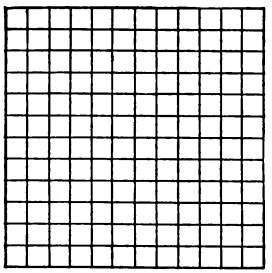
5. Draw an oblong 6 inches long and 3 inches wide. Mark it off into inch squares. How many square inches in the oblong?

A surface has two dimensions — length and breadth.

We measure surfaces or areas in square inches, square feet, and square yards.

NOTE. Drill in drawing and finding areas of rectangles should be continued until pupils grasp the principle involved.

6. Draw on the board a square 1 foot long and 1 foot wide. This is a *square foot.*



7. Now draw lines across the square from top to bottom 1 inch apart, and then from side to side 1 inch apart. Each one of the spaces is a square inch. How many square inches in the bottom row? How many rows? Then in the whole figure there are 12 times 12 square inches, or —— square inches. How many square inches, then, make a square foot?

144 square inches (sq. in.) = 1 square foot (sq. ft.)

8. How many square inches in 2 square feet? In 5 square feet? In 8 square feet? In 10 square feet? In 11 square feet?

9. How many square inches in $\frac{1}{2}$ of a square foot? In $\frac{3}{4}$ of a square foot? In $\frac{2}{3}$ of a square foot? In $\frac{5}{8}$ of a square foot? In $\frac{7}{12}$ of a square foot?

10. How many square feet in 576 square inches? In 1296 square inches? In 1728 square inches? In 432 square inches? In 1008 square inches?

A square 1 yard long is a *square yard.*

11. Draw one on the board and divide it into squares 1 foot long. How many squares? What is the area of each? Then, how many square feet make a square yard?

9 square feet = 1 square yard (sq. yd.)

12. How many square feet in 3 square yards? In 5 square yards? In 8 square yards? In 12 square yards? In 10 square yards?

13. How many square yards in 54 square feet? In 72 square feet? In 45 square feet? In 63 square feet? In 81 square feet?

14. Learn:

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)

ORAL PROBLEMS

1. How many square inches in a paper cutter 6 inches long and 1 inch wide?

2. I have a piece of paper 5 inches long and 3 inches wide. Into how many square inches can I cut it?

3. How many inch squares will be required to make a rectangle 8 inches long and 4 inches wide?

4. If I arrange 24 inch squares so as to make a rectangle 6 squares long, how many rows will I have? How many if 8 squares long? If 12 squares long?

5. How many different rectangles can you make with 36 inch squares? With 48 inch squares? With 60 inch squares?

6. A square yard of cloth was made into handkerchiefs 12 inches square. How many handkerchiefs?

7. How many 2-inch squares can be cut from a piece of paper 8 inches long and 2 inches wide?

Give areas of these rectangles:

8.	7 in. by 9 in.	8 yd. by 5 yd.
	9 ft. by 7 ft.	12 in. by 12 in.
9.	6 ft. by 5 ft.	12 in. by 7 in.
	12 yd. by 7 yd.	12 ft. by 8 ft.
10.	9 yd. by 4 yd.	9 ft. by 6 ft.
	8 in. by 4 in.	12 yd. by 9 yd.

11. How many sides has a square? How do these sides compare in length?

12. What is the distance around an inch square?

The distance around a figure is the *perimeter.*

13. What is the perimeter of a 2-inch square? A 5-inch square? A 4-inch square? A 3-inch square? A 6-inch square?

14. What is the perimeter of a table 6 feet long and 3 feet wide?

15. How long a piece of tape will it take to go around the edge of a table 3 feet long and 2 feet wide?

16. A checkerboard is 8 squares long and 8 squares wide. If the squares are 1 inch long, how many square inches in the board? How many inches around the edge of the board?

17. A square table has an area of 4 square feet. It is —— feet long and —— feet wide. Its perimeter is —— feet.

18. What is the perimeter of a table 25 inches square?

19. What is one side of a square whose perimeter is 28 feet?

PROBLEMS *Oral and Written*

1. A room 12 feet long and 12 feet wide has a floor space of —— square feet.

2. What is the area of a writing tablet 12 inches long and 10 inches wide?

3. On the floor of a room 9 yards long and 8 yards wide you can mark off —— squares each 1 yard long.

4. A room 9 yards long and 8 yards wide is —— feet long and —— feet wide.

5. At 6 cents a square foot, what will it cost to lay a floor in a room 12 feet long and 10 feet wide?

6. How many square yards in the floor of a room 6 yards long and 4 yards wide? How many square yards of plastering in the ceiling?

7. How many square feet of wire screen must I buy for 2 doors 6 feet high and $2\frac{1}{3}$ feet wide?

8. A room is 15 feet long and 12 feet wide. What will it cost to paint the floor at 8 cents a square foot?

9. How many feet of picture molding will it take to go around the room in problem 8?

10. A house lot is 60 feet on the street side and 80 feet deep. How many feet of fence necessary to inclose it?

11. A table is 30 inches long and 20 inches wide. What is its area? What is its perimeter?

12. Mrs. Grant made a rug 6 feet long and 3 feet wide. (*a*) How many square feet will it cover? (*b*) She bound the edge with tape for which she paid 6 cents a yard. What did the tape cost?

13. A room is 18 feet long and 15 feet wide.

(*a*) Express its length and width in yards.

(*b*) What will it cost to paint the floor at 75 cents a square yard?

(*c*) At 2 cents a foot what will the picture molding cost?

14. A house lot is 60 by 80 feet. (*a*) What is its area? (*b*) How many feet of fence necessary to inclose it?

15. A table is 36 inches long and 25 inches wide.

(*a*) The distance around the table is —— inches.

(*b*) It has an area of —— square inches.

(*c*) In the center of the table is a lamp mat 9 inches square. It covers an area of —— square inches.

(*d*) How many square inches of the table are left uncovered?

16. How many square feet in 54 square yards?

17. How many square yards in 54 square feet?

18. The sidewalk in front of my house is 75 feet long and 5 feet wide. What is its area?

19. The side door of my house is 42 feet from the front sidewalk and a walk $2\frac{1}{2}$ feet wide leads to it. How many square feet does this walk cover?

20. Find the surface of your desk. Its perimeter.

21. How many square inches on both sides of a sheet of your examination paper?

22. Answer these questions about your schoolroom:

(*a*) What are its dimensions?

(*b*) How many square feet in the floor?

DRILL EXERCISE IN SEVENTHS

Oral and Written

Find the indicated parts of the number in the center space.

				35					
$\frac{1}{5}$	$\frac{1}{7}$	$\frac{2}{5}$	$\frac{3}{7}$	$\frac{4}{5}$	$\frac{6}{7}$	$\frac{3}{5}$	$\frac{2}{7}$	$\frac{4}{7}$	$\frac{5}{7}$

NOTE. Use any multiple of 35 in the upper space.

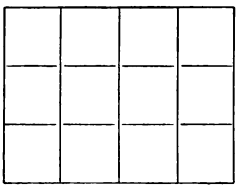
Find $\frac{1}{7}$; $\frac{2}{7}$; $\frac{3}{7}$; $\frac{4}{7}$; $\frac{5}{7}$; $\frac{6}{7}$ of these numbers:

140	154	280	420	560	700	840	630
182	357	854	448	168	301	224	525

PROBLEMS

1. How many weeks in 168 days?
2. How many days in 168 weeks?
3. Mr. Jones earns 196 dollars a month. How much will he earn in 7 months?
4. His son John earns 196 dollars in 7 months. How much does he earn in one month?
5. A farmer bought a cow for 63 dollars, and a pig for $\frac{1}{7}$ as much. How many dollars did he pay for both?
6. Add $\frac{2}{7}$ of 70 and $\frac{3}{5}$ of 70.
7. Take $\frac{2}{3}$ of 42 from $\frac{5}{7}$ of 42.
8. James is 14 years old and his father is 42 years old. How old was each 7 years ago?
9. One seventh of my age is 8 years. How old am I?
10. Out of a flock of 28 wild ducks, $\frac{1}{7}$ were shot by gunners. The rest flew away. How many escaped?

FRACTIONS: TWELFTHS



1. Draw a figure like this on the blackboard.

2. How many squares in the figure? How do they compare in size? Then each square is $\frac{1}{?}$ of the whole figure.

3. Point to $\frac{1}{2}$ of the figure. How many twelfths in $\frac{1}{2}$?

4. Point to $\frac{1}{3}$ of the figure, and tell how many twelfths in it.

5. Point to $\frac{1}{4}$. $\frac{1}{4} = \frac{?}{12}$. Point to $\frac{1}{6}$. $\frac{1}{6} = \frac{?}{12}$.

6. Point to $\frac{1}{2}$ and $\frac{1}{12}$. How many twelfths did you point out?

7. Point to $\frac{1}{6}$ and $\frac{1}{12}$. $\frac{1}{6}$ and $\frac{1}{12}$ are how many twelfths?

8. $\frac{2}{3}$ = how many twelfths? $\frac{3}{4} = \frac{?}{12}$ $\frac{5}{6} = \frac{?}{12}$

9. $\frac{1}{2}+\frac{1}{12}=$ — $\frac{1}{6}+\frac{1}{12}=$ — $\frac{1}{3}+\frac{1}{12}=$ — $\frac{1}{4}+\frac{1}{12}=$ —

10. $\frac{2}{3}+\frac{1}{12}=$ — $\frac{3}{4}+\frac{1}{12}=$ — $\frac{5}{6}+\frac{1}{12}=$ — $\frac{1}{2}+\frac{1}{6}+\frac{1}{12}=$ —

11. $\frac{1}{3}+\frac{1}{4}=$ — Think $\frac{1}{3}$ as $\frac{?}{12}$, and $\frac{1}{4}$ as $\frac{?}{12}$. Why?

12. $\frac{2}{3}+\frac{1}{4}=$ — $1\frac{1}{3}+1\frac{1}{12}=$ —

13. $2\frac{5}{6}+1\frac{1}{12}=$ — $3\frac{1}{4}+2\frac{5}{12}=$ —

14. $\frac{1}{2}-\frac{1}{12}=$ — $\frac{1}{6}-\frac{1}{12}=$ — $\frac{1}{4}-\frac{1}{12}=$ — $\frac{1}{3}-\frac{1}{12}=$ —

15. $\frac{1}{3}-\frac{1}{4}=$ — $\frac{2}{3}-\frac{1}{4}=$ — $\frac{3}{4}-\frac{1}{3}=$ — $\frac{3}{4}-\frac{2}{3}=$ —

16. $\frac{5}{6}-\frac{1}{12}=$ — $5\frac{1}{2}-2\frac{5}{12}=$ — $\frac{5}{6}-\frac{5}{12}=$ — $6\frac{2}{3}-2\frac{1}{4}=$ —

17. $\frac{1}{3}$ yd. + $\frac{5}{12}$ yd. = —

18. $\frac{1}{2}$ ft. + $\frac{1}{3}$ ft. + $\frac{1}{12}$ ft. = —

DRILL IN MULTIPLICATION

Multiply :

	A	*B*	*C*
1.	3647 by 435	3268 by 327	3082 by 807
2.	8371 by 736	4776 by 652	7609 by 908
3.	9087 by 827	2483 by 576	8760 by 706
4.	6708 by 908	6758 by 834	5904 by 547
5.	5927 by 672	8043 by 486	7608 by 763
6.	1248 by 254	1548 by 435	9351 by 289
7.	7084 by 676	4576 by 602	7283 by 347
8.	5607 by 593	7005 by 872	8520 by 468
9.	4935 by 460	2743 by 643	6040 by 987
10.	3056 by 287	3827 by 564	4675 by 486

DRILL IN DIVISION

Find quotients :

	A	*B*	*C*
1.	3476 ÷ 12	5986 ÷ 47	3764 ÷ 53
2.	73,657 ÷ 23	38,492 ÷ 26	98,129 ÷ 26
3.	42,529 ÷ 125	98,730 ÷ 342	78,235 ÷ 284
4.	36,546 ÷ 306	42,768 ÷ 356	87,042 ÷ 431
5.	43,628 ÷ 708	55,642 ÷ 253	64,203 ÷ 593
6.	987,286 ÷ 426	830,978 ÷ 265	827,398 ÷ 285
7.	817,529 ÷ 252	543,672 ÷ 464	708,396 ÷ 187
8.	764,928 ÷ 528	468,307 ÷ 235	496,503 ÷ 278
9.	648,512 ÷ 805	674,321 ÷ 326	380,964 ÷ 526
10.	915,868 ÷ 483	729,835 ÷ 424	298,327 ÷ 376

FRACTIONAL PARTS OF 100

100									
$\frac{3}{4}$	$\frac{8}{25}$	$\frac{1}{2}$	$\frac{11}{50}$	$\frac{2}{5}$	$\frac{17}{25}$	$\frac{3}{10}$	$\frac{4}{5}$	$\frac{7}{20}$	$\frac{3}{5}$

Find the indicated parts of the number in the upper space.

NOTE. In place of 100 write 200; 300; 400; 500; etc.

Learn:

1. 50 is $\frac{1}{2}$ of 100.
2. 25 is $\frac{1}{4}$ of 100; 75 is $\frac{3}{4}$ of 100.
3. 20 is $\frac{1}{5}$ of 100; 40 is $\frac{2}{5}$ of 100; 60 is $\frac{3}{5}$ of 100; 80 is $\frac{4}{5}$ of 100.
4. 10 is $\frac{1}{10}$ of 100; 30 is $\frac{3}{10}$ of 100; 70 is $\frac{7}{10}$ of 100; 90 is $\frac{9}{10}$ of 100.
5. 5 is $\frac{1}{20}$ of 100.
6. What part of a dollar is 1¢?
7. What part of a dollar is 50¢? 5¢?
8. What part of a dollar is 25¢? 75¢?
9. What part of a dollar is 20¢? 40¢? 60¢? 80¢?
10. What part of a dollar is 10¢? 30¢? 70¢? 90¢?

DECIMALS

1. How many dimes make a dollar? Then a dime is what part of a dollar?
2. How many cents make a dollar? Then a cent is what part of a dollar?

In writing dimes and cents as parts of a dollar, we write the dimes in the first place at the right of the decimal point as *tenths* of a dollar, and the cents in the second place at the right as *hundredths* of a dollar. Thus, in writing sixty-seven cents, we write \$0.67; that is, we write the 6 dimes as tenths of a dollar and the 7 cents as hundredths of a dollar.

We can write parts of other things besides dollars as tenths and hundredths.

3. When anything is divided into 10 equal parts, what is each part called? We can write *one tenth* this way, $\frac{1}{10}$, or we can write it this way, .1.

4. When anything is divided into 100 equal parts, what is each part called? We can write one *one hundredth* this way, $\frac{1}{100}$, or we can write it .01.

5. When anything is divided into 1000 equal parts, what is each part called? We can write one *one thousandth*, $\frac{1}{1000}$, or we can write it .001.

Fractions that express tenths, hundredths, thousandths are called *decimal fractions*, and when written with the decimal point are called *decimals*.

In reading and writing decimals remember that the first place at the right of the decimal point is *tenths*, the second place *hundredths*, and the third place *thousandths*.

6. In writing decimals how many places must be used to express tenths? How many to express hundredths? How many to express thousandths?

7. Write as decimals:

$\frac{5}{10}$; $\frac{7}{10}$; $\frac{36}{100}$; $\frac{8}{100}$; $\frac{125}{1000}$; $\frac{605}{1000}$; $\frac{17}{1000}$; $\frac{9}{1000}$.

8. Read .54. Read first as in whole numbers. Fifty-four. Fifty-four what? The last figure stands in the second or hundredths' place; therefore, we read, fifty-four hundredths.

9. Read .009. Nine. Nine what? The nine stands in the third or thousandths' place. So we read, nine thousandths.

Read the following:

10. .7 .17 .127 .08 .015 .006 .107

11. .4 .44 .444 .04 .044 .004 .404

In reading whole numbers and decimals, as 3.04, we always use the word "*and*" to mark the decimal point. 3.04 is read three and four hundredths.

Read the following:

12. 3.6 4.07 5.039 7.351 8.406 7.003

13. 2.3 miles 4.75 gallons 3.375 bushels 2.038 acres.

14. .5 of an acre .007 of a mile .67 of a year .605 of a ton.

15. 10.1 10.01 10.001 10.101 10.011 10.111

Write in figures:

1. One and one tenth.
2. Three and forty-six hundredths.
3. Two and five hundredths.
4. Three thousandths.
5. Seven hundred two thousandths.
6. Eight hundredths.
7. Six and six tenths.

DECIMALS: ADDITION

Add:

$3.76	3.76 miles	3.76 acres	3.76
2.04	2.04	2.04	2.04
1.7	1.7	1.7	1 7

Do you see that in learning how to add in United States money you have learned to add decimals? We place tenths under tenths, hundredths under hundredths, and so on, because we can add only things of the same kind. The decimal point in the sum is placed directly under where it occurs in the numbers above.

Add:

1.04	2.15	10.1	.8	4.15
.07	8.09	1.01	2.08	8.004
3.15	7.13	.101	.75	3.09
.29	2.23	1.001	1.64	2.12

Add by lines and by rows:

	A		*B*		*C*		*D*		*E*
1.	8.3	+	3.04	+	1.4	+	2.37	+	3.85
2.	.65	+	2.7	+	8.06	+	7.2	+	8.03
3.	.29	+	.98	+	7.74	+	.08	+	2.17
4.	.08	+	2.45	+	2.7	+	3.57	+	.64
5.	5.07	+	.7	+	.64	+	1.7	+	.09

Add three and three hundredths, and five and five thousandths.

To six hundred six thousandths add eighty and eight tenths.

DECIMALS: SUBTRACTION

Subtract:

$5.86	5.86 miles	5.86 bushels	5.86
2.52	2.52	2.52	2.52

1. From 6.24 take 3.17.
2. Take 4.025 from 8.703.
3. From 2.16 take 1.09.
4. Take 1.602 from 5.072.
5. From 4.27 take 3.07.
6. Take 5.125 from 9.006.
7. From 5.08 take 5.8.
8. Take 3.078 from 8.756.
9. From 3.4 take 2.6.
10. Take 2.012 from 7.812.

11. Take 4.65 from 6.8.

6.80 6.8 may be written 6.80. Do you see why?
4.65

12. 8.4 − 3.07	13. .8 − .052	14. 3.475 − .906
15. 9.64 − 3.252	16. .06 − .04	17. 5.7 − .43
18. .08 − .02	19. 6.03 − .006	20. 2.84 − 2.04
21. .4 − .06	22. 1.08 − 1.03	23. 7.56 − 7.5
24. .96 − .6	25. 4.7 − 2.5	26. 9.008 − 3.115

27. I had seven dollars. After spending seven tenths of a dollar, how much had I left?

28. What is the difference between eight and seven hundredths, and five and six tenths?

29. In going to school, John walks 1.75 miles, and James walks 1.08 miles. John walks how much farther than James?

DECIMALS: MULTIPLICATION

Multiply:

$6	$6.20	$6.23	2 tenths	.2
3	3	3	3	3

13 hundredths	.13	3 hundredths	.03
4	4	5	5

In these examples, how do you know what name to give to the product?

Multiply as in United States money.

When we multiply a decimal by a whole number, the decimal point in the product comes directly under the decimal point in the multiplicand.

Multiply:

	A	*B*	*C*	*D*	*E*
1.	2.24	3.15	7.8	8.2	11.84
	6	6	9	5	8
2.	5.08	.06	.3	.182	.103
	7	8	7	4	7
3.	13.6	4.27	5.5	6.08	17.25
	12	16	24	19	42
4.	22.756	15.028	12.503	.026	.008
	25	18	22	13	144

5. If your steps are 1.75 feet long, how far will you travel in 200 steps?

6. The distance by railroad between two places is 55.7 miles. How many miles does an engineer travel who makes one round trip each day?

DECIMALS: DIVISION

3)$6 3)$6.36 3)$1.56 3)$0.93 3)$3.09

Divide in decimals just as in United States money.

When we divide a decimal by a whole number, the decimal point in the quotient comes in the same column as the decimal point in the dividend.

Divide and prove your work :

1. 2)4.8 2).48 6)7.2 6).72 5)1.25
2. 7)2.94 8)1.76 3)21.6 3)2.16 4)1.36
3. 4)4.84 4).484 9)6.39 6)6.54 6).654

7)7 tenths 1 what? 7).7 7)7 hundredths 1 what? 7) 07

In dividing .07 by 7, we must write a 0 in the tenths' place to show that there are no tenths in the quotient.

4. 6).12 8).24 9).27 4).28 8).72
5. .2 ÷ 2 .02 ÷ 2 .002 ÷ 2 .16 ÷ 2 .06 ÷ 2
6. 8)5.6 8).56 8).056 9).54 9).054
7. .1.5 ÷ 5 .15 ÷ 5 .015 ÷ 5 .305 ÷ 5 .035 ÷ 5

	A	*B*	*C*	*D*
8.	7.35 ÷ 7	10.08 ÷ 7	72.99 ÷ 9	31.05 ÷ 9
9.	13.68 ÷ 6	31.05 ÷ 5	35.68 ÷ 7	21.04 ÷ 4
10.	9.38 ÷ 14	20.75 ÷ 25	23.37 ÷ 19	22.41 ÷ 27
11.	10.20 ÷ 15	49.86 ÷ 18	68.04 ÷ 21	6.804 ÷ 24
12.	6.804 ÷ 28	68.04 ÷ 36	6.804 ÷ 10	8680.4 ÷ 240

13. A farm of 25.92 acres is divided into 8 equal fields. What is the number of acres in each field ?

PROBLEMS *Written*

1. A square lot is 6.8 rods long. What is the distance around it?

2. A farm of 16.8 acres was divided into 4 equal fields. How many acres in each field?

3. On a certain street each house lot contains .18 of an acre, and there are 16 lots. What is the area of all the lots?

4. A merchant sold from a piece of dress goods 3.5 yards, 1.25 yards, 2.75 yards, and .5 yards. How many yards did he sell in all?

5. If it takes 2.5 yards to make a waist, how many yards must be bought to make 7 waists?

6. Mr. Fisher had a farm of 99.2 acres. He sold one eighth of it to a neighbor. How many acres did he sell? How many acres had he left?

7. A letter-carrier moves 2.25 feet at every step. How far does he travel in 10 steps? In 100 steps? In 1000 steps?

8. Mrs. Maxwell used 2.75 yards of cloth for a waist, and three times as many yards for a skirt. How many yards did she use in all?

9. A bicycle moves forward 7.3 feet at each revolution. How far does it move in 27 revolutions?

10. The total length of 6 equal pieces of edgestone is 37.8 feet. What is the length of each piece?

11. After selling 3.25 acres of land, I had 17.4 acres left. How many had I at first?

12. What is $\frac{1}{8}$ of .072 of a mile?

13. A man divided $2.82 equally among his six children. What did he give each one?

VOLUME OR CUBIC MEASURE

NOTE. A number of 1-inch cubes should be provided for teaching this topic.

1. A solid 1 inch long, 1 inch wide, and 1 inch high is a *cubic inch.*

How many sides or faces has this solid?

What is their shape? How do they compare in size?

A solid having six equal square sides is a *cube.*

2. With the 1-inch cubes build a solid 2 inches long, 2 inches wide, and 2 inches high.

How many inch cubes are there in this solid?

The *volume* of this cube is 8 cubic inches.

3. Build a solid 3 inches long, 2 inches wide, and 1 inch high.

What is its volume?

How many sides or faces has this solid?

What is their shape? Are they all the same size?

This is a *rectangular solid.*

4. Build a solid 3 inches long, 2 inches wide, and 2 inches high.

How many layers are there?

How many cubic inches in each layer?

What is the volume?

5. Build a solid 4 inches long, 2 inches wide, and 3 inches high.

How many rows in the bottom layer? In the bottom layer there are 2×4 cubic inches.

How many layers? In the whole solid there are 3×8 cubic inches, or 24 cubic inches.

6. Build these solids and find their volumes:

3 in. by 3 in. by 2 in.	6 in. by 2 in. by 3 in.
4 in. by 2 in. by 2 in.	4 in. by 4 in. by 3 in.
5 in. by 2 in. by 3 in.	3 in. by 3 in. by 6 in.

7. How many cubic inches in 1 row of a cube 12 inches long, 12 inches wide, and 12 inches high?

How many rows in 1 layer? Then there are 12×12 cubic inches, or 144 cubic inches in one layer.

How many layers? Then there are 12×144 cubic inches, or 1728 cubic inches in the cube.

A 12-inch cube is a 1-foot cube. How many cubic inches in a cubic foot?

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)

8. How many cubic inches in 2 cubic feet? In 5 cubic feet? In 6 cubic feet? In 10 cubic feet?

9. How many cubic inches in $\frac{1}{2}$ of a cubic foot? In $\frac{1}{4}$ of a cubic foot? In $\frac{1}{6}$ of a cubic foot? In $\frac{1}{8}$ of a cubic foot?

10. Find the volumes of these solids:

5 ft. by 8 ft. by 6 ft.	6 ft. by 7 ft. by 10 ft.
7 ft. by 9 ft. by 12 ft.	8 ft. by 5 ft. by 4 ft.

11. How many cubic feet in a 3-ft. cube?

A 3-ft. cube is a 1-yard cube. How many cubic feet make a *cubic yard?*

12. Learn:

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

13. How many cubic inches in 15 cubic feet?

14. How many cubic feet in 108 cubic yards?

15. If you cut up a 4-inch cube into 1-inch cubes, how many will you have?

16. How many inch cubes can you put in a box 6 inches long, 4 inches wide, and 5 inches deep?

17. What is the volume of a brick 8 inches by 4 inches by 2 inches?

18. In Miss Smith's schoolroom there is a window box 30 inches long, 6 inches wide, and 5 inches deep. How many cubic inches of soil will it hold?

19. A stone step is 6 feet long, 2 feet wide, and 1 foot high. Its volume is —— cubic feet.

20. How many cubic feet in a piece of ice 3 feet long, 2 feet wide, and 2 feet thick?

21. What is the volume of a stick of timber 1 foot wide, 1 foot thick, and 18 feet long?

22. How many cubic feet of earth must be removed in digging a cellar 18 feet long, 15 feet wide, and 9 feet deep?

23. A cistern 4 yards long, 3 yards wide, and 2 yards deep will hold —— cubic yards of water.

24. In planting some shrubbery I dug a trench 16 feet long, 2 feet wide, and 1 foot deep. How many cubic feet of earth did I remove?

25. How many blocks 1 inch long, 1 inch wide, and 1 inch high will it take to build a 6-inch cube? A 7-inch cube?

EXERCISE IN MEASURES *Written*

Express:

1. 576 inches as feet.
2. 576 feet as inches.
3. 576 feet as yards.
4. 576 yards as feet.
5. 576 quarts as gallons.
6. 576 gallons as quarts.
7. 576 months as years.
8. 576 years as months.
9. 576 ounces as pounds.
10. 576 pounds as ounces.
11. 576 hours as days.
12. 576 days as hours.
13. 576 square feet as square yards.
14. 576 square yards as square feet.
15. 576 pecks as quarts.
16. 576 quarts as pecks.
17. 576 pecks as bushels.
18. 576 bushels as pecks.
19. 576 cents as dollars.
20. 576 dollars as cents.
21. 576 seconds as minutes.
22. 576 minutes as seconds.
23. 576 weeks as days.
24. 576 days as weeks.
25. 576 rods as miles.
26. 576 miles as rods.

Find the cost of:

1. 2 gallons, 3 quarts of milk at 32 cents a gallon.
2. 3 bushels, 2 pecks of potatoes at $1.20 a bushel.
3. 2 pounds, 8 ounces of butter at 32 cents a pound.
4. 9 inches of ribbon at 60 cents a yard.
5. $8\frac{3}{4}$ yards of edging at 28 cents a yard.
6. $12\frac{3}{4}$ bushels of corn at 56 cents a bushel.
7. $5\frac{3}{8}$ yards of cloth at $1.04 a yard.
8. $4\frac{5}{6}$ dozen chairs at $18.60 a dozen.
9. 84 balls of twine at 40 cents a dozen.

BILLS AND RECEIPTS

BOSTON, April 27, 1910.

Mr. JOHN R. DAVIS

Bought of ALBERT S. PETERSON

1 lb. Coffee	@ $0.38	$	38		
10 lb. Sugar	@ .06		60		
1 bag Flour	@ .90		90	$1	88
Received payment, ALBERT S. PETERSON.					

In the above bill

Who was the buyer? From whom did he buy?

When did he buy? What did he buy?

What did each article cost him?

What did all his purchases cost him?

What shows that the bill has been paid?

The person who buys is the *debtor*. He owes something.

The person who sells is the *creditor*. He is one to whom something is owed.

If Elizabeth sells four paper dolls to Caroline, who is the debtor?

Who is the debtor when your father buys a barrel of flour at the grocer's?

Thomas owes Arthur twenty-five cents for a ball. Who is the debtor? Who is the creditor?

NEW YORK, May 13, 1910.

Mrs. A. P. WATSON

Bought of MARSH & STEVENS

April 6	2 doz. Straw Hats	@	$0.85 each
April 15	3½ doz. Buttons	@	.32 per doz.
May 13	75 pieces Ribbon	@	.48
" "	15½ yd. Lace	@	1.38

In this bill who is the debtor? How do you know?
Who is the creditor? How do you know?
What was bought?
Complete the items, and find the amount of the bill.

Make out bills for the following sales, using the name of some schoolmate as buyer and your own name as seller:

1.

3 locks @ $0.37.
6 pair hinges @ $0.08.
2 locks @ $1.75.
1 level @ $0.80.

2.

5 gal. naphtha @ 16¢.
3 pt. oil @ 20¢.
8 washers @ 2¢.
6 ft. hose @ 15¢.

3.

2½ lb. coffee @ $0.38.
2 pckg. raisins @ $0.12.
2 pckg. cereal @ $0.12½.

4.

8½ lb. lamb @ $0.24.
7¾ lb. veal @ $0.20.
½ bu. potatoes @ $0.80.

5.

10 yd. linen crinoline @ 23¢.
2 gr. dress fasteners @ 35¢.
6 spools silk @ 19¢.

6.

12¾ yd. gloria silk @ $0.60.
3½ yd. black taffeta @ $0.90.
12 rolls tape @ $0.02.

Make out bills for the following sales:

1. Buyer, Albert S. Harper. Seller, Martin P. Baker. Goods: 2 pairs of shoes at $3 per pair, 1 pair of slippers for 75 cents, 3 pairs of rubbers at 40 cents per pair, and 6 pairs of shoe lacings at 3 cents per pair.

2. Make out John Y. Mason's bill for milk purchased from Samuel H. Butler for August, 1910. Mr. Mason took 1 quart every day at 8 cents per quart.

3. On Oct. 19, 1910, Mr. Henry R. Simms purchased from Kittredge and Smith 8 lb. of nails at 4 cents per pound, 3 papers of screws at 35 cents per paper, and 2 saws at $1.13 each.

4. Henry M. Varney sold on Feb. 20, 1910, to James T. Perkins, 2 lb. of coffee at 36 cents, 3 lb. of tea at 52 cents, 20 lb. of sugar at 5 cents, 5 gallons of kerosene at 15 cents.

5. George R. Farmer sold his neighbor, William H. Driver, 17 sheep at $3.50 each, 9 pigs at $2.50 each, 34 hens at $0.50 each, and a calf for $7.

6. Imagine that you sell a geography, an arithmetic, a reader, and a spelling book to one of your schoolmates. Make out the bill.

7. Make out a bill for two articles purchased at a shoe store.

8. Make out a bill for three articles purchased at a furniture store.

9. Make out other bills for goods purchased at different stores, using the advertisements in the daily paper for prices.

MISCELLANEOUS PROBLEMS *Oral*

1. Malcolm had 27 doves. He sold $\frac{1}{3}$ of them to Henry and $\frac{1}{9}$ to Carl. How many did he sell?

2. Harry attended school $\frac{8}{9}$ of the year. There are 36 weeks in the school year. How many weeks was he absent?

3. Take $\frac{5}{6}$ of 54 from 50.

4. Multiply $\frac{1}{6}$ of 24 by $\frac{1}{3}$ of 36.

5. Mr. Allen's farm contains 30 acres. Mr. Mack's farm is $1\frac{1}{3}$ times as large. How many acres in Mr. Mack's farm?

6. I had \$72. After spending $\frac{5}{8}$ of it, how many dollars had I left?

7. When a bushel of quinces costs \$2.40, what is a peck worth?

8. What is land worth an acre, when I can buy a quarter of an acre for \$30?

9. A farmer raised 40 bushels of potatoes. He sold $\frac{5}{8}$ of them for \$2 a barrel. How much money did he receive for them?

10. In one year John spent \$1.00 for school books. The next year he spent $\frac{3}{4}$ as much. How much did he spend in both years?

11. If \$60 is all of my money, what is $\frac{1}{5}$ of it?

12. If \$60 is $\frac{1}{5}$ of my money, what is the whole of it?

13. A farmer has 60 sheep. $\frac{1}{5}$ are in the barn, and the rest in the pasture. How many in the pasture?

14. If coal is \$8 a ton, what are $3\frac{3}{4}$ tons worth?

MISCELLANEOUS PROBLEMS *Written*

1. Laura gains 97 credits in geography, 98 credits in spelling, 85 credits in arithmetic, and 75 credits in language. What is her average mark?

2. Mr. W. walks across the continent from Boston in 100 days. It is 2500 miles. How many miles does he average a day?

3. A schoolhouse has 2 floors and 6 rooms on a floor. There are 48 seats in each room. How many seats for pupils?

4. It takes 8 screws to fasten a school desk to the floor, and 5 to fasten a chair. How many screws to fasten 48 desks and chairs?

5. A cheese weighing 13 pounds was sold for $2.34. What was the rate per pound?

6. I bought 2 books at $1.25 each, and 1 book for 85 cents. What change did I receive from two 2-dollar bills?

7. A fruit vender bought 36 bunches of bananas at $0.65 a bunch. Six bunches spoiled. He sold the rest at $0.90 a bunch. How much did he gain?

8. A man's house lot is 60 feet wide and 60 feet deep. It is 18 cents a square foot. How much is it all worth?

9. A furniture dealer had 24 chairs. He sold 1 dozen at $6.50 each, and the rest at $5.75 each. What did he receive for all?

10. Bought 17 acres of land for $850. Sold 9 acres at $60 an acre, and the rest at $55 an acre. What was the gain?

11. Two boxes of lemons cost \$9. What will 12 boxes cost?

12. John raised 180 chickens. He sold $\frac{7}{12}$ of them at 25¢ apiece. How much did he receive for them?

13. State creamery butter is bought for 33 cents a pound, and sold for 38 cents a pound. How much is gained on 85 pounds?

14. Howard earns \$0.50 a day, and his brother \$0.75 a day. How much will they both earn in four weeks?

15. What will a man save a year who puts in the bank each month $\frac{1}{5}$ of his monthly wages of \$53.50?

16. A school committee paid \$773.55 for 27 work benches for manual training. What was the cost of each bench?

17. A fire engine weighs 6500 pounds. The driver weighs 170 pounds and the engineer 167 pounds. Three horses draw the engine. What weight does each horse pull?

18. A bushel of oats weighs 32 pounds. How many bushels are there in a carload weighing 15,200 pounds?

19. Bought a house for \$3789. Paid \$137.40 for repairs, and \$39.86 for taxes. What did all cost me?

20. Mr. Smith owned a ranch of 17,658 acres. Mr. Jones had a ranch of 12,462 acres. Mr. Smith sold 5680 acres to Mr. Jones. How many acres did Mr. Smith then have? How many acres did Mr. Jones have?

21. The poet Whittier was born in 1807. How old was he at the breaking out of the Civil War in 1861?

22. Mr. Taylor paid his chauffeur $60 a month, and paid $35 more for repairs. How much did he pay out in a month? How much in 6 months?

23. A 10-lb. basket of Catawba grapes is 25¢. What is the cost of 144 baskets?

24. Each week-day a boy delivers 58 papers. How many will he deliver in 4 weeks?

25. My gas bill for December was $3.21. This was $0.08 more than for November. How much was the bill for November? How much was it for the two months?

26. Mr. Atwood has paid a house rent of 22 dollars a month for 7 years. How much has he paid in all?

27. John's wages are 30 dollars a month. Each month he pays 12 dollars for his board, 2 dollars for car fares, and 3 dollars for clothes. How much can he save in a year?

28. A man bought a house for $4200 and sold it for $\frac{1}{6}$ more than it cost. How much did he sell it for?

29. How many times is 97 contained in 141,620?

30. A lot of land cost 552 dollars. On it was built a house costing 3600 dollars, a barn for 865 dollars, and a fence for $57.85. What was the cost of all?

31. Henry lives .58 of a mile from school. How far does he walk in a week, if the school has 2 sessions a day on 5 days of the week?

32. Mr. A.'s house lot is 68.4 feet long. Mr. B.'s 70.8 feet. Mr. C.'s 75.6 feet. Mr. D.'s 60.5 feet. How many feet long are the four lots?

PART III

NOTATION AND NUMERATION

1. How many units make 1 ten? How many tens make 1 hundred? How many hundreds make 1 thousand?

2. The middle 3 in the number 333 represents how many times as many units as the right-hand 3?

3. The left-hand 3 represents how many times as many units as the right-hand 3.

Each figure in a number has a value determined by its place in the number.

4. Compare the value of the 2's in 22; 202; 220; 2200; 2020; 2002.

5. Using 4's and 0's write a number in which one 4 represents one hundred times as many as the other 4.

Separate into groups, and read:

6. 8067	11. 20387	16. 480465	21. 1378543
7. 9350	12. 58706	17. 896302	22. 5490876
8. 7006	13. 93042	18. 107069	23. 9040732
9. 8360	14. 10087	19. 316400	24. 27438564
10. 6040	15. 80649	20. 300602	25. 764312857

26. When we separate numbers into groups of three figures each, what is the right-hand group called? The next group to the left? The next group?

Write in figures:

1. Three thousand forty.
2. Seventeen thousand nine hundred twenty-six.
3. Sixty thousand six hundred six.
4. One hundred thirty-nine thousand.
5. One hundred thousand, thirty-nine.
6. Three hundred four thousand one hundred ten.
7. Eight hundred twenty thousand twenty-four.
8. One million two hundred twelve thousand.
9. Three million forty-six thousand seventeen.
10. Two hundred sixty-seven million eight hundred four thousand seventy-six.

ROMAN NOTATION AND NUMERATION

Letters used	I	V	X	L	C	D	M
Values	1	5	10	50	100	500	1000

By combining these letters we can express any number by following these rules:

I. When a letter is followed by the same letter or by one of less value, add the values of the letters. Thus, XX = 20; XIII = 13.

II. When a letter is followed by one of greater value, subtract the letter of less value from the letter of greater value. Thus, IX = 9; XL = 40.

Read:

1. XIX XXXVII LXV CIV DC

Write in Roman notation:

2. 8 14 25 43 52 66 78 81 99

DRILL IN FUNDAMENTAL PROCESSES

NOTE. Each exercise should begin with a short, rapid oral drill in the fundamental processes. This daily drill should be continued until accuracy and facility render such work unnecessary.

ADDITION *Oral*

Add 2 to each number:

3	1	5	2	7	0	4	8	6	9

Add 4; 6; 8; 1; 3; 9; 5; 7.

Addition is the process of uniting two or more numbers into one number.

The *sum* or *amount* is the result of addition.

DRILL TABLE

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
1.	35	28	36	52	61	44	70	86	91	60
2.	20	12	78	37	53	62	45	71	87	92
3.	93	21	13	79	38	54	63	46	72	88
4.	10	30	22	14	80	39	55	64	47	73
5.	74	94	31	23	15	81	48	56	65	29
6.	98	59	40	32	24	16	82	95	57	66
7.	89	75	67	41	33	25	17	83	49	58
8.	99	68	76	50	42	34	26	18	84	97
9.	69	96	90	77	51	43	11	27	19	85

Add 2 to each number; add 3; 4; 5; 6; 7; 8; 9.

Add 20 to each number; add 30; 40; 50; 60; 70; 80; 90.

Give the sum of each number and any number of two figures. Thus, 35 + 78. This means 35 + 70 + 8. Think 35, 105, 113. Say 113.

Find the sum of each column. Of each row.

ORAL PROBLEMS

1. Miriam used her weekly allowance as follows: 7 cents for candy, 2 cents for a pencil, 6 cents for flower seeds, 5 cents for a soda, and 5 cents for the school savings bank. How much was her weekly allowance?

2. At the playground 15 boys enter the potato race, 12 the three-legged race, and 9 the running race. How many boys in the three races?

3. How much did it cost Sarah to go to the picnic, if she spent 20 cents for car fares, 5 cents for lemonade, 15 cents for a steamer ride, and 10 cents on the merry-go-round?

4. Mr. Kennedy buys Harold a knife for 25 cents, Frank a box of crayons for 20 cents, and Alice a doll for 50 cents. How much does he pay for all?

5. Mrs. Hovey canned 16 jars of blueberries, 9 jars of raspberries, 11 jars of strawberries, and 8 jars of cherries. How many jars in all?

6. We sold from our garden 6 bushels of pears, 2 bushels of plums, 13 bushels of apples, and 3 bushels of grapes. How many bushels of fruit did we sell?

7. John bought a hat for 3 dollars, a coat for 12 dollars, a pair of shoes for 4 dollars, and collars and cuffs for 1 dollar. How much did he pay for all?

8. A farmer brings us a dozen ears of corn for 12 cents. two boxes of blueberries for 25 cents, and a dozen eggs for 40 cents. How much do all cost?

9. Fred entered the primary school when he was 6 years old. He spent 3 years in the primary school, 5

years in the grammar school, 4 years in the high school. How old was he when he graduated from the high school?

10. At the settlement house there are 13 girls in the dressmaking class, 17 in the millinery class, and as many in the cooking class as in both the other classes. How many in the cooking class? How many in the three classes?

SUBTRACTION

Oral

Take 4 from:

10	13	16	19	11	14	17	12	15	18

Take 3; 6; 9; 1; 5; 8; 2; 7.

Subtraction is the process of taking one number from another, or of finding the difference between two numbers.

The *minuend* is the number from which something is taken.

The *subtrahend* is the number taken from the minuend.

The *remainder* or *difference* is the result of subtraction.

Take 2 from each number in the table on page 227. Take 3; 4; 5; 6; 7; 8; 9.

From 100 take each of the numbers in the table. Thus, $100 - 57 = 100 - 50 - 7$. Think 100, 50, 43. Say 43.

Give differences between any number of two figures and the numbers in the table.

ORAL PROBLEMS

1. Six pupils out of a class of 40 were not promoted. How many were promoted?

2. Frank earned 25 cents on Monday and 9 cents less on Tuesday. How much did he earn on Tuesday?

3. Out of a flock of 37 chickens, a hawk caught 3 and 8 died. How many were left?

4. Joe sells 43 papers and Sam 15 less. How many does Sam sell?

5. A party of 45 people started to climb Mt. Adams; 19 went half way up. How many reached the top?

6. In a box of 3 dozen eggs 9 were broken. How many were good?

7. There were 30 men and 50 women in a hospital. How many patients were there after 40 were discharged as cured?

8. What is the change from a 50-cent piece given in payment for oranges for 18 cents, tomatoes for 8 cents, and lettuce for 5 cents?

9. A party of 50 children went on a picnic down the river; 18 of them went on the boat, and the rest on the cars. How many went on the cars?

10. I gave a two-dollar bill to pay for a 75-cent cap. What was my change?

MULTIPLICATION *Oral*

Multiply by 2:

3	7	5	0	9	2	4	6	8

Multiply by 3; 4; 5; 6; 7; 8; 9; 10; 11; 12.

Multiplication is the process of combining several *equal* numbers into one number.

The *multiplicand* is one of the equal numbers. This is the number to be multiplied.

The *multiplier* is the number by which we multiply. It shows how many times the multiplicand is to be taken.

The *product* is the result of multiplication.

Multiply by 4 the numbers in the table on page 227. Thus, 68 multiplied by 4: $68 = 60 + 8$. $4 \times 60 = 240$; $4 \times 8 = 32$; $240 + 32 = 272$.

Multiply by 2; 3; 5; 6; 7; 8; 9.

ORAL PROBLEMS

1. If a steamer makes a 2-mile trip 6 times every day, how many miles does it run in a week?

2. If 2 pears are sold for 5 cents, what will 20 cost?

3. What will Ella's vacation of 3 weeks cost her, if she pays 8 dollars a week for board and 4 dollars each week for laundry and other expenses?

4. What will 24 oranges and 12 lemons cost at 25 cents a dozen?

5. How many children in the march if there are 4 lines and 15 children in each line?

6. What must I pay for 5 melons at 6 cents apiece and 2 boxes of berries at 12 cents a box?

7. Mr. Hubbard brings vegetables to the city twice a week. He lives 7 miles away. How many miles does he travel each week?

8. What will $\frac{1}{2}$ dozen bananas and 4 apples cost at 3 cents apiece?

9. How much will 5 packages of cereal cost at 15 cents a package?

10. Grace sends 8 Christmas cards. If she pays 5 cents for each card, 1 cent for each envelope, and puts a 2-cent stamp on each envelope, how much does she pay for all?

DIVISION *Oral*

Division is the process of finding how many times one number is contained in another number, or of finding one of the equal parts of a number.

The *dividend* is the number to be divided.

The *divisor* is the number by which we divide.

The *quotient* is the result of division.

Divide by 2 the numbers in the table on page 227; divide by 3; 4; 5; 6; 7; 8; 9; 10; 11; 12.

ORAL PROBLEMS

1. I have 84 pounds of salt. How many 7-pound packages can I make from it?

2. How many feet long is a steel rod that measures 108 inches?

3. How many berries at 12 cents a box must Ralph sell to earn a football worth $1.20?

4. Mrs. Miller sold the grocer 2 dozen eggs at 30 cents a dozen and took her pay in sugar at 6 cents a pound. How many pounds did she receive?

5. John had 50 cents. He lost 8 cents, and spent the rest for firecrackers at 6 cents a bunch. How many bunches did he buy?

6. Mr. Fisher earns 2 dollars a day. How long will it take him to earn 72 dollars?

7. How many calls does a district nurse average a week if she makes 160 in 4 weeks?

8. Carrie pledged \$1 to the children's aid society. How long will it take her to pay it, if she earns 15 cents every week and her mother gives her 5 cents every week?

9. Lucy spends 10 days of her vacation at the seashore, 14 days in the country, and 4 days at home. How many weeks is her vacation?

10. Eight girls have a sale of fancy articles. They pay \$2 for advertising and \$3 for other expenses. They take in \$61. What is each girl's share of the profits?

UNITED STATES MONEY *Oral and Written*

1. Read: \$4.00; \$6.00; \$2.40; \$1.08; \$0.27; \$0.20; \$0.05.

2. How many cents make one dollar? How many cents in \$2.00? \$3.00? \$2.50? \$1.67? \$1.07?

3. How many dollars in 500 cents? 600 cents? 800 ¢? 1000 ¢?

4. Write as dollars and cents: 125 cents; 260 cents; 308 ¢; 203 ¢.

5. Write with the dollar sign: 25 cents; 60 cents; 4 ¢; 1 ¢.

Remember in addition and subtraction to place the decimal points one under another. Why?

6. Add: \$8.04, \$3.17, \$2.80, \$7.05, \$9.62.

7. Add: \$0.08, \$0.56, \$0.47, \$0.40, \$0.83, \$0.05.

8. Add: \$3.00, \$3.30, \$3.03, \$0.30, \$0.33, \$0.03.

9. Take \$5.19 from \$8.43.
10. From \$0.87 take \$0.60.
11. Take \$4.70 from \$6.75.
12. From \$0.50 take \$0.08.
13. Take \$3.08 from \$4.00.
14. From \$0.90 take \$0.84.
15. Take \$2.25 from \$5.00.
16. From \$2.00 take \$0.05.
17. Take \$3.80 from \$6.20.
18. From \$6.25 take \$3.80.

Multiply:

19. \$5.12	20. \$3.02	21. \$1.05	22. \$0.12	23. \$0.18
4	3	4	3	6
24. \$0.60	25. \$0.25	26. \$1.75	27. \$0.02	28. \$0.02
8	4	2	5	3

Divide:

29. 2)\$3.12	30. 3)\$1.56	31. 4)\$4.20	32. 3)\$0.75
33. 4)\$4.80	34. 9)\$1.08	35. 5)\$1.50	36. 3)\$0.09
37. 8)\$0.24	38. 5)\$2.00	39. 6)\$4.20	40. 7)\$0.84

DRILL IN ADDITION AND SUBTRACTION *Written*

Add, and test your work:

1.	2.	3.	4.	5.
48	184	1789	11,829	235,807
79	276	1642	63,476	176,943
96	381	8959	78,259	379,870
85	768	7749	51,987	135,560
58	295	9801	21,684	874,396
78	429	7395	30,906	792,381
99	973	4728	15,897	547,869

6.	7.	8.	9.	10.
$0.74	$678	$0.87	68	96
.08	7	37.56	706	8453
.76	8	.17	9083	473,584
.09	803	.08	67,384	6708
.58	49	9.04	307	403
.29	28	.28	26,308	27
.90	7	57.01	49	8

Find the difference, and test your work:

1. $34.65 – $6.80
2. 7623 – 930
3. $12,500 – $6700
4. $58.34 – $20.70
5. 8542 – 3719
6. 32,706 – 10,834
7. $43.52 – $17.56
8. 3627 – 2864
9. 17,280 – 12,780
10. $27.90 – $18.25
11. 5625 – 4096
12. 35,060 – 12,087
13. $34.20 – $15.05
14. 8070 – 4308
15. 67,324 – 34,827
16. From 8000 take 8; 80; 800; 88; 880; 808; 888.

	Minuend	Subtrahend	Remainder		Minuend	Subtrahend	Remainder
17.	?	$6.95	$1.38	18.	722	266	?
19.	$8.00	$3.69	?	20.	?	392	827
21.	$5.23	?	$3.65	22.	648	?	209
23.	?	$5.26	$0.79	24.	900	253	?
25.	$4.60	$1.87	?	26.	?	539	278
27.	$9.05	?	$3.88	28.	753	?	167

NOTE. There should be frequent dictation of numbers to be added and subtracted.

PROBLEMS *Written*

1. One lot of cloth contained 850 yards, another 1285 yards, and a third 1460 yards. How many yards in all?

2. An iceman cut 2250 tons of ice. How much had he left after selling 1780 tons?

3. A farmer raised 375 bushels of corn in one year, and in the next year 250 bushels more than in the first year. How many bushels did he raise in both years?

4. Mr. Morse bought a house for $2800, and another for $3650. He sold both for $7290. How much did he gain?

5. Mr. Cook paid $1096 for a house lot and on it built a house for $3265. He sold both at a gain of $475. How much did he receive?

6. Mr. Wright's bank account showed a deposit of $1296 on Monday morning. On Monday he deposited $582 and withdrew by check $653; on Tuesday he deposited $498 and withdrew $379; on Wednesday he deposited $889 and withdrew $1498; on Thursday he deposited $756. What were his total deposits? How much had he to his credit on Friday morning?

7. A butcher's charges against a family for one week were $1.37, $0.69, $2.08, $0.87, $1.75, and $0.98. What change ought he to give back if he is given a ten-dollar bill in payment?

8. Find the cost of a desk for $27.50, a chair for $9.75, a table for $12, a bookcase for $18.50, and a set of reference books for $67.80.

9. James bought a geography for \$1.15, an arithmetic for \$0.65, a grammar for \$0.48, a block of paper for \$0.08, and a pencil for \$0.03. How much less than \$3.00 did he pay for all?

DRILL IN MULTIPLICATION *Written*

$3 \times 4 \times 5 = ?$ $4 \times 5 \times 3 = ?$ $5 \times 3 \times 4 = ?$

The order in which numbers are multiplied together does not affect the product.

Multiply, selecting your multipliers so as to make your work as easy as possible:

1. $18 \times 50 \times 2$	**2.** $20 \times 24 \times 5$	**3.** $25 \times 45 \times 4$
4. $10 \times 36 \times 50$	**5.** $75 \times 26 \times 2$	**6.** $15 \times 19 \times 8$
7. $35 \times 15 \times 4$	**8.** $60 \times 57 \times 20$	**9.** $16 \times 32 \times 5$
10. 308×64	**11.** 876×75	**12.** 963×56
13. 3729×78	**14.** 5087×46	**15.** 7567×75
16. 436×208	**17.** 804×279	**18.** 225×306
19. 506×3468	**20.** 2387×207	**21.** 5682×256
22. 5468×357	**23.** 864×7678	**24.** 546×6807
25. 624×9034	**26.** 504×6327	**27.** 4657×406

28. At \$16.75 each, what will 5 gas stoves cost?

29. What must be paid for 14 hammocks at \$2.98 each?

30. A crate of berries contains 32 quart baskets. How many quarts in 5 lots of 12 crates each?

31. Mr. Howe bought 3 32-quart crates of strawberries at 12 cents a quart and sold them at 15 cents a quart. How much did he make?

32. Mr. Parker raised 17 bushels of pears. He sold 8 bushels at $1.05 a bushel, and the rest at $0.85 a bushel. How much did he receive for them?

33. After buying 6 head of cattle at $65 each, Mr. Turner had $27 left. How much money had he at first?

DRILL IN DIVISION *Written*

Divide, and test your work:

	A	*B*	*C*
1.	$801 ÷ 27	2765 ÷ 44	247,583 ÷ 64
2.	$765 ÷ 34	8327 ÷ 65	627,862 ÷ 75
3.	$896 ÷ 56	6754 ÷ 36	837,921 ÷ 29
4.	$27.95 ÷ 65	46,810 ÷ 84	247,583 ÷ 304
5.	$52.48 ÷ 82	67,632 ÷ 95	507,381 ÷ 409
6.	$34.08 ÷ 76	26,981 ÷ 43	729,843 ÷ 652
7.	$64.86 ÷ 138	48,366 ÷ 54	720,480 ÷ 432
8.	$133.92 ÷ 124	51,302 ÷ 208	837,641 ÷ 751
9.	$528.75 ÷ 225	64,730 ÷ 352	808,732 ÷ 364
10.	$739.44 ÷ 316	90,387 ÷ 525	976,068 ÷ 575

11. At 9 cents a yard Ella paid 45 cents for cloth. How many yards did she buy? (As many yards as 9 is contained times in 45.)

12. Esther paid 72 cents for 6 boxes of raisins. What was that a box? (One box cost ⅙ of 72 cents.)

13. At $6 a cord how many cords of wood can be bought for $912?

14. The grocer paid $702 for 54 barrels of sugar. What was the price per barrel?

15. A lot of land cost $6244. It was divided into 28 lots. What was each lot worth?

16. A stable keeper bought horses at $137 each. He paid $1096. How many did he buy?

17. Three lawn mowers were sold for $19.35. What was that apiece?

COMPARISON OF NUMBERS *Oral*

1. Compare 18 with 6. 18 is 3 times 6.

2. Compare 6 with 18. 6 is $\frac{1}{3}$ of 18.

Compare:

3.	10 with 2	4 with 20	30 with 6	5 with 40	27 with 9
4.	24 with 6	8 with 24	48 with 12	3 with 21	28 with 4
5.	56 with 7	9 with 36	54 with 9	7 with 63	32 with 8

NOTE. This exercise may be extended by comparing the second number in each couplet with the first.

6. A newsboy buys 5 papers for 3 cents. How many does he get for 15 cents?

HINT. Compare 15 cents with 3 cents.

7. Six boxes of raisins cost 75 cents. What will 2 boxes cost?

HINT. Compare 2 boxes with 6 boxes.

8. The grocer sells 4 pounds of sugar for a quarter. How many pounds does he sell for a dollar? For a dollar and a half?

9. Eight bars of soap weigh 36 pounds. What do 2 bars weigh?

10. Chester pays 25 cents for 8 oranges. Two dozen will cost ——.

11. Harriet buys 12 papers of needles for 20 cents. This is how many papers for 5 cents?

12. Mr. Perry pays $49.50 for 15 sheep. What will 5 more cost at the same rate?

13. For 2 cords of wood I paid $13.50. What will 10 cords cost?

DICTATION EXERCISES

1. $24 \div 3, \times 9, \div 12, \times 9, -5, \div 7, +20, \div 3 = ?$
2. $17 + 8, \times 2, +4, \div 6, +3, \times 7, +6, \div 10, \times 5 = ?$
3. $56 \div 8, \times 4, +2, \div 5, \times 7, +3, \div 5, -7, \times 5 = ?$
4. $42 \div 7, \times 9, +6, \div 5, +8, \div 2, -7, \times 9, +7 = ?$
5. $32 \div 4, +7, \div 5, \times 8, +4, \div 7, \times 16, -4, \div 6 = ?$

NOTE. For securing concentration of attention, this form of oral drill is unexcelled if used daily for a few moments. Numbers must be dictated rapidly to make exercise effective.

MISCELLANEOUS PROBLEMS *Written*

1. The following represents the cash receipts of a coal firm for one week:

Kind	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Totals
Furnace	$420.87	$473.19	$296.89	$318.54	$387.53	$464.59	$
Stove	384.60	297.64	372.23	376.53	455.90	278.83	$
No. 1 Nut	297.83	308.07	424.86	565.49	387.37	588.10	$
No. 2 Nut	378.69	420.00	375.50	482.96	300.87	249.50	$
Soft	684.17	367.29	294.73	783.59	462.82	539.42	$
Totals	$	$	$	$	$	$	$

(*a*) Find the amount received each day.

(*b*) Find the amount received for the week.

(*c*) Find the total receipts for each kind of coal for the week.

(*d*) Find the total receipts for all kinds during the week.

2. If 15 books cost $12.75, what is the cost of 1?

3. At $12.75 each, what will 15 plows cost?

4. At $0.75 a bushel, what is the value of the corn raised on 26 acres, if each acre produces 37 bushels?

5. A bushel of corn in the ear weighs 70 pounds. How many bushels are there in a car of 15,750 pounds?

6. How many times at $2 a time must the blacksmith shoe the farmer's horse to pay for 5 bushels of potatoes at $0.50 a bushel and 2 barrels of apples at $1.75 a barrel?

7. Lime absorbs $2\frac{1}{4}$ times its weight in water. How many pounds of water will be required to slake 6 casks of lime of 240 pounds each?

8. What will 30 acres of land cost at the rate of 6 acres for $336?

9. Mr. Clark buys of Mr. Hodge 3 acres of land at $84 an acre. Mr. Hodge buys of Mr. Clark 18 tons of hay at $16 a ton. In order to settle the account how much money must be paid, and who must pay it?

10. A farmer had $440. With $192 he bought 24 sheep. With the rest he bought 4 cows. What did each sheep cost? Each cow?

11. A coal dealer paid $900 for coal at $ 5 a ton. He sold it at $6.50 a ton. How much did he gain?

12. A fruit dealer bought 36 baskets of peaches for $30.60. He sold 27 baskets at $0.95 each and the rest at $1.15 each. How much did he gain?

13. By selling 42 acres of timber land for $2148 a man gained $804. What did the land cost him an acre?

14. The railway fare to a place 18 miles away is 54 cents. How far away is a place the fare to which is 72 cents?

15. On a lot costing $896 there was built a house costing $4\frac{1}{2}$ times as much. What was the cost of the entire property?

16. What is the cost of 6 cases of straw hats, each case containing 12 dozen, and each hat costing 79 cents?

17. Mr. Adams bought an automobile for $975, paying $450 in cash, and agreeing to pay the rest at $75 a month. How long did it take him to pay for it?

18. A 36-pound tub of butter was bought for $9.90 and retailed at 32 cents a pound. Did the dealer lose or gain? How much?

19. A cask of 84 gallons of molasses cost $37.80. Seven gallons leaked out and the rest was sold at 48 cents a gallon. Did the grocer gain or lose? How much?

20. The pupils of the Adams school spent $10.65 for their school garden. They bought 9 dozen bulbs at 35 cents a dozen and 15 shrubs. How much did each shrub cost?

FACTORS *Oral*

When two or more numbers are multiplied together, the result is a *product.*

The numbers multiplied together are the *factors* of the product. Thus, 3 and 5 are the factors of their product, 15. 2, 3, and 5 are the factors of 30.

Any product is exactly divisible by any of its factors.

Find the missing factors:

1. ___ × 9 = 54 9 × ___ = 63 ___ × 6 = 72
6 × ___ = 42

2. ___ × 5 = 30 7 × ___ = 56 ___ × 7 = 35
4 × ___ = 32

3. ___ × 7 = 63 3 × ___ = 36 ___ × 9 = 72
8 × ___ = 96

4. ___ × 12 = 84 6 × ___ = 54 ___ × 12 = 144
12 × ___ = 132

The process of separating a number into its factors is *factoring.*

Separate into two factors:

5. 14 22 33 45 81 42 70 63 66 35

6. 56 64 21 32 72 84 54 96 55 108

7. Separate 24 into as many groups of two factors as you can. Thus, 2 × 12, 3 × 8, 4 × 6.

Name all the groups of two factors that make:

8. 16 28 20 40 50 80 72 90 84 42

9. 18 30 48 60 32 96 36 64 90 100

Separate each of these numbers into three factors:

10.	12	18	27	30	28	50	63	45	70	100
11.	32	40	66	48	20	72	54	60	56	144

Name the two equal factors of:

12.	4	9	25	49	81	64	144
13.	100	900	2500	4900	8100	3600	400

NOTE. Every number, of course, may be said to be made up of two factors consisting of itself and 1, but in giving the factors of a number the number itself and 1 are not generally included.

Numbers that can be separated into factors are *composite* numbers.

14. Name the composite numbers below 20.

Numbers that cannot be separated into factors are *prime* numbers.

15. Name the prime numbers below 20.

A *prime factor* is a prime number used as a factor.

16. What are the prime factors of 72?

2	72
2	36
2	18
3	9
	3

Dividing 72 by the prime number 2, we get 36; dividing 36 by 2, we get 18; dividing 18 by 2, we get 9; dividing 9 by the prime number 3, we get 3. All these divisors and the last quotient are prime numbers, and their product is 72. $2 \times 2 \times 2 \times 3 \times 3 = 72$. Therefore, the prime factors of 72 are 2, 2, 2, 3, and 3.

NOTE. The above example is inserted for illustration. The method given may be used if necessary, but pupils should be taught to find prime factors by inspection whenever possible. Thus, 72 may be thought of as 8×9; then 8 may be thought of as $2 \times 2 \times 2$, and 9 as 3×3.

Name the prime factors of:

17. 18 20 24 30 32 36 45 48 60 56

18. 84 50 66 80 90 64 81 63 54 100

GREATEST COMMON DIVISOR *Oral*

A number that will exactly divide a given number is an *exact divisor.*

1. Name a number that will exactly divide both 6 and 9; 8 and 12; 10 and 15; 12 and 18.

A number that will exactly divide two or more numbers is a *common divisor.*

2. Name the greatest number that will exactly divide 12 and 16; 18 and 24; 24 and 32; 30 and 40.

The greatest number that will exactly divide two or more numbers is their *greatest common divisor* (*g. c. d.*).

The greatest common divisor of two or more numbers is often called their greatest common factor.

Name the greatest common divisor of:

3. 16, 20	4. 22, 33	5. 18, 27	6. 27, 36
7. 14, 35	8. 32, 40	9. 11, 15	10. 36, 48
11. 35, 42	12. 20, 35	13. 28, 42	14. 63, 72
15. 56, 63	16. 45, 54	17. 28, 49	18. 24, 32
19. 6, 9, 12	20. 8, 12, 20	21. 12, 15, 18	22. 10, 15, 25
23. 15, 18, 30	24. 18, 24, 30	25. 12, 15, 21	26. 21, 28, 35
27. 18, 27, 45	28. 22, 33, 55	29. 24, 32, 40	30. 24, 36, 60

LEAST COMMON MULTIPLE *Oral*

When two or more whole numbers are multiplied together, their product is a *multiple* of each of the numbers. Thus, 15 is a multiple of both 3 and 5.

Any multiple of a number is exactly divisible by the number.

1. Name all the factors whose product is 12. Thus,

$$2 \times 6, \quad 3 \times 4, \quad 2 \times 2 \times 3.$$

12 is a *common multiple* of 2, 3, 4, and 6, and is exactly divisible by each of them.

24, 36, 48, 60 are also common multiples of 2, 3, 4, and 6.

As 12 is the *least multiple* that contains 2, 3, 4, and 6, it is their *least common multiple* (*l. c. m*).

The least common multiple of two or more numbers is the least number that is exactly divisible by each of the numbers.

What is the least common multiple of 5 and 6? Of 4 and 6? Of 3 and 9?

Find the least common multiple of:

2. 4 and 8	**3.** 7 and 8	**4.** 6 and 8	**5.** 6 and 9
6. 8 and 9	**7.** 8 and 12	**8.** 4 and 10	**9.** 6 and 10
10. 9 and 12	**11.** 6 and 15	**12.** 5 and 15	**13.** 8 and 24
14. 2, 4, 8	**15.** 4, 8, 16	**16.** 2, 3, 4	**17.** 3, 4, 6
18. 2, 4, 5	**19.** 3, 6, 9	**20.** 4, 5, 10	**21.** 2, 5, 20
22. 3, 6, 5	**23.** 4, 9, 36	**24.** 4, 5, 6	**25.** 3, 4, 9
26. 4, 6, 8	**27.** 6, 9, 12	**28.** 4, 8, 12	**29.** 3, 4, 5

CANCELLATION *Oral and Written*

$60 \div 20 = 6 \times 10$ divided by 2×10.

What common factor is found in both dividend and divisor?

By taking out the common factor 10 from both dividend and divisor, is the quotient changed?

What is the quotient of $60 \div 20$? Of $6 \div 2$?

Dividing both dividend and divisor by the same number does not affect the quotient.

Tell what common factors may be taken out of, or canceled from, both dividend and divisor:

1. 12×3 divided by 5×3
2. 10×3 divided by 10×2
3. 10×8 divided by 3×8
4. 21×7 divided by 4×7
5. 11×5 divided by 11×3
6. 11×12 divided by 12×3

7. In the expression 12×10 divided by 8×3 what common factors will divide both dividend and divisor? What in 14×10 divided by 5×7?

The process of dividing both dividend and divisor by the same number, or of striking out factors common to both dividend and divisor, is *cancellation.*

8. Divide 16×35 by 4×7.

$$\frac{\overset{4}{\cancel{16}} \times \overset{5}{\cancel{35}}}{\underset{1}{\cancel{4}} \times \underset{1}{\cancel{7}}} = \frac{20}{1} = 20$$

Write the dividend above a line and the divisor below it. Divide the 16 in the dividend and the 4 in the divisor by the common factor 4, writing the quotient 4 over the 16, and the quotient 1 under the 4. In like manner divide both dividend and divisor by the common factor 7.

The factors remaining in the dividend are 4 and 5, and their product is 20. The factors remaining in the divisor are 1 and 1, and their product is 1. $\frac{20}{1} = 20$.

In practice we do not write the 1's. We always remember, however, that when a factor is canceled 1 is understood to take its place.

9. Divide 56×18 by 8×9.

10. What is the quotient of 42×10 divided by 7×5?

11. How many times is 4×3 contained in 6×8?

Find quotients:

12. $\frac{4 \times 12}{2 \times 6}$ 13. $\frac{6 \times 25}{3 \times 5}$ 14. $\frac{20 \times 30}{15 \times 10}$ 15. $\frac{18 \times 30}{6 \times 5}$

16. $\frac{27 \times 18}{9 \times 3}$ 17. $\frac{28 \times 35}{4 \times 7}$ 18. $\frac{15 \times 50}{5 \times 5 \times 5}$ 19. $\frac{60 \times 30}{5 \times 12}$

20. $(22 \times 18) \div (11 \times 6)$ 21. $(35 \times 42) \div (14 \times 7)$

22. $(35 \times 42) \div (49 \times 6)$ 23. $(63 \times 72) \div (24 \times 21)$

24. $(33 \times 48) \div (12 \times 22)$ 25. $(54 \times 54) \div (6 \times 18)$

26. $(60 \times 27) \div (18 \times 45)$ 27. $(35 \times 84) \div (49 \times 30)$

Divide:

28. $\frac{6 \times 10 \times 15}{25 \times 2 \times 2}$ 29. $\frac{12 \times 15 \times 24}{20 \times 4 \times 18}$ 30. $\frac{9 \times 8 \times 10}{30 \times 2 \times 3}$

31. $\frac{18 \times 30 \times 22}{33 \times 10 \times 9}$ 32. $\frac{50 \times 42 \times 20}{35 \times 25 \times 12}$ 33. $\frac{36 \times 45 \times 27}{18 \times 15 \times 9}$

34. $\frac{11 \times 30 \times 28}{15 \times 22 \times 7}$ 35. $\frac{60 \times 42 \times 54}{9 \times 20 \times 6}$ 36. $\frac{44 \times 56 \times 96}{48 \times 77 \times 16}$

FRACTIONS

A unit is a single thing; as 1 apple.

A fraction is one or more of the equal parts of a unit; as $\frac{3}{4}$ of an apple.

$\frac{3}{4}$ of an apple means that an apple has been divided into 4 equal parts and 3 of these parts taken.

1. In the expression $\frac{2}{3}$ of a yard, what figure shows the number of equal parts into which the unit is divided?

The figure below the line is the *denominator;* it denominates or names the number of parts into which the unit is divided ; it is the *namer.*

2. In the expression $\frac{2}{3}$ of a yard, what figure shows the number of parts taken ?

The figure above the line is the *numerator;* it numerates or tells the number of parts taken ; it is the *numberer.*

The numerator and the denominator are the *terms* of the fraction.

3. Read these fractions and tell what the terms of each fraction show: $\frac{5}{8}$; $\frac{6}{7}$; $\frac{4}{5}$; $\frac{9}{10}$; $\frac{17}{20}$.

4. Write in figures and tell what each fraction means: five sixths; eight ninths; eleven twelfths; thirteen twenty-firsts.

5. Write an expression which will show that something has been divided into nine equal parts and four of those parts taken.

6. Explain $\frac{4}{5}$ of a mile ; $\$\frac{4}{5}$; $\frac{3}{8}$ bu. ; $\frac{3}{4}$ gal.

A unit may also be regarded as a group of things treated as a single thing. Thus, $\frac{3}{4}$ of a dozen oranges means that 12 oranges have been separated into 4 equal groups of 3 oranges each, and that 3 of these groups, or 9 oranges, have been taken.

In studying fractions remember :

First. The only difference between an integer, or whole number, and a fraction is that an integer is a whole thing, while a fraction is part of the whole thing.

Second. The denominator of a fraction simply tells with what kind of things we are dealing; that is, it simply gives a name to the fraction.

Third. The numerator simply tells the number of parts taken.

Fourth. A fraction must always be treated as if it were a whole number.

A *proper fraction* is a fraction whose numerator is less than its denominator; as $\frac{7}{8}$, $\frac{5}{7}$, $\frac{11}{12}$.

An *improper fraction* is a fraction whose numerator is equal to or greater than its denominator; as $\frac{5}{5}$, $\frac{8}{8}$, $\frac{16}{5}$, $\frac{7}{3}$.

7. Write a proper fraction whose denominator is 5; 8; 12; 10; 3.

8. Write a proper fraction whose numerator is 3; 7; 9; 4; 10.

9. Write an improper fraction whose numerator is 7; 6; 4; 3; 5.

10. Write an improper fraction whose denominator is 3; 6; 8; 9; 10.

A *mixed number* is a whole number and a fraction united; as $2\frac{1}{2}$, $3\frac{3}{4}$, $4\frac{5}{9}$.

CHANGING THE FORM OF FRACTIONS

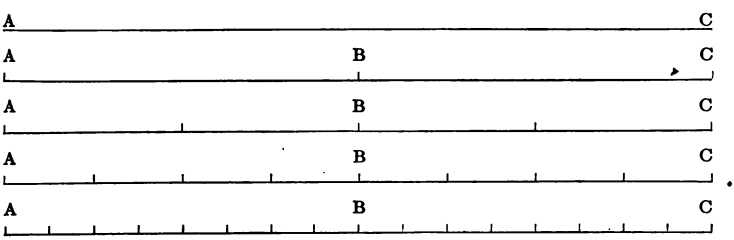
1. Cut from paper a strip 1 inch wide and 12 inches long. Place the ends together and fold into two equal parts. Show that $1 = \frac{2}{2}$.

2. Fold again and crease into four equal parts. Show that $1 = \frac{4}{4}$. Show that $\frac{1}{2} = \frac{2}{4}$.

3. Fold and crease into eight equal parts. 1 = how many eighths? $\frac{1}{2}$ = how many eighths? $\frac{1}{4}$ = how many eighths?

4. Fold another strip into two equal parts. Fold this double strip into three equal parts. 1 = how many sixths? 1 = how many thirds? $\frac{1}{2}$ = how many sixths? $\frac{1}{3}$ = how many sixths? $\frac{2}{3}$ = how many sixths?

To the Teacher: Simple fractions and their equivalents may be shown in this or some other simple manner. The extent to which such work is carried must be determined by the needs of individual pupils. While objective presentation should be used freely, care should be taken not to make pupils dependent on its use. That which is at first a help may easily become a hindrance to progress.



If the line AC be divided into two equal parts, AB is $\frac{1}{2}$ of AC; if divided into four equal parts, AB is $\frac{2}{4}$; if divided into eight equal parts, AB is $\frac{4}{8}$; if divided into sixteen equal parts, AB is $\frac{8}{16}$; that is, $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{8}$, and $\frac{8}{16}$ of the line AC are of equal value, and represent the same thing — the line AB.

Notice, that in changing $\frac{1}{2}$ to $\frac{2}{4}$ we have twice as many parts in the line AC, and also twice as many parts in the line AB. In changing $\frac{1}{2}$ to $\frac{4}{8}$, we have four times as many parts in the line AC, and also four times as many parts in the line AB. In changing $\frac{1}{2}$ to $\frac{8}{16}$, we have eight times

as many parts in the line AC, and eight times as many parts in the line AB.

$$\frac{1\times 2}{2\times 2}=\frac{2}{4} \qquad \frac{1\times 4}{2\times 4}=\frac{4}{8} \qquad \frac{1\times 8}{2\times 8}=\frac{8}{16}$$

In changing $\frac{8}{16}$ to $\frac{4}{8}$, we have one half as many parts in in the line AC, and one half as many parts in the line AB. In changing $\frac{8}{16}$ to $\frac{2}{4}$, we have one fourth as many parts in the line AC, and one fourth as many parts in the line AB. In changing $\frac{8}{16}$ to $\frac{1}{2}$, we have one eighth as many parts in the line AC, and one eighth as many parts in the line AB.

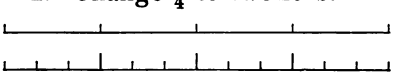
$$\frac{8\div 2}{16\div 2}=\frac{4}{8} \qquad \frac{8\div 4}{16\div 4}=\frac{2}{4} \qquad \frac{8\div 8}{16\div 8}=\frac{1}{2}$$

From this exercise we learn that

Multiplying or dividing both terms of a fraction by the same number does not change the value of the fraction.

CHANGING TO HIGHER TERMS *Oral*

1. Change $\frac{3}{4}$ to twelfths.



$$\frac{3\times 3}{4\times 3}=\frac{9}{12}$$

The fraction $\frac{3}{4}$ shows that the unit has been separated into 4 equal parts and 3 of those parts taken. If we separate the unit into twelfths, or three times as many parts, we have three times as many parts for the numerator. $\frac{1}{4}=\frac{3}{12}$; $\frac{3}{4}=\frac{9}{12}$.

To change a fraction to higher terms, we multiply both terms of the fraction by that number which will give the required denominator.

2. Why must we multiply both terms of the fraction by the same number?

Change:

3. To fourths: $\frac{1}{2}$

4. To sixths: $\frac{1}{2}$ $\frac{1}{3}$ $\frac{2}{3}$

5. To eighths: $\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{4}$

6. To ninths: $\frac{1}{3}$ $\frac{2}{3}$

7. To tenths: $\frac{1}{2}$ $\frac{1}{5}$ $\frac{2}{5}$

8. To twelfths: $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{1}{6}$ $\frac{5}{6}$

9. To fifteenths: $\frac{1}{3}$ $\frac{2}{3}$ $\frac{1}{5}$ $\frac{3}{5}$ $\frac{4}{5}$

10. To sixteenths: $\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{4}$ $\frac{3}{8}$ $\frac{5}{8}$

11. To eighteenths: $\frac{1}{2}$ $\frac{2}{3}$ $\frac{5}{6}$ $\frac{1}{9}$ $\frac{5}{9}$

12. To twentieths: $\frac{1}{2}$ $\frac{3}{4}$ $\frac{2}{5}$ $\frac{4}{5}$ $\frac{7}{10}$

CHANGING TO LOWER TERMS *Oral and Written*

1. Change $\frac{6}{9}$ to thirds.

$\frac{6 \div 3}{9 \div 3} = \frac{2}{3}$

This means change $\frac{6}{9}$ to a fraction with 3 for its denominator.

In order to get 3 for a denominator, we divide 9 by 3. In order not to change the value of the fraction, we must also divide the numerator by 3.

NOTE. If necessary, let pupils show by folding paper or by diagram that $\frac{6}{9} = \frac{2}{3}$.

2. Change to 4ths: $\frac{2}{8}$ $\frac{3}{12}$ $\frac{9}{12}$ $\frac{4}{16}$ $\frac{12}{16}$ $\frac{5}{20}$

3. Change to 5ths: $\frac{2}{10}$ $\frac{4}{10}$ $\frac{8}{10}$ $\frac{4}{20}$ $\frac{12}{20}$ $\frac{6}{30}$

4. Change to 6ths: $\frac{2}{12}$ $\frac{10}{12}$ $\frac{3}{18}$ $\frac{15}{18}$ $\frac{4}{24}$ $\frac{5}{30}$

5. Change to 9ths: $\frac{2}{18}$ $\frac{4}{18}$ $\frac{8}{18}$ $\frac{10}{18}$ $\frac{3}{27}$ $\frac{4}{36}$

6. Change to 12ths: $\frac{2}{24}$ $\frac{10}{24}$ $\frac{14}{24}$ $\frac{3}{36}$ $\frac{4}{48}$ $\frac{5}{60}$

7. Change $\frac{15}{20}$ to its simplest form.

$\frac{15 \div 5}{20 \div 5} = \frac{3}{4}$

Since the factor 5 is common to both numerator and denominator, we can divide both terms by 5 without changing the value of the fraction. As the numerator and denominator of the fraction $\frac{3}{4}$ have no common factor, the fraction $\frac{15}{20}$ has been changed to its simplest form, or, as we say, to its lowest terms.

A fraction is in its lowest terms when its numerator and denominator have no common factor.

Change to lowest terms:

8. $\frac{6}{9}$ $\frac{8}{10}$ $\frac{10}{16}$ $\frac{6}{14}$ $\frac{12}{18}$ $\frac{15}{21}$ $\frac{14}{24}$ $\frac{20}{20}$

9. $\frac{8}{12}$ $\frac{6}{15}$ $\frac{6}{6}$ $\frac{12}{16}$ $\frac{8}{18}$ $\frac{6}{20}$ $\frac{14}{21}$ $\frac{6}{24}$

10. $\frac{6}{12}$ $\frac{8}{14}$ $\frac{9}{12}$ $\frac{12}{15}$ $\frac{8}{20}$ $\frac{6}{21}$ $\frac{2}{28}$ $\frac{15}{24}$

11. $\frac{5}{15}$ $\frac{12}{21}$ $\frac{12}{20}$ $\frac{18}{21}$ $\frac{9}{24}$ $\frac{16}{16}$ $\frac{14}{22}$ $\frac{18}{27}$

12. $\frac{10}{18}$ $\frac{9}{15}$ $\frac{10}{12}$ $\frac{16}{20}$ $\frac{14}{16}$ $\frac{9}{21}$ $\frac{10}{24}$ $\frac{19}{19}$

13. $\frac{30}{42}$

$\frac{30 \div 2}{42 \div 2} = \frac{15 \div 3}{21 \div 3} = \frac{5}{7}$

Or

$\frac{30 \div 6}{42 \div 6} = \frac{5}{7}$

Dividing both terms of $\frac{30}{42}$ by 2, we get $\frac{15}{21}$; dividing both terms of $\frac{15}{21}$ by 3, we get $\frac{5}{7}$.

We can change this fraction more quickly by dividing both terms by their greatest common factor, 6.

14. $\frac{18}{42}$ 15. $\frac{49}{63}$ 16. $\frac{48}{78}$ 17. $\frac{48}{84}$ 18. $\frac{75}{135}$

19. $\frac{30}{48}$ 20. $\frac{42}{70}$ 21. $\frac{60}{72}$ 22. $\frac{84}{144}$ 23. $\frac{60}{150}$

24. $\frac{24}{54}$ 25. $\frac{56}{63}$ 26. $\frac{35}{80}$ 27. $\frac{90}{120}$ 28. $\frac{96}{108}$

29. $\frac{42}{63}$ 30. $\frac{42}{54}$ 31. $\frac{63}{84}$ 32. $\frac{48}{96}$ 33. $\frac{105}{150}$

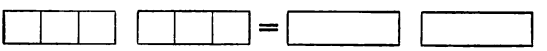
34. $\frac{30}{72}$ 35. $\frac{72}{84}$ 36. $\frac{70}{98}$ 37. $\frac{90}{108}$ 38. $\frac{125}{175}$

To change a fraction to its lowest terms, we cancel the factors common to both numerator and denominator; or we divide both terms by their greatest common factor.

NOTE. Do not now require pupils to give rules or technical explanations of process. The main thing at present is to see that pupils understand and apply the principles.

CHANGING IMPROPER FRACTIONS TO WHOLE OR MIXED NUMBERS *Oral and Written*

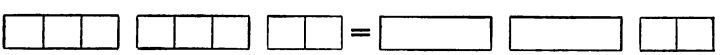
1. Change $\frac{6}{3}$ to a whole number.



$\frac{6}{3} = 2$

Since there are 3 *thirds* ($\frac{1}{3}$) in 1 unit, in 6 *thirds* ($\frac{6}{3}$) there are as many units as there are 3's in 6; that is, 2 units.

2. Change $\frac{8}{3}$ to a mixed number.



$\frac{8}{3} = 2\frac{2}{3}$

Since there are 3 thirds in 1 unit, in 8 thirds there are as many units as there are 3's in 8; that is, 2 units and 2 thirds of a unit.

To change an improper fraction to a whole or mixed number, we divide the numerator by the denominator.

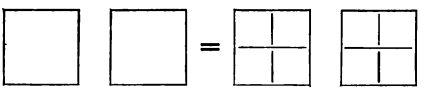
Change to whole or mixed numbers:

3. $\frac{24}{7}$	**4.** $\frac{36}{9}$	**5.** $\frac{15}{8}$	**6.** $\frac{42}{5}$	**7.** $\frac{56}{7}$
8. $\frac{27}{4}$	**9.** $\frac{28}{9}$	**10.** $\frac{24}{3}$	**11.** $\frac{48}{8}$	**12.** $\frac{29}{6}$
13. $\frac{43}{8}$	**14.** $\frac{36}{9}$	**15.** $\frac{40}{9}$	**16.** $\frac{25}{7}$	**17.** $\frac{30}{5}$
18. $\frac{15}{2}$ in.	**19.** $\frac{17}{4}$ ft.	**20.** $\frac{28}{4}$ yd.	**21.** $\frac{19}{2}$ ft.	**22.** $\frac{11}{2}$ qt.
23. $\frac{35}{4}$ gal.	**24.** $\frac{35}{8}$ pk.	**25.** $\frac{44}{4}$ bu.	**26.** $\$\frac{5}{5}$	**27.** $\$\frac{20}{4}$

CHANGING WHOLE OR MIXED NUMBERS TO IMPROPER FRACTIONS

Oral and Written

1. Change 2 to fourths.



$2 = \frac{2}{1}$

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

Since there are 4 *fourths* in one unit, in 2 units there are 2 times 4 *fourths*, or 8 *fourths*.

To change a whole number to an improper fraction, we multiply the whole number by the required denominator, and write the product over the required denominator.

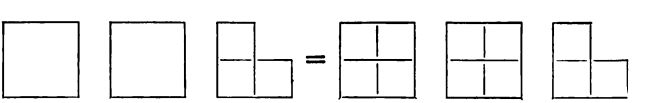
2. Change to halves: 1 2 3 4 5

3. Change to thirds: 1 2 4 6 9

4. How many fifths are there in 1? 3? 6? 7? 8?

5. Express as fractions with 8 for a denominator: 3 5 7 8 10

6. Change $2\frac{3}{4}$ to fourths.



$2\frac{3}{4} = \frac{11}{4}$

Two units equal 8 *fourths*; 8 *fourths* and 3 *fourths* are 11 *fourths*.

To change a mixed number to an improper fraction, we multiply the whole number by the denominator of the fraction, to the product add the numerator, and write the sum over the denominator.

Write as improper fractions:

7. $4\frac{2}{5}$	8. $7\frac{3}{4}$	9. $5\frac{3}{8}$	10. $2\frac{5}{9}$
11. $4\frac{1}{6}$	12. $8\frac{2}{3}$	13. $3\frac{5}{7}$	14. $5\frac{2}{5}$
15. $2\frac{5}{6}$	16. $3\frac{1}{10}$	17. $3\frac{8}{9}$	18. $5\frac{7}{8}$
19. $4\frac{9}{10}$	20. $4\frac{2}{7}$	21. $6\frac{3}{5}$	22. $3\frac{1}{8}$
23. $4\frac{2}{3}$ ft.	24. $1\frac{1}{2}$ pt.	25. $3\frac{1}{2}$ qt.	26. $5\frac{3}{4}$ in.
27. $\$4\frac{2}{5}$	28. $7\frac{5}{8}$ pk.	29. $9\frac{3}{4}$ bu.	30. $5\frac{5}{6}$ mi.

REVIEW EXERCISE *Written*

1. Write a proper fraction using 5 and 3 for its terms.

2. Change the form of the fraction you have written without changing its value.

3. Change $\frac{2}{3}$ to ninths; $\frac{3}{4}$ to 12ths; $\frac{3}{8}$ to 16ths.

4. In the fraction $\frac{9}{12}$, what factor is common to both terms? To what simpler fraction is $\frac{9}{12}$ equal?

5. Take out the common factors in these fractions: $\frac{4}{20}$ $\frac{15}{18}$ $\frac{10}{16}$ $\frac{10}{24}$ $\frac{5}{30}$.

6. Take out all the common factors in $\frac{30}{48}$.

7. Change to lowest terms: $\frac{12}{16}$ $\frac{24}{30}$ $\frac{36}{60}$ $\frac{42}{63}$ $\frac{72}{84}$.

8. Write an improper fraction whose terms are 12 and 3. Change it to a whole number.

9. Write two improper fractions that can be changed to mixed numbers.

10. What is a mixed number?

11. Write five mixed numbers and change them to improper fractions.

12. Change 3 to halves; 6 to fifths; 5 to eighths; 4 to twelfths.

ADDITION OF FRACTIONS *Oral and Written*

1. Add $\frac{3}{7}$ and $\frac{2}{7}$.

$$\frac{3}{\text{apples}} + \frac{2}{\text{apples}} = \frac{5}{\text{apples}}$$

$$\frac{3}{\text{sevenths}} + \frac{2}{\text{sevenths}} = \frac{5}{\text{sevenths}}$$

$$\tfrac{3}{7} + \tfrac{2}{7} = \tfrac{5}{7}$$

The denominator names the fraction; it simply tells the kind of things with which we are dealing.

Add:

2. $\frac{1}{6} + \frac{1}{6} + \frac{3}{6}$ **3.** $\frac{1}{5} + \frac{1}{5} + \frac{2}{5}$ **4.** $\frac{3}{8} + \frac{2}{8} + \frac{1}{8}$

5. $\frac{2}{9} + \frac{3}{9} + \frac{2}{9}$ **6.** $\frac{1}{11} + \frac{4}{11} + \frac{5}{11}$ **7.** $\frac{5}{12} + \frac{1}{12} + \frac{1}{12}$

8. $\frac{3}{16} + \frac{1}{16} + \frac{5}{16}$ **9.** $\frac{3}{20} + \frac{7}{20} + \frac{9}{20}$ **10.** $\frac{4}{25} + \frac{3}{25} + \frac{11}{25}$

11. Add $\frac{5}{8}$ and $\frac{3}{4}$.

$\frac{5}{8} + \frac{3}{4} = ?$

$\frac{3}{4} = \frac{6}{8}$

$\frac{5}{8} + \frac{6}{8} = \frac{11}{8} = 1\frac{3}{8}$

$$\frac{5}{\text{quarts}} + \frac{3}{\text{pecks}} = ?$$

Since these quantities do not represent things of the same kind, they cannot be added. But, since 1 peck is equal to 8 quarts, 3 pecks may be expressed as 24 quarts. $\frac{5}{\text{quarts}} + \frac{24}{\text{quarts}} = \frac{29}{\text{quarts}}$.

Similarly, $\frac{5}{8} + \frac{3}{4}$. Since eighths and fourths represent unlike things, we cannot add them until we express them as like things; that is, as fractions having the same denominator, which we call a common denominator. The common denominator is 8. $\frac{3}{4} = \frac{6}{8}$.

12. Add $\frac{1}{4}$ and $\frac{1}{6}$.

$c.\,d. = 12$

$\frac{1}{4} = \frac{3}{12}$

$\frac{1}{6} = \frac{2}{12}$

$\frac{5}{12}$

We can express these fractions as 24ths, for 24 is a multiple of both 4 and 6. 12 is also a multiple of 4 and 6, and is the least multiple common to both. It simplifies our work to use the least common multiple of the denominators for the common denominator.

To add fractions, we express the fractions as equivalent fractions having a common denominator, and write the sum of the numerators over the common denominator.

NOTE. As much as possible of the work in fractions, both abstract and concrete, should be done orally.

Add, changing the fraction in the answer to its lowest terms:

13. $\frac{1}{2}+\frac{1}{6}$	14. $\frac{1}{2}+\frac{3}{8}$	15. $\frac{2}{3}+\frac{5}{6}$	16. $\frac{3}{4}+\frac{5}{8}$
17. $\frac{7}{10}+\frac{1}{2}$	18. $\frac{5}{12}+\frac{1}{2}$	19. $\frac{1}{2}+\frac{5}{16}$	20. $\frac{2}{3}+\frac{1}{12}$
21. $\frac{3}{4}+\frac{5}{12}$	22. $\frac{2}{15}+\frac{1}{3}$	23. $\frac{3}{5}+\frac{2}{15}$	24. $\frac{3}{4}+\frac{9}{16}$
25. $\frac{2}{5}+\frac{7}{10}$	26. $\frac{5}{6}+\frac{5}{12}$	27. $\frac{3}{8}+\frac{7}{16}$	28. $\frac{3}{4}+\frac{7}{12}$
29. $\frac{3}{10}+\frac{4}{5}$	30. $\frac{2}{5}+\frac{7}{15}$	31. $\frac{3}{4}+\frac{7}{16}$	32. $\frac{5}{6}+\frac{7}{12}$

Find sum of:

33. $\frac{1}{2}+\frac{1}{3}$	34. $\frac{1}{4}+\frac{1}{3}$	35. $\frac{1}{2}+\frac{3}{5}$	36. $\frac{2}{3}+\frac{2}{5}$
37. $\frac{3}{7}+\frac{1}{2}$	38. $\frac{1}{2}+\frac{2}{9}$	39. $\frac{2}{5}+\frac{1}{2}$	40. $\frac{2}{3}+\frac{3}{4}$
41. $\frac{1}{3}+\frac{4}{5}$	42. $\frac{1}{2}+\frac{5}{7}$	43. $\frac{2}{3}+\frac{4}{5}$	44. $\frac{2}{3}+\frac{1}{2}$
45. $\frac{4}{5}+\frac{1}{2}$	46. $\frac{2}{3}+\frac{3}{5}$	47. $\frac{4}{5}+\frac{1}{2}$	48. $\frac{5}{6}+\frac{1}{4}$
49. $\frac{3}{4}+\frac{5}{6}$	50. $\frac{1}{3}+\frac{3}{4}$	51. $\frac{1}{2}+\frac{1}{7}$	52. $\frac{1}{3}+\frac{1}{5}$

PROBLEMS

1. Mr. Smith has $\frac{1}{2}$ of an acre in one lot and $\frac{5}{8}$ of an acre in another lot. How many acres are there in both lots?

2. Miriam's spelling book cost $\frac{1}{5}$ of a dollar and her arithmetic $\frac{1}{2}$ of a dollar. What part of a dollar did both cost?

3. A cook used $\frac{7}{8}$ of a ton of coal in January and $\frac{3}{4}$ of a ton in February. How much did she use in both months?

4. Maggie bought $\frac{5}{6}$ of a yard of lace for an apron, and $\frac{2}{3}$ of a yard for a waist. How much lace did she buy?

5. A spelling lesson takes $\frac{1}{5}$ of an hour, and a reading lesson $\frac{1}{3}$ of an hour. What part of an hour is taken for both lessons?

TO THE TEACHER: Many simple oral problems illustrating the principle under consideration should be given by the teacher. As far as possible, the problem material should be within the realm of the pupils' interest and experience. Local conditions will determine the character and content of problem work.

Pupils should be encouraged and required to make original problems based on their observation of the affairs of everyday life.

ADDITION *Written*

Find the sum of:

1. $\frac{1}{3} + \frac{3}{4} + \frac{1}{6}$

c. d. = 12

$\frac{1}{3} = \frac{4}{12}$

$\frac{3}{4} = \frac{9}{12}$

$\frac{1}{6} = \frac{2}{12}$

$\frac{15}{12} = 1\frac{3}{12} = 1\frac{1}{4}$

2. $\frac{5}{8} + \frac{1}{2} + \frac{3}{4}$

3. $\frac{1}{2} + \frac{1}{6} + \frac{3}{4}$

4. $\frac{3}{10} + \frac{2}{5} + \frac{1}{2}$

5. $\frac{2}{3} + \frac{5}{6} + \frac{5}{6}$

6. $\frac{5}{6} + \frac{3}{4} + \frac{7}{12}$

7. $\frac{1}{6} + \frac{1}{2} + \frac{1}{3}$

8. $\frac{2}{3} + \frac{1}{2} + \frac{5}{6}$

9. $\frac{7}{15} + \frac{2}{3} + \frac{3}{5}$

10. $\frac{3}{5} + \frac{3}{10} + \frac{1}{2}$

11. $\frac{1}{2} + \frac{4}{7} + \frac{3}{14}$

12. $\frac{1}{4} + \frac{2}{3} + \frac{1}{2}$

13. $\frac{1}{4} + \frac{5}{6} + \frac{2}{3}$

14. $\$\frac{1}{2} + \$\frac{3}{5} + \$\frac{1}{10}$

15. $\frac{3}{4}$ gal. + $\frac{5}{6}$ gal. + $\frac{1}{2}$ gal.

16. $\frac{1}{6}$ yr. + $\frac{2}{3}$ yr. + $\frac{7}{12}$ yr.

17. $\frac{1}{3}$ yd. + $\frac{3}{4}$ yd. + $\frac{5}{12}$ yd.

18. $\frac{1}{2}$ bu. + $\frac{3}{8}$ bu. + $\frac{1}{4}$ bu.

19. $\frac{2}{3}$ mi. + $\frac{3}{4}$ mi. + $\frac{1}{12}$ mi.

PROBLEMS

1. John spent $\frac{1}{6}$ of his money for candy, $\frac{1}{3}$ for a ball, and $\frac{1}{4}$ for a bat. What part of his money did he spend?

2. Mary earned $\frac{2}{5}$ of a dollar, $\frac{1}{2}$ of a dollar, and $\frac{3}{10}$ of a dollar. How much did she earn in all?

3. Mr. Wright has $\frac{1}{16}$ of an acre of corn, $\frac{1}{8}$ of an acre of potatoes, and $\frac{1}{4}$ of an acre of onions. What part of an acre is used for all?

4. A bag of flour cost $\frac{7}{10}$ of a dollar, a bushel of potatoes $\frac{1}{2}$ of a dollar, and a peck of apples $\frac{1}{5}$ of a dollar. How much did all cost?

5. Mrs. Whiting paid \$$\frac{1}{5}$ for oranges, \$$\frac{1}{5}$ for sugar, and \$$\frac{1}{2}$ for peaches. What part of a dollar did she pay for all?

ADDITION OF MIXED NUMBERS *Written*

1. Add $9\frac{2}{3}$ and $6\frac{3}{4}$

$$\begin{array}{r} c.d. = 12 \\ 9\frac{2}{3} = 9\frac{8}{12} \\ 6\frac{3}{4} = 6\frac{9}{12} \\ \hline 16\frac{5}{12} \end{array}$$

Express both fractions as 12ths. $\frac{8}{12} + \frac{9}{12} = \frac{17}{12} = 1\frac{5}{12}$. Write $\frac{5}{12}$ under the fractions and add 1 to the sum of the whole numbers.

Add:

2. $3\frac{3}{4}+4\frac{1}{2}$	3. $2\frac{1}{2}+7\frac{5}{6}$	4. $3\frac{5}{8}+4\frac{1}{2}$	5. $6\frac{11}{16}+7\frac{1}{2}$
6. $4\frac{2}{3}+2\frac{5}{6}$	7. $5\frac{1}{6}+8\frac{1}{2}$	8. $4\frac{5}{8}+9\frac{3}{4}$	9. $5\frac{9}{16}+3\frac{7}{8}$
10. $7\frac{1}{2}+3\frac{7}{10}$	11. $5\frac{3}{10}+3\frac{4}{5}$	12. $7\frac{11}{16}+2\frac{3}{4}$	13. $4\frac{2}{3}+3\frac{5}{9}$
14. $7\frac{5}{6}+8\frac{7}{12}$	15. $3\frac{3}{4}+5\frac{7}{12}$	16. $8\frac{5}{12}+6\frac{2}{3}$	17. $5\frac{1}{2}+8\frac{1}{12}$
18. $8\frac{2}{3}+8\frac{1}{2}$	19. $5\frac{1}{2}+2\frac{1}{5}$	20. $9\frac{3}{4}+5\frac{2}{3}$	21. $7\frac{2}{5}+6\frac{2}{3}$
22. $3\frac{3}{4}+7\frac{5}{6}$	23. $2\frac{2}{5}+1\frac{1}{2}$	24. $3\frac{2}{3}+7\frac{3}{4}$	25. $8\frac{2}{5}+8\frac{3}{10}$
26. $9\frac{7}{12}+6\frac{3}{4}$	27. $2\frac{1}{2}+2\frac{2}{5}$	28. $3\frac{7}{9}+4\frac{2}{3}$	29. $2\frac{4}{9}+3\frac{2}{3}$

NOTE. Special attention should be paid to the manner of arranging work on paper, as well as to accuracy and neatness. A slovenly paper is usually indicative of a careless and inaccurate mind.

Find the sum of:

30. $2\frac{1}{2} + 2\frac{1}{3} + 3\frac{3}{4}$

31. $4\frac{1}{5} + 2\frac{1}{2} + 3\frac{3}{10}$

32. $1\frac{2}{3} + 3\frac{1}{2} + 2\frac{1}{4}$

33. $5\frac{3}{4} + 5\frac{1}{2} + 4\frac{2}{3}$

34. $4\frac{1}{3} + 2\frac{1}{6} + 1\frac{3}{4}$

35. $2\frac{1}{4} + 3\frac{1}{3} + 4\frac{5}{12}$

36. $1\frac{1}{2} + 4\frac{2}{3} + 2\frac{5}{12}$

37. $2\frac{1}{10} + 3\frac{1}{5} + 4\frac{1}{2}$

38. $4\frac{1}{6} + 2\frac{2}{3} + 1\frac{1}{2}$

39. $2\frac{3}{4} + 5\frac{1}{2} + 6\frac{7}{16}$

PROBLEMS

1. A railroad train ran the first mile in 2 minutes, the second mile in $1\frac{7}{8}$ minutes, and the third mile in $1\frac{3}{4}$ minutes. How long did it take to run the three miles?

2. Susie is $8\frac{1}{2}$ years old, Ella is $10\frac{1}{4}$ years old, and Annie is $9\frac{1}{3}$ years old. What is the sum of their ages?

3. A clerk sold $1\frac{1}{6}$ yards of cloth, $2\frac{3}{4}$ yards, and $4\frac{1}{2}$ yards. How many yards did he sell?

4. A farmer sold a calf for $\$7\frac{1}{2}$, a pig for $\$5\frac{1}{2}$, and a sheep for $\$7\frac{3}{4}$. How much money did he receive?

5. It takes $5\frac{1}{2}$ yards of braid for Mary's skirt, $3\frac{1}{3}$ yards for her waist, and $4\frac{1}{6}$ yards for her jacket. How many yards does it take for the suit?

NOTE. Care should be taken not to proceed too rapidly in the study of fractions. It takes a long time and much patient labor to lay a secure foundation. A new process should not be taken up until pupils show by their mastery of the present work that they are prepared for advanced work.

SUBTRACTION OF FRACTIONS *Oral and Written*

1. $\frac{5}{\text{apples}} - \frac{2}{\text{apples}} = ?$

2. $\frac{5}{\text{sevenths}} - \frac{2}{\text{sevenths}} = ?$

3. $\frac{5}{7} - \frac{2}{7} = ?$

4. $\frac{3}{4} - \frac{1}{4} = ?$

5. $\frac{7}{8} - \frac{3}{8} = ?$

6. $\frac{8}{9} - \frac{2}{9} = ?$

7. Subtract $\frac{3}{4}$ from $\frac{7}{8}$.

$$\begin{array}{r} \text{c.d.} = 8 \\ \hline \frac{7}{8} = \frac{7}{8} \\ \frac{3}{4} = \frac{6}{8} \\ \hline \frac{1}{8} \end{array}$$

Only like quantities can be subtracted. Change $\frac{3}{4}$ to 8ths. $\frac{3}{4} = \frac{6}{8}$. $\frac{7}{8} - \frac{6}{8} = \frac{1}{8}$.

To subtract one fraction from another, we express the fractions as equivalent fractions having a common denominator, and write the difference of the numerators over the common denominator.

Find the difference:

8. $\frac{1}{2} - \frac{1}{6}$	9. $\frac{1}{2} - \frac{1}{10}$	10. $\frac{1}{2} - \frac{1}{12}$	11. $\frac{2}{3} - \frac{1}{6}$
12. $\frac{2}{3} - \frac{4}{9}$	13. $\frac{2}{3} - \frac{1}{12}$	14. $\frac{3}{4} - \frac{5}{12}$	15. $\frac{5}{6} - \frac{1}{2}$
16. $\frac{5}{6} - \frac{5}{12}$	17. $\frac{7}{8} - \frac{7}{8}$	18. $\frac{8}{9} - \frac{2}{3}$	19. $\frac{7}{10} - \frac{1}{2}$
20. $\frac{9}{10} - \frac{2}{5}$	21. $\frac{2}{3} - \frac{2}{15}$	22. $\frac{2}{3} - \frac{2}{9}$	23. $\frac{1}{2} - \frac{5}{14}$
24. $\frac{7}{15} - \frac{1}{3}$	25. $\frac{2}{3} - \frac{5}{9}$	26. $\frac{11}{15} - \frac{1}{3}$	27. $\frac{7}{15} - \frac{1}{5}$

Find the difference:

28. $\frac{5}{6} - \frac{3}{4}$	29. $\frac{3}{4} - \frac{2}{3}$	30. $\frac{3}{4} - \frac{1}{6}$	31. $\frac{2}{3} - \frac{1}{2}$
32. $\frac{2}{3} - \frac{2}{5}$	33. $\frac{1}{2} - \frac{1}{7}$	34. $\frac{2}{3} - \frac{1}{4}$	35. $\frac{2}{3} - \frac{1}{6}$
36. $\frac{4}{5} - \frac{1}{2}$	37. $\frac{2}{5} - \frac{1}{3}$	38. $\frac{3}{4} - \frac{3}{10}$	39. $\frac{3}{4} - \frac{1}{6}$
40. $\frac{4}{5} - \frac{2}{3}$	41. $\frac{2}{3} - \frac{1}{6}$	42. $\frac{5}{7} - \frac{1}{2}$	43. $\frac{2}{3} - \frac{3}{5}$
44. $\frac{5}{6} - \frac{1}{4}$	45. $\frac{3}{4} - \frac{1}{3}$	46. $\frac{5}{6} - \frac{3}{4}$	47. $\frac{3}{5} - \frac{1}{3}$

48. From $\frac{3}{4}$ yr. take $\frac{1}{2}$ yr. **49.** Take $\$\frac{2}{5}$ from $\$1\frac{7}{10}$.

50. From $\frac{3}{4}$ bu. take $\frac{3}{8}$ bu. **51.** Take $\frac{1}{2}$ acre from $\frac{3}{5}$ acre.

52. From $\frac{2}{3}$ hr. take $\frac{1}{2}$ hr. **53.** Take $\frac{2}{3}$ yd. from $\frac{3}{4}$ yd.

PROBLEMS

1. Mary has $\frac{7}{8}$ of a yard of ribbon. She gives $\frac{1}{4}$ of a yard to her sister. How much has she left?

2. A man buys $\frac{3}{4}$ of a ton of coal. After using $\frac{2}{3}$ of a ton, how much has he left?

3. James walks $\frac{1}{2}$ of a mile to school, and William walks $\frac{1}{8}$ of a mile. James walks how much farther than William?

4. A grocer buys eggs for $\frac{2}{5}$ of a dollar a dozen, and sells them for $\frac{1}{2}$ of a dollar. How much does he make?

5. Mr. Merrill had $\frac{5}{8}$ of a bushel of potatoes. $\frac{1}{4}$ of a bushel decayed. What part of a bushel was good?

SUBTRACTION OF MIXED NUMBERS *Written*

1. Subtract $6\frac{3}{4}$ from $9\frac{7}{12}$.

c.d. $= 12$

$9\frac{7}{12} = 9\frac{7}{12} = 8\frac{19}{12}$

$6\frac{3}{4} = 6\frac{9}{12} = 6\frac{9}{12}$

$2\frac{10}{12} = 2\frac{5}{6}$

Since $\frac{9}{12}$ cannot be taken from $\frac{7}{12}$, we take one of the 9 units in the minuend, change it to 12ths, $1 = \frac{12}{12}$, and add it to the $\frac{7}{12}$, making $\frac{19}{12}$. $9\frac{7}{12} = 8\frac{19}{12}$.

Find differences:

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

6. $2\frac{7}{8} - 1\frac{1}{2}$ 7. $4\frac{3}{10} - 1\frac{2}{5}$ 8. $4\frac{5}{9} - 1\frac{2}{3}$ 9. $5\frac{1}{2} - 2\frac{3}{10}$

10. $8\frac{2}{3} - 5\frac{1}{6}$ **11.** $6\frac{1}{4} - 5\frac{3}{8}$ **12.** $4\frac{5}{12} - 2\frac{1}{4}$ **13.** $6\frac{2}{3} - 2\frac{5}{12}$

14. $6\frac{2}{15} - 2\frac{1}{5}$ **15.** $6\frac{1}{2} - 2\frac{1}{5}$ **16.** $12\frac{1}{2} - 5\frac{1}{7}$ **17.** $7\frac{1}{5} - 2\frac{1}{3}$

18. $10\frac{3}{4} - 2\frac{2}{3}$ **19.** $8\frac{1}{3} - 4\frac{1}{2}$ **20.** $7\frac{2}{3} - 2\frac{1}{2}$ **21.** $9\frac{2}{5} - 5\frac{1}{2}$

PROBLEMS

1. A farmer had $10\frac{1}{6}$ dozen eggs. He sold $8\frac{1}{2}$ dozen. How many dozen had he left?

2. Mrs. Street earns $\$10\frac{1}{2}$ a week and spends $\$8\frac{2}{5}$. How much does she save?

3. A fruit dealer bought 7 boxes of oranges. After selling $2\frac{2}{5}$ boxes, how many had he left?

4. Margaret bought $12\frac{2}{3}$ yards of ribbon. After using $4\frac{1}{4}$ yards, how much has she left?

5. Mr. Price planted $8\frac{2}{3}$ acres of corn and $5\frac{1}{5}$ acres of wheat. How many more acres of corn than wheat did he plant?

REVIEW EXERCISE *Oral and Written*

1. Write two fractions that can be added or subtracted without changing their form.

2. Write two fractions that cannot be added or subtracted without changing their form.

3. Change the form of these fractions without changing their value: $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$ $\frac{7}{12}$

4. Find the sum of $\frac{3}{4} + \frac{7}{12}$; $\frac{1}{2} + \frac{2}{3}$; $\frac{2}{3} + \frac{5}{6}$; $\frac{2}{3} + \frac{3}{4} + \frac{5}{6}$.

5. Add: $\frac{3}{4}$ mile + $\frac{3}{8}$ mile + $\frac{1}{2}$ mile; $\frac{2}{3}$ yd. + $\frac{5}{6}$ yd. + $\frac{1}{2}$ yd.

6. Add: $2\frac{3}{4} + 5\frac{1}{2} + 6\frac{7}{8}$; $5\frac{3}{5} + 5\frac{1}{2} + 4\frac{3}{10} + 3$.

7. What is the difference between $\frac{5}{6}$ and $\frac{5}{12}$? $\frac{1}{2}$ and $\frac{1}{7}$? $\frac{5}{12}$ and $\frac{3}{4}$? $\frac{1}{2}$ and $\frac{7}{10}$?

8. Subtract $\frac{1}{2}$ hr. from $\frac{2}{3}$ hr.; $\frac{2}{3}$ acre from $\frac{3}{4}$ acre.

9. From 4 take $\frac{3}{4}$. Express one of the units as 4ths. Then $4 = 3\frac{4}{4}$. $3\frac{4}{4} - \frac{3}{4} = 3\frac{1}{4}$.

10. From $3\frac{7}{8}$ take $1\frac{1}{2}$. Take $5\frac{3}{8}$ from $6\frac{1}{4}$.

11. Which is larger, $\frac{4}{5}$ of a dollar or $\frac{7}{10}$ of a dollar? How much larger?

12. What must be added to $\frac{3}{5}$ to make $\frac{7}{10}$?

13. What must be taken from $\frac{5}{6}$ to leave $\frac{1}{4}$?

14. From 5 take $\frac{2}{5}$. Take $\frac{7}{9}$ from 7.

15. From 6 take each of these fractions:

$\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{2}{5}$ $\frac{4}{5}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{7}{8}$ $\frac{2}{9}$ $\frac{7}{9}$

Read:

16. $\frac{3}{4}$ $\frac{7}{7}$ $\frac{5}{3}$ $\frac{5}{8}$ $\frac{9}{9}$ $\frac{9}{8}$ $\frac{7}{10}$ $\frac{5}{5}$ $\frac{9}{5}$ $\frac{12}{12}$

17. $\frac{8}{9}$ $\frac{11}{6}$ $\frac{8}{8}$ $\frac{3}{7}$ $\frac{5}{11}$ $\frac{3}{2}$ $\frac{17}{15}$ $\frac{18}{25}$ $\frac{13}{13}$ $\frac{27}{20}$

Select from fractions in 16 and 17:

18. All the proper fractions, and name the smallest fraction that must be added to each to make it an improper fraction.

19. All the improper fractions that are equal to **1.**

20. All the improper fractions that are greater than 1. and name the fraction that must be taken from each to leave **1.**

NOTE. As pupils progress, all processes should be reviewed frequently.

MULTIPLICATION OF FRACTIONS *Oral and Written*

1. 2 times $\frac{3}{\text{apples}} = ?$ 2. $2 \times \frac{3}{\text{fifths}} = ?$ 3. $2 \times \frac{3}{5} = \frac{6}{5} = 1\frac{1}{5}$

Find:

4. $3 \times \frac{5}{7}$	5. $4 \times \frac{2}{3}$	6. $3 \times \frac{3}{8}$	7. $4 \times \frac{3}{5}$
8. $5 \times \frac{3}{4}$	9. $6 \times \frac{3}{7}$	10. $9 \times \frac{2}{5}$	11. $5 \times \frac{5}{6}$
12. $7 \times \frac{5}{8}$	13. $8 \times \frac{5}{9}$	14. $9 \times \frac{3}{10}$	15. $5 \times \frac{7}{9}$
16. $7 \times \frac{4}{5}$	17. $4 \times \frac{4}{7}$	18. $5 \times \frac{8}{9}$	19. $9 \times \frac{7}{10}$
20. $4 \times \frac{9}{11}$	21. $6 \times \frac{4}{13}$	22. $5 \times \frac{7}{12}$	23. $8 \times \frac{2}{15}$
24. $10 \times \frac{2}{3}$	25. $15 \times \frac{7}{8}$	26. $12 \times \frac{6}{7}$	27. $17 \times \frac{3}{4}$
28. $12 \times \frac{3}{5}$	29. $11 \times \frac{8}{15}$	30. $15 \times \frac{4}{7}$	31. $21 \times \frac{4}{5}$
32. $20 \times \frac{5}{7}$	33. $17 \times \frac{5}{8}$	34. $14 \times \frac{4}{5}$	35. $13 \times \frac{7}{15}$
36. $14 \times \frac{8}{9}$	37. $18 \times \frac{4}{7}$	38. $14 \times \frac{5}{9}$	39. $22 \times \frac{7}{9}$
40. $13 \times \frac{8}{11}$	41. $23 \times \frac{3}{8}$	42. $19 \times \frac{5}{12}$	43. $24 \times \frac{9}{13}$

PROBLEMS

1. A family uses $\frac{3}{5}$ of a bushel of apples a month. How many bushels will they use in 6 months?

2. If a yard of silk costs $\frac{3}{4}$ of a dollar, what will 5 yards cost?

3. If a pound of butter costs $\frac{2}{5}$ of a dollar, what will 4 pounds cost?

4. A horse eats $\frac{3}{4}$ of a peck of oats a day. How many pecks will he eat in 9 days?

5. John walks $\frac{3}{8}$ of a mile to school. How many miles does he walk in 5 mornings?

6. Prescott's hens lay $\frac{2}{3}$ of a dozen eggs every day. How many dozen do they lay in a week?

7. Mabel bought 3 hair ribbons, each $\frac{5}{8}$ of a yard long. How many yards of ribbon did she buy?

8. At $\frac{4}{5}$ of a dollar a yard, what will 9 yards of poplin cost?

9. Henry paid $\frac{4}{5}$ of a dime for marbles. What would he pay for 5 times as many?

10. If 2 handkerchiefs cost $\frac{1}{3}$ of a dollar, what will a dozen cost?

MULTIPLYING A WHOLE NUMBER BY A FRACTION

Oral and Written

1. Find $\frac{1}{3}$ of 12; 24; 36; 48; 60.

2. Find $\frac{2}{3}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{6}$; $\frac{5}{6}$, of the above numbers.

3. What is $\frac{3}{8}$ of 32?

4. What is $\frac{5}{12}$ of 72?

5. What is $\frac{5}{9}$ of 63?

6. What is $\frac{7}{8}$ of 56?

7. What is $\frac{8}{9}$ of 72?

8. What is $\frac{5}{6}$ of 54?

Finding a fractional part of a number is called multiplying by a fraction.

9. Find $\frac{2}{5}$ of 9.

$\frac{1}{5}$ of 9 is $\frac{9}{5}$; $\frac{2}{5}$ of 9 is 2 times $\frac{9}{5}$, or $\frac{18}{5}$, or $3\frac{3}{5}$.

10. $\frac{2}{3}$ of 4

11. $\frac{2}{5}$ of 8

12. $\frac{5}{6}$ of 5

13. $\frac{3}{4}$ of 5

14. $\frac{3}{7}$ of 8	**15.** $\frac{8}{9}$ of 4	**16.** $\frac{4}{5}$ of 9	**17.** $\frac{6}{7}$ of 6
18. $\frac{5}{9}$ of 8	**19.** $\frac{2}{3}$ of 7	**20.** $\frac{5}{8}$ of 3	**21.** $\frac{3}{8}$ of 9

The sign $\times$ in the expression $\frac{2}{3} \times 7$ is equivalent to the word "of."

Find products:

22. $\frac{5}{7} \times 8$	**23.** $\frac{4}{5} \times 8$	**24.** $\frac{3}{5} \times 6$	**25.** $\frac{5}{6} \times 7$
26. $\frac{2}{9} \times 10$	**27.** $\frac{2}{3} \times 10$	**28.** $\frac{3}{4} \times 11$	**29.** $\frac{2}{5} \times 4$
30. $\frac{2}{5} \times 14$	**31.** $\frac{5}{6} \times 11$	**32.** $\frac{3}{7} \times 9$	**33.** $\frac{3}{10} \times 7$
34. $\frac{3}{4} \times 17$	**35.** $\frac{2}{3} \times 16$	**36.** $\frac{5}{6} \times 22$	**37.** $\frac{2}{5} \times 18$
38. $\frac{3}{5} \times 24$	**39.** $\frac{3}{7} \times 25$	**40.** $\frac{4}{5} \times 16$	**41.** $\frac{5}{7} \times 12$
42. $\frac{3}{8} \times 27$	**43.** $\frac{6}{7} \times 18$	**44.** $\frac{5}{8} \times 15$	**45.** $\frac{4}{7} \times 10$
46. $\frac{7}{8} \times 15$	**47.** $\frac{2}{9} \times 40$	**48.** $\frac{4}{9} \times 32$	**49.** $\frac{5}{9} \times 28$

PROBLEMS

1. At 20 cents a dozen, what will $\frac{3}{4}$ of a dozen of bananas cost?

2. George picked 15 quarts of berries and sold $\frac{3}{5}$ of them. How many quarts did he sell?

3. Olive has an allowance of 10 cents a week. She saves $\frac{1}{10}$ of it. How much does she spend?

4. A butcher bought 3 pairs of chickens for 6 dollars. How much did he pay for each chicken?

5. Ethel is 18 years old and her sister is $\frac{5}{6}$ as old. How old is her sister?

6. There are 36 shade trees on a street. Seven ninths of them are maples. How many of other kinds?

7. When oranges are 60 cents a dozen, what will one cost? 4? $\frac{1}{4}$ of a dozen? $\frac{2}{3}$ of a dozen? $\frac{3}{4}$ of a dozen? $\frac{1}{2}$ of a dozen? $\frac{5}{6}$ of a dozen?

8. I have 32 raspberry bushes and $\frac{3}{8}$ as many currant bushes. How many currant bushes?

9. If $\frac{3}{7}$ of the days are stormy, how many pleasant days in 2 weeks? In 5 weeks?

10. George has 4 dollars. Henry has $\frac{4}{5}$ as much. How much has Henry?

MULTIPLYING A MIXED NUMBER BY A WHOLE NUMBER

Written

1. Multiply $2\frac{3}{5}$ by 8.

$2\frac{3}{5}$
$\underline{8}$
$4\frac{4}{5} = 8 \times \frac{3}{5}$
$16 = 8 \times 2$
$20\frac{4}{5} = 8 \times 2\frac{3}{5}$

This means 8 times 2 + 8 times $\frac{3}{5}$.
$8 \times \frac{3}{5} = \frac{24}{5} = 4\frac{4}{5}$
$8 \times 2 = 16$
$16 + 4\frac{4}{5} = 20\frac{4}{5}$

Multiply:

2. $2\frac{2}{3}$ by 4
3. $12\frac{1}{2}$ by 7
4. $16\frac{5}{8}$ by 7
5. $37\frac{1}{2}$ by 27
6. $3\frac{3}{4}$ by 5
7. $10\frac{1}{4}$ by 9
8. $17\frac{2}{9}$ by 9
9. $16\frac{2}{3}$ by 25
10. $4\frac{5}{6}$ by 7
11. $15\frac{5}{8}$ by 5
12. $20\frac{4}{9}$ by 8
13. $87\frac{1}{2}$ by 35
14. $5\frac{3}{8}$ by 8
15. $16\frac{5}{6}$ by 7
16. $18\frac{3}{10}$ by 9
17. $66\frac{2}{3}$ by 28
18. $3\frac{7}{8}$ by 7
19. $15\frac{5}{9}$ by 5
20. $20\frac{7}{12}$ by 5
21. $80\frac{2}{3}$ by 24
22. $83\frac{1}{3}$ by 15

PROBLEMS

1. What will 6 yards of muslin cost at $8\frac{1}{3}$ cents a yard?

2. Sugar is $5\frac{3}{4}$ cents a pound. How much must be paid for 4 pounds?

3. At $6\frac{1}{4}$ cents a pound, what will 9 pounds of meat cost?

4. Mary earns $8\frac{2}{5}$ dollars a week. How much will she earn in 4 weeks?

5. At $12\frac{1}{2}$ cents apiece, what will half a dozen collars cost?

MULTIPLYING A WHOLE NUMBER BY A MIXED NUMBER

1. Multiply 12 by $7\frac{2}{5}$. *Written*

$$\begin{array}{r} 12 \\ 7\frac{2}{5} \\ \hline 4\frac{4}{5} = \frac{2}{5} \text{ of } 12 \\ 84 = 7 \times 12 \\ \hline 88\frac{4}{5} = 7\frac{2}{5} \times 12 \end{array}$$

This means 7 times 12 + $\frac{2}{5}$ of 12.
$\frac{2}{5}$ of $12 = \frac{24}{5} = 4\frac{4}{5}$
$7 \times 12 = 84$
$84 + 4\frac{4}{5} = 88\frac{4}{5}$

Multiply:

2. 8 by $2\frac{3}{4}$	3. 7 by $3\frac{1}{6}$	4. 9 by $5\frac{3}{4}$
5. 12 by $2\frac{4}{5}$	6. 5 by $3\frac{3}{8}$	7. 7 by $2\frac{5}{8}$
8. 11 by $4\frac{5}{6}$	9. 9 by $4\frac{7}{8}$	10. 8 by $4\frac{2}{9}$
11. 9 by $4\frac{3}{5}$	12. 10 by $3\frac{5}{7}$	13. 7 by $5\frac{3}{8}$
14. 12 by $8\frac{3}{4}$	15. 20 by $4\frac{3}{5}$	16. 18 by $3\frac{5}{6}$
17. 24 by $5\frac{5}{8}$	18. 17 by $2\frac{4}{5}$	19. 14 by $4\frac{3}{8}$
20. 16 by $4\frac{2}{3}$	21. 25 by $6\frac{3}{10}$	22. 36 by $5\frac{3}{5}$

MULTIPLYING A FRACTION BY A FRACTION

Oral and Written

$\frac{2}{3} \times \frac{3}{5}$ means $\frac{2}{3}$ of $\frac{3}{5}$.

1. $\frac{2}{3}$ of $\frac{3}{\text{apples}} = ?$

2. $\frac{1}{3}$ of $\frac{3}{\text{apples}} = \frac{1}{\text{apple}}$

3. $\frac{2}{3}$ of $\frac{3}{\text{apples}} = \frac{2}{\text{apples}}$

4. $\frac{2}{3}$ of $\frac{3}{5} = ?$

5. $\frac{1}{3}$ of $\frac{3}{5} = \frac{1}{5}$

6. $\frac{2}{3}$ of $\frac{3}{5} = \frac{2}{5}$

Notice that $\frac{2}{3}$ of $\frac{3}{5} = \frac{2 \times 3}{3 \times 5} = \frac{6}{15} = \frac{2}{5}$

and $\frac{2 \times \cancel{3}}{\cancel{3} \times 5} = \frac{2}{5}$

To multiply a fraction by a fraction, we write the product of the numerators over the product of the denominators, canceling when possible.

This rule applies to all cases of multiplication of fractions, for every whole number may be written as a fraction with 1 for its denominator. Thus, $8 = \frac{8}{1}$; $\frac{2}{3}$ of 8 may be written $\frac{2}{3} \times \frac{8}{1}$; 8 times $\frac{2}{3}$ may be written $\frac{8}{1} \times \frac{2}{3}$.

Find:

7. $\frac{1}{4}$ of $\frac{4}{5}$	8. $\frac{1}{5}$ of $\frac{5}{6}$	9. $\frac{1}{3}$ of $\frac{6}{7}$	10. $\frac{2}{3}$ of $\frac{6}{7}$
11. $\frac{2}{3} \times \frac{3}{4}$	12. $\frac{3}{5} \times \frac{5}{6}$	13. $\frac{3}{7} \times \frac{7}{8}$	14. $\frac{3}{4} \times \frac{4}{5}$
15. $\frac{1}{2} \times \frac{1}{2}$	16. $\frac{2}{3} \times \frac{1}{4}$	17. $\frac{3}{5} \times \frac{7}{9}$	18. $\frac{9}{10} \times \frac{5}{8}$
19. $\frac{2}{3} \times \frac{7}{8}$	20. $\frac{3}{4} \times \frac{5}{6}$	21. $\frac{5}{7} \times \frac{1}{15}$	22. $\frac{8}{9} \times \frac{1}{2}$
23. $\frac{3}{4} \times \frac{1}{8}$	24. $\frac{2}{3} \times \frac{1}{2}$	25. $\frac{4}{5} \times \frac{1}{4}$	26. $\frac{7}{8} \times \frac{1}{2}$

Find the product of:

27. $\frac{1}{4} \times \frac{8}{15}$	**28.** $\frac{1}{4} \times \frac{12}{17}$	**29.** $\frac{2}{7} \times \frac{2}{7}$	**30.** $\frac{5}{6} \times \frac{24}{25}$
31. $\frac{3}{10} \times \frac{5}{6}$	**32.** $\frac{8}{15} \times \frac{3}{8}$	**33.** $\frac{5}{8} \times \frac{3}{4}$	**34.** $\frac{5}{21} \times \frac{14}{25}$
35. $\frac{5}{8} \times \frac{8}{9}$	**36.** $\frac{3}{4} \times \frac{5}{7}$	**37.** $\frac{6}{7} \times \frac{4}{5}$	**38.** $\frac{11}{16} \times \frac{8}{33}$
39. $\frac{14}{15} \times \frac{5}{7}$	**40.** $\frac{4}{9} \times \frac{7}{12}$	**41.** $\frac{2}{3} \times \frac{4}{9}$	**42.** $\frac{12}{25} \times \frac{15}{16}$
43. $\frac{5}{9} \times \frac{9}{20}$	**44.** $\frac{4}{5} \times \frac{7}{8}$	**45.** $\frac{2}{3} \times \frac{5}{6}$	**46.** $\frac{5}{14} \times \frac{14}{35}$

PROBLEMS

1. What will $\frac{1}{2}$ of a yard of silk cost at $\frac{3}{5}$ of a dollar a yard?

2. If Alfred picks $\frac{1}{2}$ of a peck of cherries and sells $\frac{3}{4}$ of them, what part of a peck does he sell?

3. Blanche had $\frac{3}{4}$ of a pound of candy. She gave $\frac{1}{3}$ of it to Susie. How much did she give to Susie?

4. Mrs. Whiting bought $\frac{7}{8}$ of a yard of ruching and used $\frac{2}{3}$ of it. What part of a yard did she use?

5. What will $\frac{2}{3}$ of a yard of lace cost at $\frac{3}{5}$ of a dollar a yard?

6. It takes Frank $\frac{3}{4}$ of an hour to mow his lawn. Herbert can mow it in $\frac{2}{3}$ the time. How long does it take Herbert?

7. Mr. Kimball bought $\frac{4}{5}$ of a ton of oats. He had to throw away $\frac{1}{6}$ of the lot. What part of a ton did he lose?

8. Two thirds of $\frac{3}{7}$ of an acre of corn is sweet corn. How much sweet corn is there?

9. I have $\frac{4}{5}$ of a dollar. If I spend $\frac{3}{4}$ of it for a book, what part of a dollar does the book cost?

10. The schoolhouse is $\frac{5}{8}$ of a mile from my home. The church is $\frac{2}{3}$ as far. What part of a mile do I walk in going to church?

MULTIPLYING A MIXED NUMBER BY A MIXED NUMBER

Written

1. Find $1\frac{2}{3} \times 1\frac{2}{5}$. Change to improper fractions.

$$1\frac{2}{3} \times 1\frac{2}{5} = \frac{\cancel{5}}{3} \times \frac{7}{\cancel{5}} = \frac{7}{3} = 2\frac{1}{3}$$

Find products:

2. $2\frac{1}{3} \times 1\frac{1}{5}$	**3.** $3\frac{3}{4} \times 2\frac{2}{3}$	**4.** $2\frac{2}{5} \times 1\frac{3}{4}$	**5.** $1\frac{4}{5} \times 3\frac{1}{3}$
6. $\frac{3}{4} \times 3\frac{2}{5}$	**7.** $\frac{5}{6} \times 4\frac{1}{2}$	**8.** $\frac{7}{8} \times 2\frac{1}{8}$	**9.** $\frac{8}{9} \times 2\frac{5}{7}$
10. $1\frac{3}{5} \times 2\frac{1}{2}$	**11.** $3\frac{3}{4} \times 1\frac{5}{7}$	**12.** $5\frac{1}{3} \times 2\frac{1}{4}$	**13.** $2\frac{1}{7} \times 2\frac{1}{10}$
14. $2\frac{5}{6} \times \frac{3}{5}$	**15.** $4\frac{3}{8} \times \frac{8}{9}$	**16.** $3\frac{5}{6} \times \frac{7}{8}$	**17.** $5\frac{2}{3} \times \frac{5}{7}$
18. $1\frac{5}{6} \times 3\frac{3}{5}$	**19.** $2\frac{1}{12} \times 4\frac{4}{5}$	**20.** $4\frac{2}{7} \times 1\frac{5}{9}$	**21.** $2\frac{7}{8} \times 3\frac{3}{5}$

FINDING WHAT PART ONE NUMBER IS OF ANOTHER

Oral

1. What part of 4 dollars is 1 dollar? 2 dollars? 3 dollars?

2. Express as parts of a gallon: 2 quarts; 1 quart.

3. Express as parts of a dollar: 50 cents; 25 cents; 75 cents; 20 cents; 40 cents; 60 cents; 80 cents.

4. What part of a bushel is 1 peck? 3 pecks?

5. What part of 12 inches is 1 inch? 5 inches? 7 inches? 11 inches?

6. Express as parts of a foot: 6 inches; 3 inches; 9 inches; 4 inches; 8 inches; 2 inches; 10 inches.

Express as parts of an hour :

7. 30 minutes
8. 15 minutes; 45 minutes
9. 20 minutes; 40 minutes
10. 10 minutes; 50 minutes
11. 6 minutes; 18 minutes
12. 12 minutes; 48 minutes
13. 5 minutes; 35 minutes
14. 3 minutes; 9 minutes
15. 4 minutes; 16 minutes

What part of :

16. 24 is 8
17. 32 is 4
18. 40 is 8
19. 20 is 10
20. 12 is 9
21. 20 is 12
22. 25 is 10
23. 40 is 30
24. 84 is 7
25. 63 is 9
26. 54 is 6
27. 56 is 8
28. 84 is 21
29. 63 is 35
30. 54 is 36
31. 56 is 32

32. Elsie solves 8 of her 10 problems. What part does she solve?

33. Out of 20 words Jack misspelled 2. What part did he misspell?

34. James bought 24 newspapers. He sold 20. What part had he left?

FINDING THE WHOLE WHEN A PART IS GIVEN *Oral*

1. Four dollars is $\frac{1}{2}$ of my money. What is the whole of it?

2. Ned sold his rabbit for 30 cents. This was $\frac{3}{5}$ of what he paid. What did he pay for the rabbit?

SOLUTION. Since 30 cents is 3 fifths, 1 fifth is $\frac{1}{3}$ of 30 cents, or 10 cents; 5 fifths is 5 × 10 cents, or 50 cents.

3. 12 is $\frac{2}{3}$ of what number? 4. 9 is $\frac{3}{4}$ of what number?

5. 24 is $\frac{6}{7}$ of what number? 6. 15 is $\frac{5}{6}$ of what number?

7. 20 is $\frac{4}{5}$ of what number? 8. 28 is $\frac{4}{7}$ of what number?

9. Maggie paid 40 cents for a veil. This was $\frac{4}{5}$ of what she paid for a pin. How much did she pay for her pin?

10. In one pasture there are 10 cows. This is $\frac{2}{3}$ of the number in another pasture. How many in the second pasture?

11. A baseball team won 12 games. This was $\frac{3}{4}$ of the number played. How many games did it play?

12. 60 miles is $\frac{5}{6}$ of the distance between two cities. How far apart are the cities?

13. I have read 48 pages of a book. This is $\frac{4}{7}$ of the book. How many pages in the book?

Find the number of which:

14. 27 is $\frac{3}{5}$ 15. 60 is $\frac{5}{8}$ 16. 84 is $\frac{7}{12}$ 17. 35 is $\frac{7}{8}$

18. 96 is $\frac{2}{3}$ 19. 96 is $\frac{3}{4}$ 20. 96 is $\frac{8}{9}$ 21. 72 is $\frac{3}{4}$

22. A man spends $\frac{7}{9}$ of his yearly wages. He spends $630. How much does he earn?

DICTATION EXERCISES

1. $9 \times 8, \div 6, +4, \div 8, \times 5, \times 7, -4, \div 11, +9 = ?$
2. $8 + 4, \times 5, -6, \div 9, \times 7, +3, \div 9, +7, +8 = ?$
3. $63 \div 7, \times 3, +8, \div 7, +4, \times 6 -5, \div 7, +5 = ?$
4. $84 \div 12, \times 8, -2, \div 9, \times 7, -6, \div 4, \times 7, +9 = ?$
5. $48 \div 4, +3, -7, \times 4, +8, \div 8, +3, \times 7, +4 = ?$

DRILL EXERCISE

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*
1.	6	12	2	16	4	24	18	14	10	22	8	20
2.	12	24	4	32	8	48	36	28	20	44	16	40
3	24	48	8	64	16	96	72	56	40	88	32	80
4.	36	72	12	96	24	144	108	84	60	132	48	120
5.	9	18	3	24	6	36	27	21	15	33	12	30
6.	18	36	6	48	12	72	54	42	30	66	24	60
7.	27	54	9	72	18	108	81	63	45	99	36	90
8.	15	30	5	40	10	60	45	35	25	55	20	50
9.	30	60	10	80	20	120	90	70	50	110	40	100
10.	21	42	7	56	14	84	63	49	35	77	28	70
11.	33	66	11	88	22	132	99	77	55	121	44	110

Each number in

Row 1, or column *E*, is $\frac{2}{3}$ of what number?

Row 2, or column *K*, is $\frac{4}{5}$ of what number?

Row 3, or column *D*, is $\frac{8}{9}$ of what number?

Row 4, or column *F*, is $\frac{1}{2}$ of what number?

Row 5, or column *A*, is $\frac{3}{4}$ of what number?

Row 6, or column *B*, is $\frac{6}{7}$ of what number?

Row 7, or column *G*, is $\frac{9}{10}$ of what number?

Row 8, or column *I*, is $\frac{5}{6}$ of what number?

Row 9, or column *L*, is $\frac{10}{11}$ of what number?

Row 10, or column *H*, is $\frac{7}{8}$ of what number?

Row 11, or column *J*, is $\frac{11}{12}$ of what number?

Each number in column *C* is $\frac{1}{2}$ of what number? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$? $\frac{1}{7}$? $\frac{1}{8}$? $\frac{1}{9}$? $\frac{1}{10}$? $\frac{1}{11}$? $\frac{1}{12}$?

REVIEW EXERCISE *Written*

1. Using the numbers 7 and 8, write a proper fraction; an improper fraction.

2. Write an improper fraction that can be changed to a whole number. Change it.

3. Write a proper fraction that can be changed to lower terms. Change it.

4. Write an improper fraction that can be expressed as a mixed number. Write the mixed number.

5. Write five fractions that are each equal to $\frac{2}{3}$.

6. A man said he owned $\frac{20}{32}$ of a mill. What simpler fraction might he have used?

7. Write a fraction that will show what part of the days of a week you attend school.

8. Using any of the numbers from 1 to 10, write the largest proper fraction you can; the smallest proper fraction.

9. Using the numbers 3, 4, 4, 5, write two fractions that can be added without changing their form. Add them.

10. Using the same numbers, write two fractions that cannot be added without changing their form. Change their form and add them.

11. Write as fractions: 1; 5; 8.

12. From 8 take $\frac{1}{8}$; $1\frac{1}{8}$; $2\frac{7}{8}$; $2\frac{3}{4}$; $3\frac{1}{2}$.

13. Find 4 times $\frac{5}{7}$; $\frac{7}{8}$; $2\frac{1}{4}$; $2\frac{3}{5}$; $3\frac{2}{9}$.

14. Find $2\frac{1}{2}$ times 2; $\frac{3}{5}$; $1\frac{2}{5}$; $1\frac{1}{2}$; $2\frac{5}{8}$.

15. Find $\frac{1}{2}$ of $\frac{3}{4}$; $\frac{6}{7}$; $\frac{1}{2}$; $1\frac{1}{2}$; $2\frac{3}{5}$.

16. Find $\frac{2}{3}$ of $\frac{3}{4}$; $\frac{7}{9}$; $1\frac{1}{2}$; 2; $2\frac{2}{3}$.

17. What is $\frac{3}{4}$ of 12?

18. 12 is $\frac{3}{4}$ of what number?

19. John sold 18 doves. This was $\frac{3}{5}$ of the number he had at first. How many had he at first?

DIVISION *Oral and Written*

1. $\frac{4 \text{ apples}}{} \div \frac{2 \text{ apples}}{} = ?$

2. $\frac{4 \text{ fifths}}{} \div \frac{2 \text{ fifths}}{} = ?$

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

4. $\frac{5}{8} \div \frac{1}{8} = ?$

5. $\frac{5}{8} \div \frac{2}{8} = ?$

6. $\frac{5}{8} \div \frac{3}{8} = ?$

7. $\frac{4}{5} \div \frac{2}{3} = ?$ Change to like fractions.

$1\frac{2}{15} \div \frac{10}{15}$

$$\frac{12 \text{ fifteenths}}{} \div \frac{10 \text{ fifteenths}}{} = 12 \div 10 = 1\frac{2}{10} = 1\frac{1}{5}$$

8. Divide 4 by $\frac{2}{3}$. $4 = \frac{4}{1}$, for any whole number may be expressed as a fraction with 1 for its denominator.

$\frac{4}{1} \div \frac{2}{3}$ Change to like fractions.

$1\frac{2}{3} \div \frac{2}{3} = 12 \div 2 = 6$

9. Divide $\frac{5}{6}$ by 2.

$\frac{5}{6} \div \frac{2}{1}$ Change to like fractions.

$\frac{5}{6} \div \frac{12}{6} = 5 \div 12 = \frac{5}{12}$

Any number may be divided by a fraction by changing both numbers to fractions having a common denominator,

and then dividing the numerator of the dividend by the numerator of the divisor.

By multiplying the dividend by the divisor inverted, we obtain the same results as in the process just described.

Thus,
$$\frac{4}{5} \div \frac{2}{3} = \frac{\overset{2}{\cancel{4}}}{5} \times \frac{3}{\underset{2}{\cancel{2}}} = \frac{6}{5} = 1\tfrac{1}{5}$$

$$4 \div \frac{2}{3} = \frac{\overset{2}{\cancel{4}}}{1} \times \frac{3}{\underset{2}{\cancel{2}}} = 6$$

$$\frac{5}{6} \div 2 = \frac{5}{6} \times \frac{1}{2} = \frac{5}{12}$$

To divide fractions, we change to like fractions and divide the numerator of the dividend by the numerator of the divisor; or, for convenience, we invert the divisor and multiply, canceling when possible.

Divide by changing to like fractions, or by inverting the divisor:

	A	*B*	*C*	*D*	*E*
10.	$4 \div \frac{1}{2}$	$\frac{1}{5} \div 2$	$9 \div \frac{3}{7}$	$\frac{2}{5} \div \frac{1}{2}$	$\frac{2}{3} \div \frac{1}{5}$
11.	$6 \div \frac{1}{3}$	$\frac{3}{4} \div 3$	$\frac{3}{4} \div 5$	$\frac{3}{4} \div \frac{2}{3}$	$\frac{4}{5} \div \frac{3}{4}$
12.	$3 \div \frac{1}{4}$	$\frac{7}{8} \div 7$	$12 \div \frac{4}{5}$	$\frac{3}{5} \div \frac{5}{8}$	$\frac{2}{3} \div \frac{3}{4}$
13.	$5 \div \frac{1}{6}$	$\frac{4}{5} \div 6$	$\frac{5}{6} \div 4$	$\frac{5}{8} \div \frac{5}{7}$	$\frac{6}{7} \div \frac{2}{3}$
14.	$2 \div \frac{1}{8}$	$\frac{5}{7} \div 5$	$\frac{3}{8} \div \frac{3}{4}$	$\frac{4}{9} \div \frac{5}{6}$	$\frac{3}{5} \div \frac{3}{4}$
15.	$8 \div \frac{3}{4}$	$\frac{8}{9} \div 3$	$\frac{3}{4} \div \frac{7}{8}$	$\frac{3}{5} \div \frac{6}{7}$	$\frac{3}{8} \div \frac{7}{8}$
16.	$5 \div \frac{2}{5}$	$\frac{4}{5} \div 2$	$\frac{2}{3} \div \frac{8}{9}$	$\frac{8}{9} \div \frac{2}{3}$	$\frac{4}{9} \div \frac{2}{3}$
17.	$10 \div \frac{5}{6}$	$\frac{3}{8} \div 5$	$\frac{4}{5} \div \frac{2}{3}$	$\frac{2}{3} \div \frac{5}{6}$	$\frac{5}{6} \div \frac{3}{4}$

DIVIDING MIXED NUMBERS *Written*

1. Divide $9\frac{2}{7}$ by 4.

(1) $9\frac{2}{7} \div 4 = \frac{65}{7} \div 4 = \frac{65}{7} \times \frac{1}{4} = \frac{65}{28} = 2\frac{9}{28}$

(2) $4)\overline{9\frac{2}{7}}$ $\frac{1}{4}$ of 9 is 2, and 1 over

$2\frac{9}{28}$ $\frac{1}{4}$ of $1\frac{2}{7} = \frac{1}{4}$ of $\frac{9}{7} = \frac{9}{28}$

Give quotients:

2. $3\frac{1}{5} \div 2$	**3.** $16\frac{2}{3} \div 7$	**4.** $16\frac{2}{3} \div 4$	**5.** $14\frac{4}{5} \div 6$
6. $4\frac{7}{8} \div 3$	**7.** $8\frac{1}{3} \div 5$	**8.** $14\frac{2}{3} \div 5$	**9.** $12\frac{2}{5} \div 7$
10. $8\frac{2}{3} \div 4$	**11.** $8\frac{1}{2} \div 6$	**12.** $15\frac{5}{8} \div 4$	**13.** $24\frac{3}{4} \div 3$
14. $12\frac{1}{2} \div 3$	**15.** $12\frac{2}{5} \div 7$	**16.** $33\frac{1}{3} \div 8$	**17.** $14\frac{4}{5} \div 6$
18. $9\frac{5}{7} \div 5$	**19.** $7\frac{2}{3} \div 5$	**20.** $18\frac{3}{4} \div 2$	**21.** $33\frac{1}{3} \div 8$
22. $20\frac{2}{3} \div 6$	**23.** $15\frac{7}{9} \div 4$	**24.** $17\frac{7}{8} \div 7$	**25.** $25\frac{1}{2} \div 9$

26. Divide $3\frac{1}{2}$ by $1\frac{3}{4}$.

$$3\tfrac{1}{2} \div 1\tfrac{3}{4} = \frac{7}{2} \div \frac{7}{4} = \frac{\cancel{7}}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{\cancel{7}} = 2$$

Give quotients:

27. $2\frac{1}{4} \div 1\frac{1}{8}$	**28.** $\frac{7}{8} \div 1\frac{5}{8}$	**29.** $\frac{3}{4} \div 1\frac{1}{2}$	**30.** $1\frac{2}{3} \div \frac{5}{9}$
31. $1\frac{1}{2} \div 2\frac{1}{4}$	**32.** $1\frac{1}{4} \div \frac{2}{5}$	**33.** $3\frac{1}{8} \div \frac{5}{8}$	**34.** $\frac{7}{8} \div 2\frac{1}{3}$
35. $3\frac{1}{3} \div \frac{2}{5}$	**36.** $\frac{5}{6} \div 2\frac{1}{4}$	**37.** $\frac{2}{3} \div 3\frac{1}{3}$	**38.** $3\frac{3}{4} \div 1\frac{7}{8}$
39. $2\frac{2}{5} \div 5\frac{2}{5}$	**40.** $3\frac{3}{5} \div 2\frac{1}{4}$	**41.** $1\frac{2}{3} \div 3\frac{2}{3}$	**42.** $5\frac{2}{5} \div 2\frac{1}{4}$
43. $4\frac{1}{8} \div 1\frac{1}{2}$	**44.** $2\frac{3}{4} \div 1\frac{5}{6}$	**45.** $6\frac{1}{4} \div 1\frac{7}{8}$	**46.** $2\frac{2}{7} \div 1\frac{1}{8}$

PROBLEMS *Written*

1. If 1 pound of coffee costs $\frac{1}{4}$ of a dollar, how many pounds can be bought for $6\frac{1}{2}$ dollars?

2. Mrs. Martin paid $4\frac{2}{5}$ dollars for $5\frac{1}{2}$ yards of cloth. What was the price a yard?

3. Two boys walked 4 miles in $2\frac{3}{4}$ hours. How far did they walk in 1 hour?

4. Alice paid the photographer $1\frac{2}{5}$ dollars for finishing 20 pictures. What was the cost of each picture?

5. At $5\frac{1}{2}$ cents a pound, how many pounds of sugar can be bought for 55 cents?

6. If 9 yards of carpeting cost $12\frac{3}{5}$ dollars, what will 1 yard cost?

7. A boy picked 4 boxes of strawberries and sold them for 50 cents. How much did he receive a box?

8. A farmer's coal cost 33 dollars. He paid for it in apples worth $2\frac{3}{4}$ dollars a barrel. How many barrels did it take?

9. If a man earns $1\frac{4}{5}$ dollars a day, how long will it take him to earn 9 dollars?

10. Three barrels of flour cost $19\frac{1}{2}$ dollars. What was the price of a barrel?

11. A field containing $2\frac{5}{8}$ acres is cut up into 7 equal lots. What part of an acre is each lot?

12. Mrs. Jones sold some eggs for $\frac{2}{5}$ of a dollar a dozen. She received $1\frac{3}{5}$ dollars for them. How many dozen did she sell?

13. If $4\frac{1}{5}$ dollars will pay for 7 pounds of tea, what is the cost of a pound?

14. In 6 minutes a railroad train ran $4\frac{2}{7}$ miles. What was the rate per minute?

15. A woman received $11\frac{1}{4}$ dollars for 5 days' work. What did she receive a day?

16. At $\frac{2}{5}$ of a dollar a pound, how many pounds of chocolate can be bought for $2\frac{2}{5}$ dollars?

17. How many half-gallon bottles will be required to bottle $3\frac{1}{2}$ gallons of vinegar?

18. How many strips of paper $\frac{5}{8}$ of a yard wide will be needed to cover the side of a room 5 yards long?

19. Julia uses $\frac{4}{9}$ of a yard of cretonne to make a work-bag. How many bags can she make from 4 yards?

20. Mrs. Danforth divided $3\frac{1}{2}$ pounds of candy among 4 children. What part of a pound did she give to each child?

REVIEW EXERCISE *Oral and Written*

1. Name the largest of these quantities: $\frac{1}{8}$ of a dollar, $\frac{1}{3}$ of a dollar, $\frac{1}{2}$ of a dollar.

2. What is the product of $10 \times \frac{3}{5}$? $12 \times \frac{6}{7}$? $20 \times \frac{5}{12}$?

3. What does the expression $\frac{4}{5} \times 9$ mean?

4. Find the product of $\frac{4}{5} \times 8$; $\frac{3}{7} \times 9$; $\frac{3}{8} \times 2$.

5. Multiply $3\frac{3}{4}$ by 5; $5\frac{3}{8}$ by 8; $12\frac{1}{2}$ by 7.

6. Multiply 8 by $2\frac{2}{3}$; 12 by $4\frac{2}{9}$; 20 by $3\frac{3}{5}$.

7. What is $\frac{1}{4}$ of $\frac{8}{15}$? $\frac{5}{9}$ of $\frac{9}{20}$? $\frac{2}{3}$ of $\frac{4}{5}$?

8. Find $2\frac{3}{5} \times 2\frac{1}{2}$; $\frac{5}{6} \times 4\frac{1}{2}$; $2\frac{2}{7} \times 2\frac{1}{10}$.

9. Divide $\frac{2}{3}$ by $\frac{5}{6}$; $\frac{8}{9}$ by $\frac{4}{5}$; $\frac{9}{10}$ by $\frac{5}{6}$.

10. Divide 9 by $\frac{3}{7}$; 12 by $\frac{4}{5}$; $\frac{5}{6}$ by 4; $\frac{7}{8}$ by 7.

11. Divide $3\frac{3}{5}$ by $2\frac{1}{4}$; $4\frac{1}{5}$ by $\frac{5}{7}$; $\frac{4}{7}$ by $3\frac{3}{7}$; $4\frac{3}{8}$ by 5.

12. What is the value of $\frac{5}{6} + \frac{3}{4}$? $\frac{5}{6} - \frac{3}{4}$? $\frac{5}{6}$ of $\frac{3}{4}$? $\frac{5}{6} \div \frac{3}{4}$?

MISCELLANEOUS PROBLEMS *Written*

1. What is the cost of $3\frac{3}{4}$ pounds of coffee at $\frac{2}{5}$ of a dollar a pound?

Omitting fractions, read "What will 3 pounds cost at 1 dollar a pound?" 3 times 1 dollar.

Similarly, $3\frac{3}{4}$ pounds will cost $3\frac{3}{4}$ times $\frac{2}{5}$ of a dollar.

$$3\tfrac{3}{4} \times \frac{2}{5} = \frac{\overset{3}{\cancel{15}}}{\underset{2}{\cancel{4}}} \times \frac{2}{\cancel{5}} = \frac{3}{2}, \text{ or } 1\tfrac{1}{2}$$

Answer, $\$1\frac{1}{2}$.

Notice that in the mechanical work we treat the quantities as abstract numbers.

2. What must I pay for $2\frac{1}{2}$ tons of coal at $6\frac{4}{5}$ dollars a ton?

3. A bushel of oats weighs 32 pounds. What is the weight of a load of $20\frac{5}{8}$ bushels?

4. Mr. Farmer has 280 sheep. Mr. Harlow has $2\frac{1}{8}$ times as many. How many has Mr. Harlow?

5. How many quarts of pickles are there in 15 jars if each jar holds $1\frac{3}{4}$ quarts?

6. At 12 cents a pound, how much must be paid for 6 cheeses, each weighing $12\frac{5}{8}$ pounds?

7. If $15\frac{5}{8}$ yards of cloth cost $6\frac{1}{4}$ dollars, what is the cost of 1 yard?

Omitting fractions, read "If 15 yards cost 6 dollars, what will 1 yard cost?" $\$6 \div 15 =$ cost of 1 yard.

Similarly, $\$6\frac{1}{4} \div 15\frac{5}{8} =$ cost of 1 yard.

$$6\tfrac{1}{4} \div 15\tfrac{5}{8} = \frac{25}{4} \times \frac{2}{\cancel{125}} = \frac{2}{5}$$

Answer, $\frac{2}{5}$ of a dollar.

8. How many bushels of potatoes at $\frac{4}{5}$ of a dollar a bushel can be bought for 20 dollars?

9. In 6 days James earned $\$10\frac{1}{2}$. What were his daily wages?

10. For $5\frac{1}{2}$ days' work a gardener received $13\frac{3}{4}$ dollars. How much did he receive a day?

11. It takes $\frac{5}{8}$ of a yard of cloth to make an apron. How many aprons can be made from $7\frac{1}{2}$ yards of cloth?

12. If $\frac{7}{8}$ of a yard of cloth is used for an apron, how many yards must be bought to make 20 aprons?

13. How much cloth is used for an apron when 22 aprons are made from $8\frac{1}{4}$ yards?

14. A small park contains $5\frac{3}{5}$ acres. In the same city there is another park $8\frac{3}{4}$ times as large. What is the size of the larger park?

15. A clerk receives $\$60$ a month. He spends $\$20\frac{3}{4}$ for board, $\$7\frac{1}{2}$ for room rent, $\$5\frac{1}{4}$ for clothing, and $\$1\frac{3}{4}$ for car fares. How much does he save?

16. A carpenter agreed to do a piece of work at $\$3\frac{3}{4}$ a day. He worked $7\frac{1}{2}$ days. How much did he charge?

17. Oil is worth at the wells $37\frac{1}{2}$ cents a barrel. What are 1000 barrels worth?

18. Mr. Jenkins received $\$108\frac{1}{2}$ for his apples. He sold them at $\$1\frac{3}{4}$ a barrel. How many barrels did he sell?

19. From $6\frac{1}{2}$ acres of land there were cut $9\frac{3}{4}$ tons of hay. What was the yield of one acre?

20. A can contains $8\frac{1}{2}$ quarts of milk. How much is left after $1\frac{1}{2}$ quarts are sold to one customer and twice as much to another customer?

RELATION OF ONE NUMBER TO ANOTHER *Oral*

1. What is the relation of 8 to 2?

The relation of 8 to 2 is found by dividing 8 by 2. $8 \div 2 = 4$.

The relation of one number to another is called their *ratio.*

This principle is nothing new, as every division expresses a ratio, as, also, does every fraction.

Ratio is expressed by the sign : written between the two numbers or quantities. This sign is equivalent to the sign of division, and means that the first number is to be divided by the second. $3)\underline{5}$, $3 \div 5$, $\frac{3}{5}$, $3 : 5$, and the ratio 3 to 5, all mean the same thing.

2. What is the ratio (1) of 12 to 3; (2) of 3 to 12?

(1) The ratio of 12 to $3 = \frac{12}{3} = 4$.

(2) The ratio of 3 to $12 = \frac{3}{12} = \frac{1}{4}$.

Find the ratio of:

3. 20 to 4 **4.** 27 to 9 **5.** 2 to 10 **6.** 3 to 15

7. 54 : 9 **8.** 56 : 7 **9.** 12 : 60 **10.** 5 : 40

11. 36 : 6 **12.** 35 : 5 **13.** 8 : 48 **14.** 7 : 63

15. 28 : 7 **16.** 84 : 7 **17.** 12 : 72 **18.** 8 : 32

What is the ratio of :

19. 56 days to 8 days **20.** 5 boys to 60 boys

21. 32 men to 4 men **22.** 8 barrels to 48 barrels

23. Mr. Rich is 40 years old. His son Harry is 8 years old. What is the ratio of the father's age to the son's age ?

24. Harriet solved 9 out of 10 problems. What is the ratio of the number solved to the number given ?

25. Jennie has 2 dolls. Maggie has 6. What is the ratio of Jennie's dolls to Maggie's dolls ?

26. A shoe dealer sold 40 pairs of shoes in the afternoon and 20 pairs in the evening. What is the ratio of the afternoon sales to the evening sales ?

The following table contains pairs of fractions whose sums, differences, and quotients have no denominators greater than 16. The exercises should be used frequently for a few moments at a time for quick oral work until pupils acquire accuracy and facility in the use of these simple fractions.

1. Add the fractions in each couplet.

2. Subtract the second fraction in each couplet from the first fraction.

3. Find the product of the fractions in each couplet.

4. Divide the first fraction in each couplet by the second fraction.

5. Compare the first fraction in each couplet with the second fraction.

6. Compare the second fraction in each couplet with the first fraction.

7. Make up simple problems based upon the fractions given in the table.

DRILL TABLE IN FRACTIONS

	A	*B*	*C*	*D*	*E*	*F*
1.	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{2}$			
2.	$\frac{1}{2}$ $\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{2}$	$\frac{1}{3}$ $\frac{1}{6}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{1}{3}$	$\frac{5}{6}$ $\frac{2}{3}$
3.	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{1}{2}$				
4.	$\frac{1}{4}$ $\frac{1}{8}$	$\frac{3}{4}$ $\frac{1}{8}$	$\frac{3}{8}$ $\frac{1}{4}$	$\frac{5}{8}$ $\frac{1}{4}$	$\frac{7}{8}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{3}{8}$
5.	$\frac{3}{4}$ $\frac{5}{8}$	$\frac{7}{8}$ $\frac{3}{4}$	$\frac{1}{2}$ $\frac{1}{8}$	$\frac{1}{2}$ $\frac{3}{8}$	$\frac{5}{8}$ $\frac{1}{2}$	$\frac{7}{8}$ $\frac{1}{2}$
6.	$\frac{1}{3}$ $\frac{1}{9}$	$\frac{1}{3}$ $\frac{2}{9}$	$\frac{4}{9}$ 1	$\frac{5}{9}$ $\frac{1}{3}$	$\frac{7}{9}$ $\frac{1}{3}$	$\frac{8}{9}$ $\frac{1}{3}$
7.	$\frac{2}{3}$ $\frac{1}{9}$	$\frac{2}{3}$ $\frac{2}{9}$	$\frac{2}{3}$ $\frac{4}{9}$	$\frac{2}{3}$ $\frac{5}{9}$	$\frac{7}{9}$ $\frac{2}{3}$	$\frac{8}{9}$ $\frac{2}{3}$
8.	$\frac{1}{2}$ $\frac{1}{5}$	$\frac{1}{2}$ $\frac{2}{5}$	$\frac{3}{5}$ $\frac{1}{2}$	$\frac{4}{5}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{10}$	$\frac{1}{2}$ $\frac{3}{10}$
9.	$\frac{7}{10}$ $\frac{1}{2}$	$\frac{9}{10}$ $\frac{1}{2}$	$\frac{1}{5}$ $\frac{1}{10}$	$\frac{3}{10}$ $\frac{1}{5}$	$\frac{7}{10}$ $\frac{1}{5}$	$\frac{9}{10}$ $\frac{1}{5}$
10.	$\frac{2}{5}$ $\frac{1}{10}$	$\frac{2}{5}$ $\frac{3}{10}$	$\frac{7}{10}$ $\frac{2}{5}$	$\frac{9}{10}$ $\frac{2}{5}$	$\frac{3}{5}$ $\frac{1}{10}$	$\frac{3}{5}$ $\frac{3}{10}$
11.	$\frac{7}{10}$ $\frac{3}{5}$	$\frac{9}{10}$ $\frac{3}{5}$	$\frac{4}{5}$ $\frac{1}{10}$	$\frac{4}{5}$ $\frac{3}{10}$	$\frac{4}{5}$ $\frac{7}{10}$	$\frac{9}{10}$ $\frac{4}{5}$

12.	$\frac{1}{2}$ $\frac{1}{12}$	$\frac{1}{2}$ $\frac{5}{12}$	$\frac{7}{12}$ $\frac{1}{2}$	$\frac{11}{12}$ $\frac{1}{2}$	$\frac{1}{3}$ $\frac{1}{12}$	$\frac{5}{12}$ $\frac{1}{3}$
13.	$\frac{7}{12}$ $\frac{1}{3}$	$\frac{11}{12}$ $\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{12}$	$\frac{2}{3}$ $\frac{5}{12}$	$\frac{2}{3}$ $\frac{7}{12}$	$\frac{11}{12}$ $\frac{2}{3}$
14.	$\frac{1}{4}$ $\frac{1}{12}$	$\frac{5}{12}$ $\frac{1}{4}$	$\frac{7}{12}$ $\frac{1}{4}$	$\frac{11}{12}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{12}$	$\frac{3}{4}$ $\frac{5}{12}$
15.	$\frac{3}{4}$ $\frac{7}{12}$	$\frac{11}{12}$ $\frac{3}{4}$	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{2}{3}$
16.	$\frac{1}{6}$ $\frac{1}{12}$	$\frac{5}{12}$ $\frac{1}{6}$	$\frac{7}{12}$ $\frac{1}{6}$	$\frac{11}{12}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{1}{12}$	$\frac{5}{6}$ $\frac{5}{12}$
17.	$\frac{5}{6}$ $\frac{7}{12}$	$\frac{11}{12}$ $\frac{5}{6}$				

18.	$\frac{1}{2}$ $\frac{1}{14}$	$\frac{1}{2}$ $\frac{3}{14}$	$\frac{1}{2}$ $\frac{5}{14}$	$\frac{9}{14}$ $\frac{1}{2}$	$\frac{11}{14}$ $\frac{1}{2}$	$\frac{13}{14}$ $\frac{1}{2}$
19.	$\frac{1}{2}$ $\frac{1}{7}$	$\frac{1}{2}$ $\frac{2}{7}$	$\frac{1}{2}$ $\frac{3}{7}$	$\frac{4}{7}$ $\frac{1}{2}$	$\frac{5}{7}$ $\frac{1}{2}$	$\frac{6}{7}$ $\frac{1}{2}$

20.	$\frac{1}{3}$ $\frac{1}{5}$	$\frac{2}{5}$ $\frac{1}{3}$	$\frac{3}{5}$ $\frac{1}{3}$	$\frac{4}{5}$ $\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{5}$	$\frac{2}{3}$ $\frac{2}{5}$
21.	$\frac{2}{3}$ $\frac{3}{5}$	$\frac{4}{5}$ $\frac{2}{3}$				

22.	$\frac{1}{2}$ $\frac{1}{16}$	$\frac{1}{2}$ $\frac{3}{16}$	$\frac{1}{2}$ $\frac{5}{16}$	$\frac{1}{2}$ $\frac{7}{16}$	$\frac{9}{16}$ $\frac{1}{2}$	$\frac{11}{16}$ $\frac{1}{2}$
23.	$\frac{13}{16}$ $\frac{1}{2}$	$\frac{15}{16}$ $\frac{1}{2}$	$\frac{1}{4}$ $\frac{1}{16}$	$\frac{1}{4}$ $\frac{3}{16}$	$\frac{1}{4}$ $\frac{5}{16}$	$\frac{7}{16}$ $\frac{1}{4}$
24.	$\frac{9}{16}$ $\frac{1}{4}$	$\frac{11}{16}$ $\frac{1}{4}$	$\frac{13}{16}$ $\frac{1}{4}$	$\frac{15}{16}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{16}$	$\frac{3}{4}$ $\frac{3}{16}$
25.	$\frac{3}{4}$ $\frac{5}{16}$	$\frac{3}{4}$ $\frac{7}{16}$	$\frac{3}{4}$ $\frac{9}{16}$	$\frac{3}{4}$ $\frac{11}{16}$	$\frac{13}{16}$ $\frac{3}{4}$	$\frac{15}{16}$ $\frac{3}{4}$
26.	$\frac{1}{8}$ $\frac{1}{16}$	$\frac{3}{16}$ $\frac{1}{8}$	$\frac{5}{16}$ $\frac{1}{8}$	$\frac{7}{16}$ $\frac{1}{8}$	$\frac{9}{16}$ $\frac{1}{8}$	$\frac{11}{16}$ $\frac{1}{8}$
27.	$\frac{13}{16}$ $\frac{1}{8}$	$\frac{15}{16}$ $\frac{1}{8}$	$\frac{3}{8}$ $\frac{1}{16}$	$\frac{3}{8}$ $\frac{3}{16}$	$\frac{3}{8}$ $\frac{5}{16}$	$\frac{7}{16}$ $\frac{3}{8}$
28.	$\frac{9}{16}$ $\frac{3}{8}$	$\frac{11}{16}$ $\frac{3}{8}$	$\frac{13}{16}$ $\frac{3}{8}$	$\frac{15}{16}$ $\frac{7}{8}$	$\frac{5}{8}$ $\frac{1}{16}$	$\frac{5}{8}$ $\frac{3}{16}$
29.	$\frac{5}{8}$ $\frac{5}{16}$	$\frac{5}{8}$ $\frac{7}{16}$	$\frac{5}{8}$ $\frac{9}{16}$	$\frac{11}{16}$ $\frac{5}{8}$	$\frac{13}{16}$ $\frac{5}{8}$	$\frac{15}{16}$ $\frac{5}{8}$
30.	$\frac{7}{8}$ $\frac{1}{16}$	$\frac{7}{8}$ $\frac{3}{16}$	$\frac{7}{8}$ $\frac{5}{16}$	$\frac{7}{8}$ $\frac{7}{16}$	$\frac{7}{8}$ $\frac{9}{16}$	$\frac{7}{8}$ $\frac{11}{16}$
31.	$\frac{7}{8}$ $\frac{13}{16}$	$\frac{15}{16}$ $\frac{7}{8}$				

DRILL EXERCISE IN RAPID ADDITION AND SUBTRACTION

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

1. Beginning with any number in the margin and going in either direction, rapidly add the numbers until 100 or any given number is reached.

2. Beginning with 100 or any given number, rapidly subtract the successive numbers in the margin.

NOTE. The above exercise is valuable only when additions and subtractions are performed rapidly.

MISCELLANEOUS PROBLEMS *Written*

1. Two men do a piece of work for 84 dollars. One does $\frac{3}{7}$ of the work. How much ought each to receive?

2. John had $\frac{15}{20}$ of a dollar. He gave $\frac{2}{5}$ of it to his sister. How much had he left?

3. If he had given $\frac{2}{5}$ of a dollar to his sister, how much would he have had left?

4. After spending $\frac{2}{3}$ of his money for a knife, Austin had 24 cents left. How much had he at first?

5. What is the cost of a yard of cloth when $\frac{1}{2}$ of a yard costs $\frac{1}{2}$ of a dollar?

6. What is the cost of $\frac{1}{2}$ of a yard of cloth at $\frac{1}{2}$ of a dollar a yard?

7. What is the cost of $1\frac{1}{2}$ yards of cloth at $1\frac{1}{2}$ dollars a yard?

8. Rope is sold for $2\frac{5}{8}$ cents a foot. How much will 176 feet cost?

9. A merchant paid $9\frac{3}{5}$ dollars for a dozen hats. He sold them at cost. How much did he receive for each hat?

10. A book which cost $\frac{9}{10}$ of a dollar was sold for $\frac{4}{5}$ of a dollar. What was the loss?

11. What are the daily wages of a man who earns $13\frac{1}{2}$ dollars in a week?

12. A telephone pole 30 feet long was set 6 feet in the ground. What part of the pole was in the ground?

13. A grocer had 72 gallons of molasses. He sold $\frac{1}{4}$ of it to one customer and $\frac{1}{3}$ of it to another. How many gallons had he left?

14. Mr. Brown has 100 dollars. If he pays the grocer $17\frac{1}{2}$ dollars, and buys 8 cords of wood at $5\frac{3}{4}$ dollars a cord, how much will he have left?

15. By the single package, raisins are 12 cents; by the dozen packages, $10\frac{3}{4}$ cents. What is saved by buying a dozen packages at a time?

16. What is the change from 2 ten-dollar bills given to pay for $2\frac{1}{2}$ tons of coal at $6\frac{2}{5}$ dollars a ton?

17. Two boys started from the same point and walked in opposite directions. One walked $3\frac{5}{8}$ miles and the other $2\frac{3}{4}$ miles. How far apart were they then?

18. What is the cost of $\frac{3}{4}$ of a pound of tea at $\frac{2}{5}$ of a dollar a pound?

19. A man earns $17\frac{1}{2}$ dollars a week and saves $\frac{3}{7}$ of it. How much can he save in 4 weeks?

20. Three fourths of a fish line is 36 feet. How long is the line?

21. Another line is $\frac{2}{3}$ of 36 feet. How long is this line?

22. What part of a dollar is 50 cents? 25 cents? 75 cents?

23. What part of a dollar is 20 cents? 40 cents? 60 cents? 80 cents?

24. What part of a dollar is 10 cents? 30 cents? 70 cents? 90 cents?

25. If land is worth 100 dollars an acre, what part of an acre can be bought with 50 dollars? 25 dollars? 75 dollars?

26. What part of a century (one hundred years) is 20 years? 40 years? 60 years? 80 years?

27. A bundle of 10 pencils is what part of 100 pencils? A bundle of 30? A bundle of 70? A bundle of 90?

28. How long will it take Joseph to save 21 dollars for a bicycle if he saves $1\frac{3}{4}$ dollars a week?

29. Every Saturday night Robert puts $\frac{3}{4}$ of a dollar in the savings bank. How much will he save in 20 weeks?

30. If you earn 2 dollars and save $\frac{3}{4}$ of it, how much do you save?

31. If you earn 2 dollars and save 1 cent out of every 10, how much do you save?

MEASURING DISTANCES *Oral and Written*

Distances have one dimension — length.

We measure short distances in inches, feet, and yards.

1. How many lines 1 inch long will make a line 1 foot long?

2. How many feet long is a yardstick?

3. How many inches make a yard?

We measure long distances in rods and miles.

4. $5\frac{1}{2}$ yards make a rod. How many feet in a rod?

5. A distance of 320 rods is a mile. How many feet in a mile?

6. Write the table of long or linear measure.

7. My desk is 54 inches long. Express its length in feet and inches. In feet.

8. One foot minus 3 inches is how many inches? What part of a foot?

9. One stick is $1\frac{1}{2}$ feet long and another 15 inches. Both together will reach how far?

10. A house lot is 4 rods long. What is its length in feet?

11. It is 32 rods around a running track in a playground. How many times will Henry and Forrest go around it in running a mile? $\frac{1}{2}$ of a mile?

12. If your steps are $1\frac{2}{3}$ feet long, how many will you take in walking a mile?

MEASURING SURFACES *Oral*

NOTE. An accurate conception of surface area is rare with young pupils. A little time spent now in developing this idea will prove of great help in subsequent work.

Surfaces have two dimensions — length and width.

We measure surfaces or areas in square inches, square feet, square yards, square rods, acres, and square miles.

A square inch is a square 1 inch long and 1 inch wide.

1. A square foot is a square —— long and —— wide.

2. A square 1 foot long is 12 inches long and 12 inches wide. It contains 12 times 12 square inches, or —— square inches.

3. A square yard is a square —— long and —— wide. It is equal to a square —— feet long and —— feet wide. Its area is —— square feet.

4. $30\frac{1}{4}$ square yards make a square rod. How many square feet make a square rod?

160 square rods make 1 acre.

5. Learn:

TABLE OF SQUARE OR SURFACE MEASURE

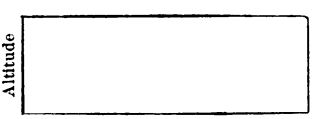
144	square inches (sq. in.)	= 1 square foot (sq. ft.)
9	square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$	square yards	= 1 square rod (sq. rd.)
	or	
$272\frac{1}{4}$	square feet	
160	square rods	= 1 acre (A.)
640	acres	= 1 square mile (sq. mi.)

The side on which a figure seems to stand is its *base*.

The height of a figure from the base is its *altitude*.

6. How many sides has a rectangle?

7. How many corners or angles has a rectangle? How do they compare in size?

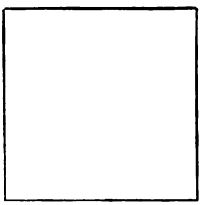


A RECTANGLE

Each of the angles of a rectangle is a *right angle*.

A figure bounded by four straight lines and having four equal angles is a *rectangle*.

8. How many sides has a square? How do they compare in length?



A SQUARE

9. How many angles has a square? How do they compare in size?

A figure bounded by four equal straight lines and having four equal angles is a *square*.

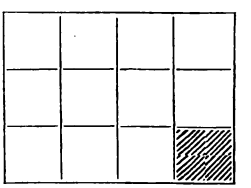
10. In what respects are squares and rectangles alike?

11. In what respect are squares and rectangles unlike?

12. Are all squares rectangles?

The number of square units in the surface of a figure is its *area*.

Let the figure at the right represent a rectangle 4 inches long and 3 inches wide.



The shaded part represents the unit of measurement — one square inch.

13. How many of these units are there in the lower row?

How many rows of these units are there?

Then in the whole figure there are 3 times 4 square inches. The area is 12 square inches.

Note that in finding areas we take these steps:

First. Determine the unit of measurement.

Second. Find the number of these units in one row.

Third. Multiply the number of units in one row by the number of rows.

Think first of the unit of measurement.

The area of a rectangle can always be found by multiplying together its length and its width, when both are expressed in the ***same*** *unit of measurement (inches, feet, yards, etc.).*

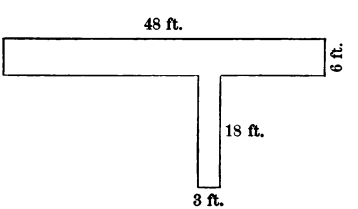
NOTE. Pupils should draw diagrams of rectangles and other plane figures in their problem work until they apprehend the principle involved. The extent to which diagrams are used must be determined by the needs of individuals, since some pupils acquire the powers of visualization and generalization earlier than others.

PROBLEMS *Oral and Written*

1. A post card is 5 inches by 3 inches. How many square inches of writing surface on one side?

2. What is the area of a walk 40 feet long and 3 feet wide?

3. This diagram shows the sidewalk in front of a house and the walk leading to the front door. Find the area of each walk. Express the dimensions of each walk in yards. How many square yards in both walks?



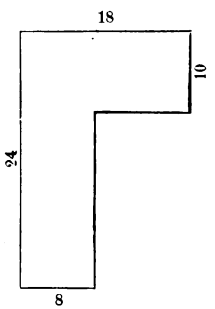
4. A room is 27 feet long and 18 feet wide. Express its dimensions in yards. How many square yards in the floor of the room?

5. A box cover is 15 inches long. Its width is $\frac{2}{3}$ the length. What is the area of the top of the cover?

6. A book is $6\frac{1}{2}$ inches long and 4 inches wide. How much space does it cover on the table?

7. A picture 13 inches by 10 inches is surrounded by a frame 1 inch wide. What are the dimensions of the frame? How much space does the framed picture cover on the wall?

8. The perimeter of a square table is 12 feet. What is the length of one side? What is the area of the top of the table?



9. This diagram represents a field whose dimensions are given in rods. Divide into rectangles and find the area.

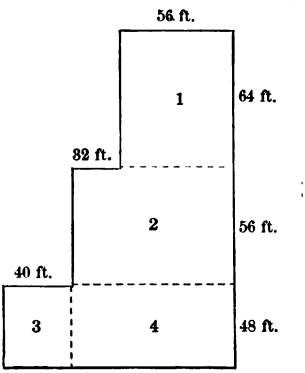
10. Give the dimensions and perimeters of all the different rectangles you can make with 36-inch squares, using all the squares each time. With 48-inch squares. With 60-inch squares.

Find areas and perimeters of these rectangles:

	LENGTH	WIDTH		LENGTH	WIDTH
11.	18 in.	12 in.	**12.**	17 ft.	6 ft.
13.	15 ft.	$8\frac{2}{3}$ ft.	**14.**	14 yd.	16 yd.
15.	$8\frac{3}{4}$ ft.	$2\frac{1}{2}$ ft.	**16.**	25 ft.	5 yd.
17.	$4\frac{1}{2}$ in.	$4\frac{1}{2}$ in.	**18.**	4 yd.	$3\frac{3}{4}$ ft.
19.	30 in.	$2\frac{1}{2}$ ft.	**20.**	$16\frac{1}{2}$ in.	$10\frac{2}{3}$ in.

21. The following diagram represents a plot of ground which was cut up into house lots as indicated by the

dotted lines. Lot 1 was sold for 15¢ a square foot; lot 2 for 12¢ a square foot; lot 3 for 18¢ a square foot; and lot 4 for 20¢ a square foot. Find the selling price of each lot.



22. How many yards of tape will it take to bind a rug $2\frac{1}{2}$ yards long and 1 yard wide? How much space will the rug cover?

Give the areas and the perimeters of:

23. A 4-inch square

24. A 9-yard square

25. A 5-inch square

26. A 10-inch square

27. A 6-foot square

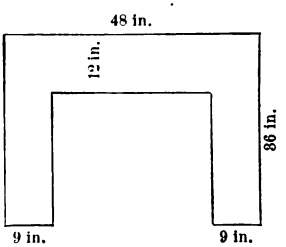
28. An 11-foot square

29. A 7-yard square

30. A 12-yard square

31. An 8-yard square

32. A 20-rod square



33. Find the area of this figure by dividing it into rectangles. Find its perimeter.

34. At 12 cents a square foot, what is the cost of a lot of land 75 feet by 40 feet?

35. A house lot is 75 feet by 48 feet.

(1) Express its dimensions in yards.

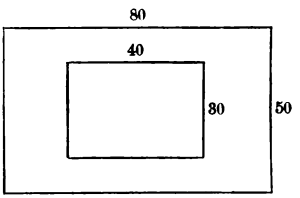
(2) Express the area in square yards. In square feet.

(3) Express the perimeter in feet. In yards.

36. What is the length in yards of a tablecloth that covers 54 square feet if it is 2 yards wide?

37. How many square feet of sod will it take to make a lawn 18 yards long and 9 yards wide?

38. How many strips of turf 4 feet long and 1 foot wide must be used to cover a space 28 feet by 15 feet?



39. A house lot is 50 feet on the street side and has a depth of 80 feet. At 15¢ a foot, what will it cost to fence it? How many square feet in the lot? What is it worth at 18¢ a square foot?

40. A house 30 feet by 40 feet stands in the center of the lot. How far from the street is the front of the house? How far from the sides of the lot does the house stand? How many square feet does the house cover? What part of the lot does it cover?

41. A lot of land is 160 rods long and 1 rod wide. Express its area in square rods. What other name is given to this area?

42. A lot contains 1 acre of land. It is 40 rods long. How wide is it?

43. A farmer has a field containing 2000 square rods. How many acres in the field?

44. It takes 80 rods of fence to inclose a square field. How many acres in the field?

45. What is the area in acres of a square park $\frac{1}{2}$ of a mile on each side?

46. The distance around a square field is $\frac{1}{2}$ of a mile. How many acres in the field?

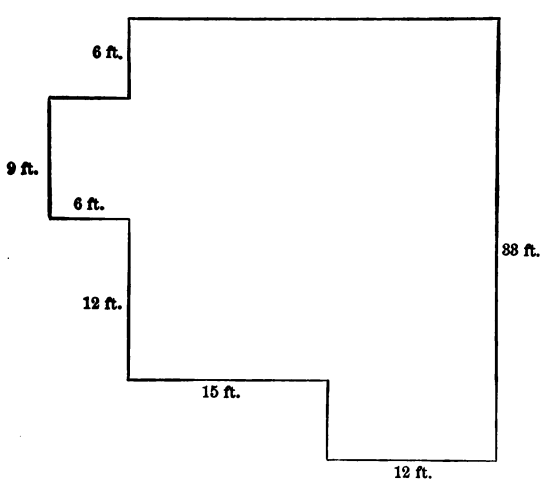
47. How many acres in a lot $\frac{1}{2}$ of a mile long and $\frac{1}{4}$ of a mile wide?

48. At \$45 an acre, what is a field 40 rods by 20 rods worth?

49. A lot of land 9 rods by 6 rods was sold for \$1188. What was the price per square rod? Per acre?

50. At 50 cents a square yard, what will it cost to lay a sidewalk 60 feet by 6 feet?

51. The following diagram represents the ground plan of a house. Find its perimeter. Find its area.



Express:

52. 2880 square inches as square feet.

53. 2880 square feet as square yards.

54. 2880 square feet as square inches.

55. 2880 square yards as square feet.

56. 2880 square rods as acres.

57. 2880 acres as square rods.

DRAWING TO SCALE *Oral and Written*

1. Draw a line 4 inches long. Divide it into four equal parts. If 1 inch represents 1 foot, how many feet does the line represent? $\frac{1}{2}$ of the line? $\frac{3}{4}$ of the line?

2. If 1 inch represents 2 feet, how many feet does the line stand for? $\frac{1}{2}$ of the line? $\frac{3}{4}$ of the line? A line twice as long?

3. On a map a street is represented by a line 12 inches long. If 1 inch represents 1 rod, how long is the street?

4. Letting 1 inch stand for 5 feet, draw a line that will represent 15 feet. How many inches long is your line?

This is drawing to a scale. The scale you have just used is 1 inch to 5 feet.

Scales on which plans, maps, or diagrams are made are usually indicated in this way: $1'' = 5'$, the sign $''$ meaning inches and the sign $'$ feet. Scale $1'' = 5'$ means that 1 inch represents 5 feet.

5. If on a map a line 1 inch long represents the distance from New York to Philadelphia — 90 miles — what is the scale?

6. From New York to Albany is 140 miles. On the scale $1'' = 14$ miles, how long a line will represent the distance between these two cities?

7. On a scale of 1 inch to 4 feet draw a line that will represent 12 feet.

8. On a scale of 1 inch to 3 feet, how many feet does a line 9 inches long represent?

9. Draw a 4-foot square on a scale of 1 inch to 2 feet.

10. On the scale $1'' = 3'$, what length of lines must you draw to represent a square 1 yard long? A rectangle 12 feet by 9 feet?

11. What is the scale when 3 inches stands for 18 rods?

12. On a map a street 60 rods long is represented by a line 10 inches long. What is the scale?

13. My desk is 5 feet long and 3 feet wide. Draw a picture or diagram of its top, letting 1 inch represent 1 foot.

(1) How many inches long is your diagram?

(2) How many inches wide?

(3) What is the perimeter of the diagram? How many feet does it represent?

(4) What is the area of the diagram? How many square feet does it represent?

14. A flower bed is 60 inches by 40 inches. Draw a plan of it on a scale of 1 inch to 10 inches.

15. Another flower bed is 6 yards square. Draw a plan on a scale of 1 inch to 2 yards.

16. On the scale $1'' = 4'$ draw the diagram of a blackboard 4 feet wide and 24 feet long.

17. What are the dimensions of a room represented by a diagram 8 inches long and 5 inches wide if the scale is 1 inch to 2 feet? What is the floor area?

18. On a builder's plan, drawn to scale 1 foot = 10 feet, a house is represented by a rectangle 4 feet by 3 feet. What are the dimensions of the house? Its area?

19. A dining room is $16'$ by $12'$. Draw diagram to scale $1'' = 4'$.

20. The dining room table is $8'$ by $4'$. Draw a diagram of it in the diagram of the room.

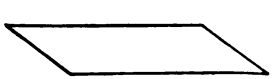
21. Letting 1 inch stand for 20 inches, draw the diagram of a window 60 inches high and 40 inches wide.

22. On a scale of 1 inch to 15 inches draw the diagram of a window sash having 4 panes of glass, each 30 inches by 15 inches.

PARALLELOGRAMS *Oral and Written*

Lines that run in the same direction are *parallel lines.*

A four-sided figure whose opposite sides are parallel is a *parallelogram.*



A PARALLELOGRAM

1. If the shaded part of figure 1 is cut off and placed in the position indicated by the dotted lines, what kind of a figure will you have? See figure 2.

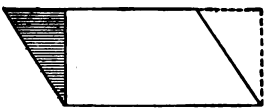


FIG. 1

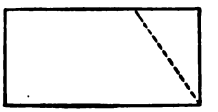


FIG. 2

2. How does the base of the parallelogram compare with the base of the rectangle?

3. How does the altitude of the parallelogram compare with the altitude of the rectangle?

4. Compare the areas of the parallelogram and the rectangle.

5. Draw on paper a parallelogram 3 inches long and 2 inches wide. Cut it out. Cut the parallelogram into two pieces and arrange them to make a rectangle. Compare bases, altitudes, and areas of the parallelogram and rectangle.

6. Draw other parallelograms. Cut, and arrange the parts until you see that a parallelogram is equal to a rectangle having the same base and the same altitude as the parallelogram.

7. How can you find the area of a parallelogram?

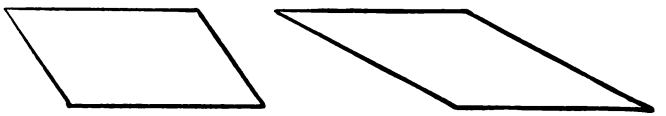
To find the area of a parallelogram, we find the product of its base and its altitude.

8. Draw a rectangle $3\frac{1}{2}$ inches long and 2 inches high. Write the area in the rectangle.

9. Draw a parallelogram whose base is $3\frac{1}{2}$ inches and whose altitude is 2 inches. Write the area in the parallelogram.

10. How do the areas of the two figures you have just drawn compare?

11. Compare the bases and the altitudes of these parallelograms:



12. Find and compare their areas.

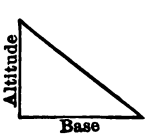
Find areas of parallelograms of these dimensions:

	Base	Altitude		Base	Altitude
13.	12 inches	8 inches	14.	18 inches	5 inches
15.	9 feet	10 feet	16.	8 yards	9 yards
17.	12 inches	$8\frac{1}{2}$ inches	18.	16 feet	$5\frac{2}{3}$ feet
19.	$10\frac{2}{3}$ yards	6 yards	20.	$16\frac{1}{2}$ feet	12 feet
21.	4 yards	8 feet	22.	18 inches	3 feet

Note. Measurement of plane figures made from or drawn on cardboard will prove helpful and interesting. A variety of these figures should be prepared by the teacher, numbered consecutively, and a record of their dimensions and areas kept to facilitate the checking of pupils' work.

Finding measurements and areas of plane figures from the actual figures and from diagrams drawn on the blackboard should precede finding of areas from data given by the teacher.

TRIANGLES *Oral and Written*



A three-sided figure is a *triangle.*

The height of a triangle is its *altitude.*

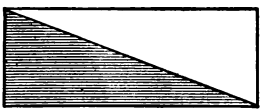


FIG. 1

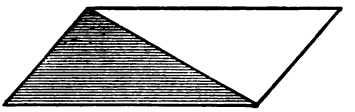


FIG. 2

1. What kind of a figure is the shaded part of figure 1?

2. Compare the base of the triangle with the base of the rectangle.

3. Compare the altitude of the triangle with the altitude of the rectangle.

4. What part of the area of the rectangle is the area of the triangle?

5. How, then, can the area of a triangle be found?

6. In like manner compare the shaded part of figure 2 with the whole parallelogram.

7. Draw on paper a rectangle 4 inches by 3 inches. Cut it into two parts as in figure 1. Compare areas.

8. Draw on paper other parallelograms. Cut each into two parts along the diagonal. Compare areas.

9. Draw on paper a triangle whose base is 4 inches and whose altitude is 2 inches. Cut it out. Cut another triangle exactly like this. Arrange the two triangles so as to form a parallelogram. What are the dimensions of the parallelogram? Compare the base of the parallelogram and the base of the triangles. Compare the altitude of the parallelogram and the altitude of the triangles. What is the area of the parallelogram? The area of each triangle is what part of the area of the parallelogram? What is the area of each triangle?

The area of a triangle is equal to one half the product of its base and its altitude.

To find the area of a triangle, we find one half the product of its base and its altitude.

Note that the dimensions must be expressed in like units.

NOTE. Work like the above should be continued until pupils grasp the principle involved. Different pupils should draw, cut, and compare parallelograms and triangles of different dimensions. Care should be taken that most of the parallelograms and triangles are not rectangles and right-angled triangles.

Give the areas of these triangles :

	ALTITUDE	BASE		ALTITUDE	BASE
10.	10 inches	12 inches	**11.**	15 inches	18 inches
12.	9 inches	3 inches	**13.**	11 inches	7 inches
14.	25 feet	18 feet	**15.**	17 feet	12 feet
16.	13 rods	8 rods	**17.**	7 yards	9 yards

18. What are the base and altitude of the largest triangle you can cut from a piece of paper 4 inches square?

19. What are the dimensions of the largest triangle you can cut from a piece of paper 5 inches by 3 inches?

20. What are the base and altitude of the largest triangle you can draw on a sheet of your arithmetic paper? How does the area of this triangle compare with the area of the sheet on which it is drawn?

21. In the corner of a room is a triangular shelf. The two sides that touch the wall are each 10 inches in length. What is the area of the shelf? On the shelf stands a box

4 inches long and $2\frac{1}{2}$ inches wide. How many square inches of the shelf does it cover?

22. Three roads form the sides of a triangular lot. The base of the lot is 22 feet and the altitude is 18 feet. How many square feet in the lot?

23. A field 32 rods long and 20 rods wide is separated into two equal triangular parts by a path running between two opposite corners. What are the base and the altitude of each part? How many acres in each part?

24. At 15 cents a square foot, what is the value of a three-sided lot of land whose base is 64 feet and whose altitude is 40 feet?

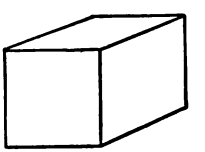
25. How many square yards are there in a triangular lot whose base is 18 yards and whose altitude is one half the length of the base?

26. The height of a triangle is 24 inches. The base is $\frac{3}{4}$ as long. What is the area of the triangle?

27. A triangular flower bed is 36 inches on each side. How many feet of wire netting will inclose it?

MEASURING VOLUMES *Oral and Written*

A number of 1-inch cubes should be used in teaching this subject.



1. How many sides or faces has a cube?

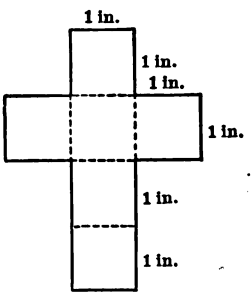
2. How do the sides compare in shape?

3. How do the sides compare in size?

A solid bounded by six equal sides or faces is a *cube*.

A solid has three dimensions — length, breadth, and thickness.

4. Draw on cardboard a figure like this. Cut it out and fold on dotted lines. Paste, sew, or pin the edges together. You have made a cube 1 inch long, 1 inch wide, and 1 inch high. This is called an inch cube or a cubic inch. How many sides or faces has it? How do they compare in size? What is the shape of each face? What is the area of each face? What is the area of all the faces?



5. Could you have told the area of the surface of the cube from the diagram?

6. With the inch cubes build a solid like figure 1, 3 inches long, 2 inches wide, and 1 inch thick. This is a rectangular solid or rectangular prism.

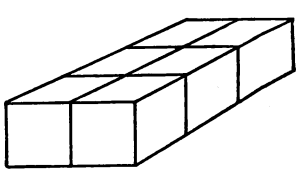


FIG. 1

How many cubic inches are there in 1 row? In both rows?

We say its contents or volume is 6 cubic inches.

The number of cubic units in a solid is its *volume*.

7. With the inch cubes build a solid like figure 2, 3 inches long, 2 inches wide, and 3 inches high.

How many cubic inches in 1 row of the bottom layer? Then in the bottom layer there are 2 times 3 cubic inches, or 6 cubic inches.

How many layers are there? Then in the whole solid there are 3 times 6 cubic inches, or 18 cubic inches.

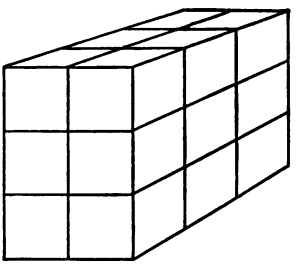


FIG. 2

Note that in finding volumes we take these four steps:

First. Determine the unit of measurement.

Second. Find the number of these units in one row of the lower layer.

Third. Multiply the number of units in one row by the number of rows.

Fourth. Multiply the number of units in one layer by the number of layers.

Think first of the unit of measurement.

The volume of a solid can always be found by multiplying together its length, its width, and its height, when all are expressed in the ***same*** *unit of measurement (inches, feet, yards, etc.).*

NOTE. Practice in computing volumes of blocks, boxes, and so forth, from measurements made by pupils, should precede the solution of problems from data given by the teacher.

Give the volumes of these rectangular prisms:

8. 2 in. by 4 in. by 5 in.

9. 3 in. by 4 in. by 2 in.

10. 4 in. by 5 in. by 3 in.

11. 6 in. by 5 in. by 2 in.

12. 5 in. by 8 in. by 2 in.

13. 3 in. by 8 in. by 2 in.

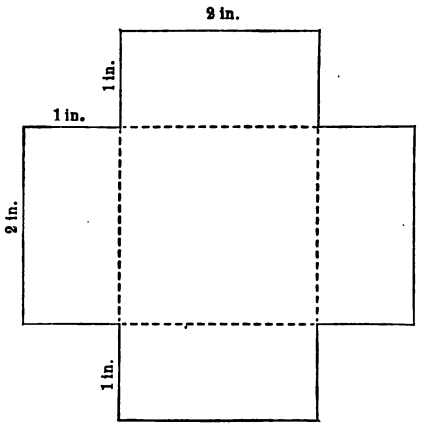
14. 3 in. by 5 in. by 4 in.

15. 6 in. by 2 in. by 8 in.

16. 10 in. by 3 in. by 6 in.

17. 12 in. by 5 in. by 4 in.

18. With the help of this diagram construct a box that will hold 4 cubic inches.



19. How high will you have to make the sides of a box of the same base to hold twice as much? Make one.

20. With the diagram below as an aid, construct a rectangular prism 3 inches by 2 inches by 2 inches.

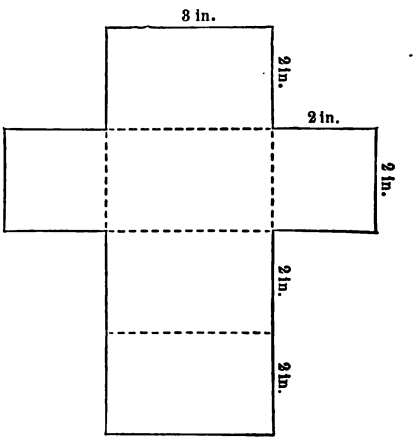
21. How many sides has this rectangular prism?

22. Of what shape are the sides? Are all the sides equal?

23. What is the area of the two ends? Of the four sides? What is the total area of the six sides?

24. Could you determine the surface area from the pattern?

25. How many 1-inch prisms could you put into the prism you have just made?



26. A cube 1 foot long, 1 foot wide, and 1 foot high is a cubic foot.

27. Express its dimensions in inches.

28. A cubic foot contains $12 \times 12 \times 12$ cubic inches, or —— cubic inches.

29. Describe a cubic yard.

30. Express its dimensions in feet.

31. What is its volume in cubic feet?

32. Write the table of cubic measure.

33. Make a pattern of a 2-inch cube. Cut it out and fold it into a cube.

How long is this cube? How wide? How high?

What is the area of one of its faces? Of all its faces?

What is its volume? How many 1-inch cubes will it take to make a 2-inch cube?

34. What is the volume of a 3-inch cube?

35. How many inch cubes can you put into a box 4 inches on each edge?

36. How many cubic inches are occupied by a book 6 inches long, $3\frac{1}{2}$ inches wide, and 1 inch thick?

37. The inside measurements of a box are 5 inches, 3 inches, $1\frac{1}{2}$ inches. What is its capacity?

38. A drawer in a desk is 8 inches by 5 inches by $1\frac{3}{4}$ inches. What is its capacity?

39. A coal bin is 10 feet by 6 feet by 4 feet. How many cubic feet of coal will it hold when even full?

Find the volumes of these rectangular prisms:

	Length	Width	Height		Length	Width	Height
40.	10 ft.	6 ft.	5 ft.	**41.**	9 in.	7 in.	4 in.
42.	15 ft.	12 ft.	9 ft.	**43.**	18 in.	15 in.	1 ft.
44.	14 ft.	4 ft.	$\frac{3}{4}$ ft.	**45.**	20 in.	$8\frac{1}{2}$ in.	5 in.
46.	$18\frac{3}{4}$ ft.	16 ft.	$4\frac{1}{2}$ ft.	**47.**	27 in.	$4\frac{2}{3}$ in.	$\frac{1}{2}$ ft.
48.	$3\frac{5}{8}$ in.	3 in.	$1\frac{1}{3}$ ft.	**49.**	$1\frac{1}{4}$ ft.	1 ft.	18 in.

50. Find the surface areas of the prisms in examples 8 to 17 on page 311.

WOOD MEASURE

Wood is usually sold by the cord.

1. A pile of wood 8 ft. by 4 ft. by 4 ft. is a cord. How many cubic feet in a cord?

2. $\frac{1}{8}$ of a cord is a cord foot. How many cubic feet in a cord foot?

3. Learn:

16 cubic feet = 1 cord foot (cd. ft.)
8 cord feet = 1 cord (cd.)
128 cubic feet = 1 cord

4. How many cords of wood in a pile 8 feet long, 4 feet wide, and 8 feet high? How many in a pile 16 feet by 4 feet by 8 feet?

5. A wagon body 4 feet wide and 12 feet long has on it a pile of wood 6 feet high. How many cords?

6. By the roadside near a farmer's house I saw a pile of wood 4 feet wide, 6 feet high, and 18 feet long. How many cords in the pile?

7. A leather firm bought from this farmer a pile of hemlock bark 4 ft. × 4 ft. × 16 ft. How many cords?

8. Express 1 cord, 16 cord feet as cords.

9. How many cubic feet in three quarters of a cord?

10. How many cords in 1728 cubic feet of bark?

DECIMALS *Oral and Written*

Dimes, cents, and mills are decimal parts of a dollar.

Dimes are written in the first place at the right of the decimal point as *tenths* of a dollar; cents are written in the second place at the right as *hundredths* of a dollar; mills in the third place at the right as *thousandths* of a dollar.

A dime, or a tenth of a dollar, is written \$.1.

A cent, or a hundredth of a dollar, is written \$.01.

A mill, or a thousandth of a dollar, is written \$.001.

\$0.87 may be read 87 hundredths of a dollar.

\$0.875 may be read 875 thousandths of a dollar.

Read as parts of a dollar:

1. \$0.6; \$0.05; \$0.003; \$0.802; \$0.025.

2. What do the 0's show in the numbers you have just read?

3. Write decimally $\frac{5}{10}$ of a dollar; $\frac{50}{100}$ of a dollar; $\frac{37}{100}$ of a dollar; $\frac{125}{1000}$ of a dollar; $\frac{25}{1000}$ of a dollar; $\frac{5}{1000}$ of a dollar.

Write decimally:

4. 7 hundredths of a dollar.

5. 70 hundredths of a dollar.

6. 75 hundredths of a dollar.

7. 75 thousandths of a dollar.

8. 225 thousandths of a dollar.

9. 5 thousandths of a dollar.

10. How many places are used to express tenths of a dollar? Hundredths of a dollar? Thousandths of a dollar?

We can express other things besides dimes, cents, and mills as tenths, hundredths, and thousandths. Thus, .25 yd. This means 25 hundredths of a yard.

11. Read: .5 bu.; .75 A.; .287 mi.; .08 rd.

2.25 yd. means 2 whole yards and 25 hundredths of a yard. It is read two and twenty-five hundredths yards.

Whenever we read a number made up of a whole number and a decimal, we always use the word *and* to mark the decimal point.

12. Read: 2.5 ft.; 3.275 mi.; 4.08 sq. rd.; 7.006 A.

13. Write decimally:

$\frac{7}{10}$; $\frac{8}{100}$; $\frac{47}{100}$; $\frac{84}{1000}$; $\frac{6}{1000}$;

$\frac{75}{100}$ bu.; $\frac{5}{10}$ in.; $\frac{22}{1000}$ A.; $\frac{205}{1000}$ mi.

14. Write decimally:

$5\frac{3}{10}$; $2\frac{4}{100}$; $3\frac{15}{100}$; $6\frac{2}{1000}$;

$3\frac{7}{10}$ yd.; $7\frac{25}{100}$ in.; $5\frac{8}{100}$ sq. yd.; $8\frac{4}{1000}$ mi.

Read:

15.	.8	.96	.07	.519	.806	.087	.005
16.	.3	.03	.33	.303	.033	.003	.333
17.	4.7	3.64	5.07	7.602	8.319	9.054	2.008

Write in figures:

18. Seven tenths.
19. Five hundredths.
20. Nine thousandths.
21. Seventeen thousandths.
22. Sixty-eight hundredths.
23. One hundred two thousandths.
24. Three hundred eighty-seven thousandths.
25. Four and nineteen hundredths.
26. Thirty-two and four hundred seven thousandths.
27. Sixteen and six thousandths.

CHANGING DECIMALS TO COMMON FRACTIONS

1. Write as common fractions: .1; .01; .001.

$$.1 = \tfrac{1}{10} \quad .01 = \tfrac{1}{100} \quad .001 = \tfrac{1}{1000}$$

Write these decimals as common fractions:

2.	.2	.4	.6	.8	.3	.5	.7	.9
3.	.12	.07	.67	.05	.83	.07	.56	.03
4.	.125	.402	.019	.009	.047	.004	.103	.005

5. Write .6 as a common fraction and change to its simplest form:

$$.6 = \frac{6}{10} \div \frac{2}{2} = \frac{3}{5}$$

Express these decimals as common fractions in their simplest form:

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
6.	.2	.4	.6	.8	.02	.04	.06	.08
7.	.25	.50	.75	.66	.32	.56	.24	.48
8.	.15	.45	.65	.35	.85	.64	.84	.76

Express as common fractions in their lowest terms:

.5 .50 .500

How do .5, .50, and .500 compare in value?

Ciphers annexed to a decimal do not change its value. Why?

CHANGING COMMON FRACTIONS TO DECIMALS

1. Write as tenths of a dollar: $\frac{1}{2}$ of a dollar; $\frac{1}{5}$ of a dollar; $\frac{2}{5}$ of a dollar; $\frac{3}{5}$ of a dollar; $\frac{4}{5}$ of a dollar.

2. Write as hundredths of a dollar: $\frac{1}{2}$ of a dollar; $\frac{1}{4}$ of a dollar; $\frac{3}{4}$ of a dollar; $\frac{1}{5}$ of a dollar; $\frac{2}{5}$ of a dollar; $\frac{3}{5}$ of a dollar; $\frac{4}{5}$ of a dollar.

3. Write as hundredths of a dollar: $\frac{1}{20}$ of a dollar; $\frac{7}{20}$ of a dollar; $\frac{1}{25}$ of a dollar; $\frac{2}{25}$ of a dollar; $\frac{1}{50}$ of a dollar; $\frac{9}{50}$ of a dollar.

4. Express decimally, first as tenths, then as hundredths: $\frac{1}{2}$; $\frac{1}{5}$; $\frac{3}{5}$; $\frac{2}{5}$; $\frac{4}{5}$.

5. Express decimally as hundredths: $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{10}$; $\frac{3}{10}$; $\frac{7}{10}$; $\frac{9}{10}$; $\frac{1}{20}$; $\frac{11}{20}$; $\frac{1}{25}$; $\frac{6}{25}$; $\frac{9}{25}$; $\frac{1}{50}$; $\frac{7}{50}$; $\frac{27}{50}$.

Write as whole numbers and decimals:

6. $2\frac{1}{2}$; $2\frac{1}{4}$; $5\frac{3}{4}$; $2\frac{1}{5}$; $1\frac{3}{5}$; $7\frac{3}{10}$.

7. $5\frac{1}{20}$; $3\frac{7}{20}$; $6\frac{1}{25}$; $2\frac{4}{25}$; $7\frac{1}{50}$; $5\frac{17}{50}$.

8. Express as the decimal of a foot: 6 inches; 3 inches; 9 inches.

9. What decimal part of an hour is 3 minutes?

3 minutes $= \frac{3}{60} = \frac{1}{20} = \frac{5}{100} = .05$ of an hour.

Express as decimals of an hour:

10. 30 minutes; 15 minutes; 45 minutes.

11. 12 minutes; 24 minutes; 36 minutes; 48 minutes.

12. 6 minutes; 18 minutes; 42 minutes; 54 minutes.

13. 9 minutes; 21 minutes; 33 minutes; 57 minutes.

DECIMALS: ADDITION *Oral and Written*

Add:

1. \$0.60 / .20

2. 6 dimes / 2 dimes

3. 6 tenths / 2 tenths

4. .6 / .2

5. \$0.05 / .04

6. 5 cents / 4 cents

7. 5 hundredths / 4 hundredths

8. .05 / .04

9. \$0.375 / .233

10. 375 thousandths / 233 thousandths

11. .375 / .233

In adding decimals, why must tenths come under tenths, hundredths under hundredths, and so on?

Add by rows and by columns:

	A	*B*	*C*	*D*	*E*
12.	6.73	+ 18.4	+ 8.5	+ 60	+ 4.003
13.	5.8	+ 7.29	+ 7.06	+ 6	+ .87
14.	.97	+ 3.07	+ 4.12	+ .6	+ .008
15.	.008	+ 15.007	+ 10.01	+ .06	+ 5.17
16.	70.49	+ 3.9	+ 9.004	+ .006	+ 4.09

Write in columns and add :

17. .5, .27, .08, .762, .007.
18. .007, .64, .303, .09, .3.
19. .606, .04, .005, .008, .7, .3.
20. .302, .08, .009, .54, .16, .016.
21. .97, .087, .07, .05, .09, .008.
22. .07, .017, .009, .108, .05, .012.
23. 4.37, 2.05, 9.007, .03, 4.1.
24. 8.007, .37, 6.09, 4.304, .006.
25. 5.5, .004, 3.018, 6.704, .076.
26. 4.85, 3.001, 5.07, .008, .02.

DECIMALS: SUBTRACTION *Oral and Written*

Subtract :

1. \$0.63	2. \$0.80	3. \$0.08	4. \$0.40
.44	.60	.05	.37
5. \$1.00	6. \$0.625	7. \$0.600	8. \$0.008
.05	.375	.045	.005
9. 1.000	10. 1.000	11. .087	12. .308
.025	.004	.009	.088
13. .402	14. .072	15. .067	16. .6
.391	.006	.059	.27

In example 16 think .6 as hundredths.

17. .8	18. .57	19. .7	20. .69	21. .1
.34	.3	.07	.6	.05
22. .563	23. .427	24. .8	25. .5	26. .3
.5	.42	.425	.463	.292

27. From .4 take .4 ; .04 ; .004.

28. From 8 take .8 ; .08 ; .008.

29. From one take one tenth ; one hundredth ; one thousandth.

30. From one tenth take one tenth ; one hundredth ; one thousandth.

31. From one hundredth take one hundredth ; one thousandth.

32. From ten take one tenth.

33. From one hundred take one hundredth.

34. From one thousand take one thousandth.

35. From 13.7 take 6.08.

36. Take .017 from 6.6.

37. From 1.672 take 1.005.

38. Take .305 from 1.055.

39. From 27.06 take 14.3.

40. Take 14.07 from 70.04.

41. From 3.002 take .998.

42. Take 7.006 from 10.04.

43. From 643.7 take .691.

44. Take 1.125 from 11.325.

PROBLEMS *Oral and Written*

1. Edward walked .3 of a mile and rode .5 of a mile. How far did he go?

2. A stick of braid contained 4 yards. The dressmaker used .5 of a yard. How much was left?

3. In making candy, Emma used .25 of a pound of chocolate and .75 of a pound of sugar. What was the weight of both?

4. If you spend .6 of your money, how much will you have left?

5. Charles bought a necktie for .25 of a dollar and a collar for .15 of a dollar. What part of a dollar did he pay for both?

6. My pencil was 7 inches long. How long was it after I had used 1.75 inches?

7. The grocer sold .5 of a bushel of potatoes to one customer and .625 of a bushel to another. How many bushels did he sell?

8. Mr. Hollis has three pastures, one of 4.75 acres, one of 25.5 acres, and one of 8.42 acres. What is the area of the three?

9. William raised a bushel of strawberries. He sold .125 of a bushel to Mrs. Waite, .25 of a bushel to Mrs. Long, and the rest to the grocer. What part of a bushel did he sell to the grocer?

10. The three sides of a triangle are 12.4 ft., 18.65 ft., and 15.75 ft. What is the perimeter?

11. The perimeter of a triangle is 8.5 ft. Two sides are respectively 2.25 ft. and 3.8 ft. What is the length of the third side?

12. A playground contains 7.32 acres. In it is a pond covering 1.67 acres. What is the area not covered by the pond?

13. A tub of maple sugar weighs 34.625 pounds. The tub itself weighs 3.875 pounds. What is the weight of the sugar?

14. The weights of five tubs of butter were 30.125 lb., 28.5 lb., 29.875 lb., 30.25 lb., and 27 lb. What was the total weight?

DECIMALS: MULTIPLICATION *Oral and Written*

1. 3 times 3 apples = ——

2. 3 times 3 tenths = ——

3. $3 \times \frac{3}{10} = \frac{9}{10} = .9$

4. $3 \times .3 = .9$

5. Multiply .3 by .3.

$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100} = .09$

$.3 \times .3 = .09$

Express both decimals as common fractions.

Multiplying $\frac{3}{10}$ by $\frac{3}{10}$, we get $\frac{9}{100}$, which, written decimally, is .09.

In multiplying .3 by .3 it is clear that, since the denominators are 10 and 10, the denominator of the product must be 10×10, or 100. A decimal expressing hundredths occupies two decimal places, which is the sum of the decimal places in the multiplicand (.3) and the multiplier (.3).

6. Multiply .03 by .3.

$\frac{3}{100} \times \frac{3}{10} = \frac{9}{1000} = .009$

$$\begin{array}{r} .03 \\ .3 \\ \hline .009 \end{array}$$

The product of the denominators is 1000. A decimal expressing thousandths occupies three decimal places. This is the sum of the decimal places in the multiplicand (.03) and the multiplier (.3).

To multiply decimals, we multiply as in whole numbers, and point off as many decimal places in the product as there are decimal places in both multiplicand and multiplier.

Note that the "pointing off" is the multiplying together of the denominators.

7. How many decimal places are there in the product when we multiply units and tenths? $3 \times .2$.

8. How many when we multiply units and hundredths? $3 \times .02$.

9. How many when we multiply units and thousandths? $3 \times .002$.

10. How many when we multiply tenths and tenths? $.3 \times .2$.

11. How many when we multiply tenths and hundredths? $.3 \times .02$.

Multiply, orally, by 2 each number in the table:

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
12.	1	4	7	2	6	9	3	5	8
13.	.1	.4	.7	.2	.6	.9	.3	.5	.8
14.	.01	.04	.07	.02	.06	.09	.03	.05	.08

15. Use 1, 3, 5, 7, 9, 2, 4, 6, 8, 10, 11, 12 as multipliers.

16. Use .1, .3, .5, .7, .9, .2, .4, .6, .8, 1.1, 1.2 as multipliers.

17. Multiply each number in the first two rows by .01, .02, .03, .04, .05, .06, .07, .08, .09.

18. Victor is 7.5 years old and Hubert is twice as old. How old is Hubert?

19. Sarah has 50 cents. Marion has .5 as much. How many cents has Marion?

20. There are 80 trees in an orchard. .3 of them are pear trees. How many pear trees?

21. What is the area of a square .5 of a yard long? What is its perimeter?

22. The three sides of a triangle are each 2.4 feet long. What is the total length of the sides?

23. How many square rods in a rectangle .7 of a rod long and .6 of rod wide? What is the perimeter?

Multiply:

24. .76 × 42	25. 2.07 × 63	26. 3.4 × 8.7	27. 6.25 × 1.4	28. 3.07 × 8.9
29. 39 × .07	30. .045 × 52	31. 27.3 × 4.4	32. 78.5 × .08	33. 4.55 × 6.6
34. .096 × 75	35. .308 × 47	36. 408 × .027	37. 78.5 × 1.07	38. .875 × 64
39. 25.04 × 56	40. 500.5 × 3.17	41. 648 × .035	42. 39.3 × 2.06	43. 720 × .225
44. 30.05 × .48	45. 520.7 × 4.05	46. 28.76 × 1.15	47. 1728 × .375	48. 17.28 × 37.5

49. The multiplicand is .643; the multiplier is 867; what is the product?

50. Multiply sixty and six tenths by ten and one tenth.

51. $6.06 \times 5.5 \times 2.002 = ?$

MULTIPLYING BY 10, 100, 1000

$.222 \times 10 = 2.22$
$.222 \times 100 = 22.2$
$.222 \times 1000 = 222.$

1. In multiplying .222 by 10, the decimal point was moved how many places to the right? How many places to the right was it moved in multiplying by 100? How many places to the right was it moved in multiplying by 1000?

2. Change the decimal point in 1.234 so that you will have a number 10 times as great. So that you will have a number 100 times as great. So that you will have a number 1000 times as great.

Write numbers 10 times as great as these:

3. .284 3.75 42.6 .008 .06 .3

4. 3.706 .903 4.62 .05 .4 .007

5. Write numbers 100 times as great; 1000 times as great.

6. What is the weight of 10 chickens if each weighs 3.75 pounds?

7. What is the total length of 100 boards, each 6.25 feet long?

8. How many yards of cloth in 1000 pieces, each of which contains 27.5 yards?

9. Frederick's cap cost \$0.25; his shoes cost 10 times as much, and his suit 100 times as much. How much did the shoes cost? The suit? How much did all cost?

MULTIPLYING BY .1, .01, .001

$$222 \times .1 = 22.2$$
$$222 \times .01 = 2.22$$
$$222 \times .001 = .222$$

1. In multiplying 222 by .1 the decimal point was moved how many places to the left? How many in multiplying by .01? How many in multiplying by .001?

2. Change the decimal point in 3456 so that you will have a number .1 as great. So that you will have a number .01 as great. So that you will have a number .001 as great.

Multiply by .1:

3.	$525	$37.50	$2.45	$0.70	$0.66	$0.04
4.	236	42.5	3.17	.5	.75	.03

Multiply by .01:

5.	4325	372.5	30.4	100.1	.2	1.1

Multiply by .001:

6.	46,800	1000	144	36	8	1

7. Howard had 80 marbles. He lost .1 of them. How many did he lose?

8. Mr. Wilson paid $1000 for an automobile and .01 as much for a license to run it. How much did he pay for the license?

9. Out of 125,000 yards of cloth .001 was found imperfect. How many yards were poor?

PROBLEMS *Written*

1. There are 16.5 feet in a rod. What is the length in feet of a fence 7 rods long?

2. How many feet in 320 rods or 1 mile?

3. What is the area of a square 15.4 yards long?

4. Henry has 8 rows of peas. He gathers 2.75 bushels from 1 row. How many bushels will he probably get from the other rows?

5. Mr. Moulton mowed 2.6 acres of grass in a day. How many acres will he mow in 3.5 days?

6. A square lot is 32.07 rods on a side. How many rods of wall will inclose it?

7. A cubic foot of water weighs 62.5 pounds. What weight of water will a tank 2 feet square and 3 feet high hold?

8. Ice weighs .92 as much as water. What is the weight of a cubic foot of ice?

9. How far will a railroad train run in 2.4 hours if the rate is 40.75 miles an hour?

10. A cow gives 3.2 gallons of milk a day. How many pounds is this if a gallon weighs 8.625 pounds?

11. Mr. Slater's house-lot contains .65 of an acre. His pasture is 10 times as large, and his garden is .1 as large. What is the size of the pasture? Of the garden?

12. Our school paid 75 dollars for trees for the school grounds, .1 as much for flowering shrubs, and .01 as much for seeds for the vegetable garden. How much was paid for shrubs? For seeds? How much was paid for all?

DECIMALS: DIVISION *Oral and Written*

Divide:

1. 2)8 dollars
2. 2)$8.00
3. 2)$1.68
4. 2)$0.68
5. 2)$0.60
6. 2)6 tenths
7. 2).6
8. 2)64 hundredths
9. 2).64
10. 2)648 thousandths
11. 2).648
12. 2).608
13. 2).812

Note that in dividing a decimal by a whole number the decimal point in the quotient comes directly under the decimal point in the dividend. The first step in division is to write the decimal point in the dividend.

Divide, and test your work:

	A	*B*	*C*	*D*	*E*
14.	3)3.696	3)36.96	3)3.696	3).603	3).906
15.	4)3.08	4)177.2	4)1.984	4)2.24	4)4.08
16.	5)14.5	5)2.045	5)4.05	5)3.55	5)2.65
17.	6)2.76	6).72	6)8.4	6).84	6).726
18.	7)8.05	7)85.4	7).924	7)285.6	7)35.7
19.	8)1.28	8)34.4	8)4.32	8).808	8)11.52
20.	9)12.78	9)7.2	9)63.36	9)54.72	9)9.009

21. Divide .36 by 9.

9)$\underline{.36}$ There being no tenths in the quotient, we write a 0 in
$\underline{.04}$ the tenths' place.

22. Divide .008 by 4.

4)$\underline{.008}$ Why do we write two 0's in the quotient in this divi-
$\underline{.002}$ sion?

23. Divide .2 by 5. .2 may be written .20.

Divide, and test your work:

	A	*B*	*C*	*D*	*E*
24.	3)$\underline{.018}$	2)$\underline{.08}$	4)$\underline{.036}$	7)$\underline{.056}$	5)$\underline{.005}$
25.	6)$\underline{.072}$	7)$\underline{.049}$	4)$\underline{.028}$	5)$\underline{.14}$	2)$\underline{.01}$
26.	8)$\underline{.04}$	5)$\underline{.065}$	9)$\underline{.729}$	6)$\underline{.426}$	8)$\underline{.056}$
27.	7)$\underline{.084}$	6)$\underline{.006}$	8)$\underline{.12}$	7)$\underline{.28}$	9)$\underline{.198}$

28. Divide 12.88 by 28.

.47
28)$\overline{13.16}$ In long division be careful to place the decimal
$\underline{11\ 2}$ point in the quotient directly over the decimal point
196 in the dividend.
$\underline{196}$

Divide, and test your work:

	A	*B*	*C*	*D*
29.	22.68 by 27	34.68 by 34	9.90 by 45	1.44 by 16
30.	17.92 by 32	5.184 by 24	51.84 by 72	15.75 by 15
31.	17.28 by 36	172.8 by 24	1.728 by 48	34.56 by 12
32.	345.6 by 16	3.456 by 32	34.56 by 54	.3456 by 27
33.	35.68 by 16	775.2 by 19	7.752 by 38	77.52 by 57

Find the quotient of :

34.	$4.536 \div 42$	$26.20 \div 35$	$5.12 \div 64$	$21.28 \div 76$
35.	$46.72 \div 73$	$4.672 \div 146$	$.522 \div 29$	$5.04 \div 84$
36.	$74.16 \div 72$	$68.4 \div 90$	$374.48 \div 62$	$17.385 \div 57$
37.	$416.56 \div 82$	$6.916 \div 28$	$38.52 \div 36$	$1297.8 \div 63$
38.	$.552 \div 92$	$3.12 \div 39$	$44.8 \div 56$	$816.08 \div 202$

PROBLEMS *Written*

1. A coal dealer sent out 5.25 tons of coal in 3 equal loads. What was the weight of each load?

2. Maggie used .5 of a yard of cloth in making 2 dresses for her dolls. How much was used for each dress?

3. A merchant sold 8 pairs of shoes for $13.20. How much was this a pair?

4. What is the side of a square whose perimeter is 36.24 square rods?

5. Richmond rode his bicycle 17.4 miles on Tuesday and $\frac{1}{5}$ as far on Wednesday. How far on Wednesday?

6. It took 15 fence rails to build a fence 118.5 feet long. What was the length of each rail?

7. If 57.75 tons of hay were cut from 7 fields, what was the average cut from each field?

8. My gas bills for six months were $1.89, $2.16, $2.43, $1.80, $2.70, $2.52. What was the average cost of the gas a month?

9. At the rate of 17 miles an hour, how long will it take to go to a place 40.8 miles away?

10. In 6 days a range burned 2.4 thousand cubic feet of gas. What part of a thousand cubic feet was this a day?

BILLS AND RECEIPTS

WASHINGTON, July 1, 1910.

Mr. CHARLES R. WATSON

Bought of CROSBY & MARSH

Mar. 3	3 pr. Shoes	@	$2.15	$6	45	
Apr. 7	3 pr. Slippers	@	.83	2	49	
June 1	2 pr. Rubbers	@	.69	1	38	
						$10 32

Received payment
July 15, 1910
CROSBY & MARSH
By Goodwin.

When were the above purchases made?

By whom were the goods bought?

From whom were they bought?

What was bought?

What did each kind cost?

What did all cost?

When was the bill paid?

What shows that the bill has been paid?

Was the money paid directly to the owners of the store or to one of their clerks? How do you know?

Who is the creditor in the above bill? Why?

Who is the debtor? Why?

Mr. Ames sells his black horse to Mr. Baker. Who is the debtor?

Mr. Childs buys a house from Mr. Burns. Who is the debtor?

1. Complete the following bill :

BUFFALO, July 29, 1910.

MRS. HENRY P. DUNCAN

Bought of ARTHUR P. DAVIS

2 lb. Figs	@	$0.20	$	
3½ lb. Raisins	@	.14		
5¾ lb. Mixed Nuts	@	.16		
4 lb. Candy	@	.35		
				$

Received payment
ARTHUR P. DAVIS.

When purchases are made at one time, the date is written in the heading only.

Make out bills for the following school supplies. Buyer, the city in which you live. Seller, yourself.

2.

120 reams of paper @ 35¢
12 boxes of pens @ 32¢
25 dozen pencils @ 18¢

3.

50 arithmetics @ 65¢
75 arithmetics @ 42¢
20 number cards @ 3½¢

4.

68 grammars @ 54¢
38 geographies @ 95¢
18 geographies @ 75¢

5.

4 wall maps @ $3.75
100 spelling books @ 18¢
35 readers @ 25¢

6. Make out the bill for 10 grammars, 12 number cards, and 20 spelling books at the prices given above.

7. Mr. George R. Hamilton used 14,000 pounds of ice during the year 1909. Make out his bill at $3 a ton.

8. Mr. Alfred Smith buys $6\frac{1}{2}$ tons of coal at $6.50 a ton and 2 tons at $6.75 a ton. Make out his bill.

9. The pupils in the Jackson school bought the following seeds for their school garden: 8 10-cent packets of nasturtiums, 6 5-cent packets of poppies, and 5 5-cent packets of asters. Make out the bill.

10. Make out your bill for cutting your neighbor's lawn three times: on July 10 you work 6 hours, on July 24 you work $6\frac{1}{2}$ hours, and on Aug. 7, $5\frac{1}{2}$ hours. You receive 20 cents per hour.

11. Imagine that you sell to a hotel 4 barrels of potatoes at $3.35 per barrel, 2 bushels of peas at $1.75 per bushel, 2 boxes of lettuce at 65 cents each, and $1\frac{1}{2}$ bushels of beans at $1.12 per bushel. Make out the bill.

12. Robert put electric bells in his house. He paid $0.75 for one bell and $0.60 for the other. It took $1\frac{1}{2}$ pounds of wire at 20 cents a pound. He used a 6-cent paper of tacks, and 2 buttons at 12 cents each. Make out the bill, using your own name as seller.

13. Make out the bill for three articles purchased by your mother at the grocer's.

14. Make out your milk bill for the month of April.

15. Make out the bill for three kinds of fruit you see every day in the stores.

16. Make out other bills for goods purchased at different stores, using the prices given in the daily paper.