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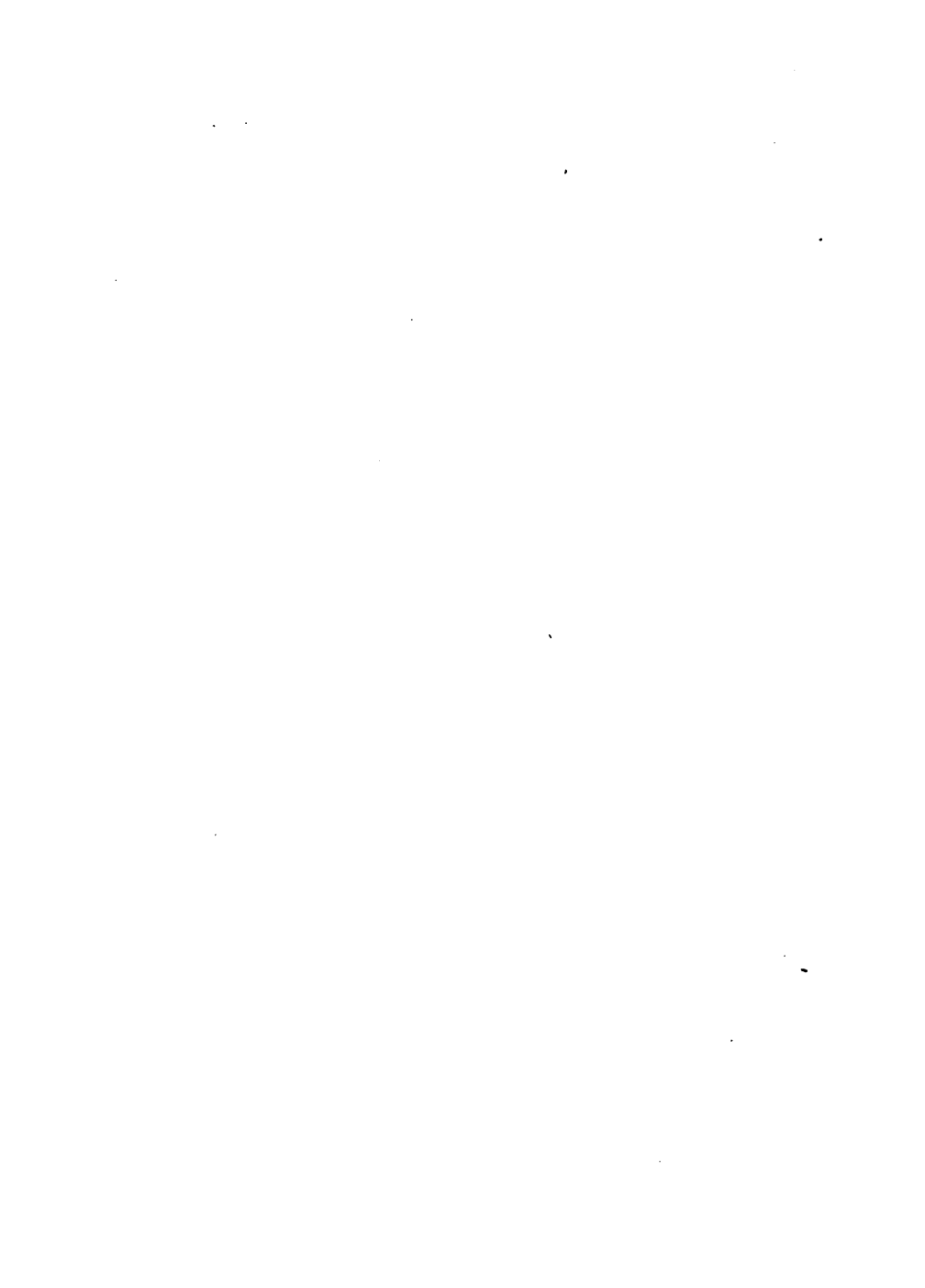
Fish's

Arithmetic

FISH'S

ARITHMETIC

NUMBER ONE

ORAL AND WRITTEN

ON AN ENTIRELY NEW PLAN

CONTAINING A GREAT VARIETY OF USEFUL DRILL TABLES, ORAL, SLATE, AND DICTATION EXERCISES.

By DANIEL W. FISH, A. M.

EDITOR OF ROBINSON'S "PROGRESSIVE SERIES" AND "SHORTER COURSE"

IVISON, BLAKEMAN, TAYLOR, & CO.

NEW YORK AND CHICAGO

FISH'S

NEW ARITHMETICAL SERIES:

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PREFACE.

A text-book in arithmetic is entirely useless in the hands of pupils who have not made some progress in learning to read well.

The first presentation of numbers must be *oral*, and any text-book which presents numbers, beginning with *one*, so that each number shall be learned not merely as a name or symbol, but as an *idea*, must necessarily and mainly be a book for the *teacher*, and should be addressed to the teacher, and give such *suggestions* as to *methods* of work as will aid in the presentation of the *first lessons* in numbers.

Hence, this book has been prepared as the *first book in arithmetic for pupils* commencing the *third* school year, and assumes that they have already been *orally* instructed to *read* and *write* numbers of four or more figures, and are able to answer simple mental questions involving addition, subtraction, multiplication, and division.

The first fifty pages of this work is meant to be largely a review of previous *oral* work, and a *drill* upon simple arithmetical processes, designed to give the pupil a more thorough knowledge of the multiplication and other tables, and to solve readily and correctly easy examples in the fundamental rules, preparatory to taking up a second or *complete* work on arithmetic.

The plan of this little book is *unique*, and will, it is believed, supply the *kind* of *first book* in arithmetic much needed. Several new features will be apparent at a glance, including Countings, Groupings, Signs, Drill Tables for abstract and *concrete work, forms* for slate work, etc.

The provision made for exhaustive *drill exercises* cannot fail to meet the wants of the most thorough and exacting teacher, and at the same time interest and attract the pupil.

No other device can be made so efficient and useful in fixing relations of numbers in the mind of the pupil, and in securing *rapidity* and *accuracy* in the performance of work, as these drill tables.

Such of the denominate tables as enter into the business transactions of everyday life, and United States Money are used, to furnish applications in the fundamental rules, and *not* for the purpose of teaching reduction. Also the fractions $\frac{1}{2}$, $\frac{1}{3}$, etc., to $\frac{1}{10}$, which occur in daily life, are made familiar by drill tables and *applied* work, from the commencement.

No more of fractions has been presented than will give the pupil a distinct and correct idea of what fractions are, and their application to simple *oral* exercises.

To avoid the monotony of too much *abstract* work, a large amount of *applied* work, covering a wide scope of easy examples, in which only the natural relations of everyday life are introduced, have been given, and these have been so prepared as to review, and give practice on all *previous work*.

The author would make special acknowledgment of the valuable services rendered in the plan, arrangement, and compilation of this book, by Prof. Jonathan Piper, of Chicago, whose large experience as an educator, and acquaintance with many of the best teachers and schools of the country, have made him familiar with their needs.

With an earnest desire to add to the facilities for elementary instruction, this little book is confidently submitted to the public.

<div align="right">D. W. F.</div>

BROOKLYN, August, 1883.

SUGGESTIONS.

GOOD books aid good teachers. The book cannot contain all that is needed or useful pertaining to the subject, and the *best* book is the one *most teachable* and *most suggestive*. The skillful teacher will *enlarge* the work suggested by the text-book. Read carefully the following:

1. Do not advance *too rapidly*.
2. *Review* daily. "Repetition is a condition of memory."
3. Seek to cultivate in pupils the habit of *self-reliance*.
4. Frequently find something to commend. A little *judicious praise* operates as a great incentive to effort, and stimulates the intellect.
5. Oral and slate work should be carried on together.
6. This book should be used both for seat-work and *in recitation*.
7. The pupil should *first* read and solve the questions from the *open book*. The work should also be prepared on slate or writing-pad, the solution and answer of each question being expressed by the proper signs.
8. Daily *oral* as well as slate practice should be given in naming and writing sums, differences, products, and quotients.
9. In all *written* work by the pupil, *neatness, rapidity*, and *accuracy* should be insisted on from the start, until it becomes a fixed *habit*.

10. The names and signs or abbreviations of the *measures* in common use should also be taught, and be as familiar to the pupil as the signs of operation, and used from the first in all *oral* and *written* work.

11. At the same time the pupil should be made familiar with the *equal parts* of numbers or things, from *one half* to *one tenth* inclusive.

12. The *practical* use of arithmetic is not *oral*, but *mental ;* therefore, the *eye* and the *hand*, rather than the ear and the tongue, are the instruments of work.

13. The *eye* should be trained to act promptly.   The pupil should *see results,* using the lips and tongue in naming them. As much depends upon this *eye-training* in all *figure* work, as in *reading*, in order to secure *rapidity* in reaching results.

14. *Monotony* should be guarded against, and the exercises *varied,* by plenty of *easy* slate work.

15. Pupils should be encouraged also to bring their slates from home, filled with neatly arranged work.

16. Every pupil should be provided with a foot-rule divided into inches, and taught to use it until measurements with it are familiar.

17. The same usage should be observed, whenever practicable, in the use of other standard measures, as the yard measure, the liquid pint, quart, and gallon measures, the dry quart and peck measures, the different weights, etc.

18. In estimating the value of the pupil's work, the *time* taken to do the work, and also the *neatness* should be noted.

19. Finally, to secure the *best results* in the *least time*, and in a manner most in accordance with the laws of mental *growth, should be* the constant aim of the teacher.

FISH'S ARITHMETIC.

NUMBER ONE.
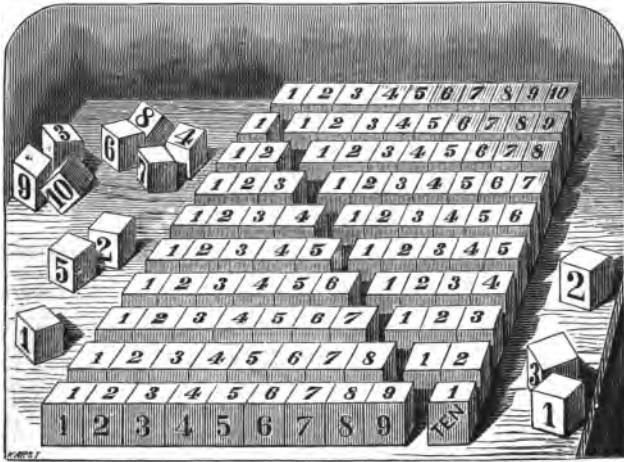
LESSON I.

NUMBERS.

One block.	1 block.	I block.
Two blocks.	2 blocks.	II blocks.
Three blocks.	3 blocks.	III blocks.
Four blocks.	4 blocks.	IV blocks.
Five blocks.	5 blocks.	V blocks.
Six blocks.	6 blocks.	VI blocks.
Seven blocks.	7 blocks.	VII blocks.
Eight blocks.	8 blocks.	VIII blocks.
Nine blocks.	9 blocks.	IX blocks.
Ten blocks.	10 blocks.	X blocks.

LESSON II.

SIGNS OF NUMBERS.

The signs or symbols of numbers are *words, figures,* and *letters.*

Each of the first nine numbers is expressed by a single *figure* in the Arabic notation, and by *letters* in the Roman notation, as shown on the preceding page.

The figure 0 is called *naught, zero,* or *cipher.*

These ten figures, when combined according to certain principles, can be made to express any number.

The following symbols of numbers should also be learned:

Words.	Figures.	Letters.
Twenty,	20	XX
Thirty,	30	XXX
Forty,	40	XL
Fifty,	50	L
Sixty,	60	LX
Seventy,	70	LXX
Eighty,	80	LXXX
Ninety,	90	XC
One hundred,	100	C
One hundred ten,	110	CX
Three hundred forty,	340	CCCXL
Five hundred,	500	D
Five hundred fifty,	550	DL
Six hundred,	600	DC
Six hundred sixty,	660	DCLX
One thousand,	1000	M

LESSON III.

Since these *signs of numbers* must be known perfectly, before any *slate work* can be performed, pupils should be exercised daily, a few minutes, upon combinations similar to the following, until they are thoroughly familiar with them.

Two caps,	2 boys,	and	III dolls.
Three men,	6 cars,	and	V days.
Six books,	5 slates,	and	IV balls.
Seven hours,	8 days,	and	VI weeks.
Nine cats,	7 dogs,	and	VII rats.
Eight oxen,	4 horses,	and	X cows.

The above to be read rapidly by *line,* then by *column.*

When the number symbols as far as *ten,* 10, X, have been learned, then pupils may write upon the slate, paper, or board, and repeat *orally,* the symbols of numbers from *ten* to *twenty,* applying them to familiar objects, thus:

Eleven tops,	11 kites,	and	XI marbles.
Twelve doors,	12 sash,	and	XII windows.
Thirteen hours,	13 stoves,	and	XIII churches.
Fourteen weeks,	14 months,	and	XIV years.
Fifteen saws,	15 axes,	and	XV awls.
Sixteen knives,	16 forks,	and	XVI spoons.
Seventeen coats,	17 vests,	and	XVII dresses.
Eighteen maps,	18 charts,	and	XVIII globes.
Nineteen pencils,	19 rulers,	and	XIX pointers.
Twenty cans,	20 pails,	and	XX measures.

Then from *twenty* to *thirty,* and from thirty to forty, and so on to *one hundred.*

LESSON IV.

SIGNS OF OPERATIONS

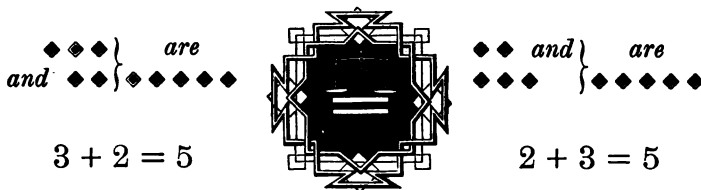**1.** At the same time that *number signs* are taught, the meaning and use of the following *word signs*, $+$, $=$, $-$, $\times$, $\div$, and $, should also be taught.

◆ ◆ ◆ *and* ◆ ◆   ◆ ◆ *and* ◆ ◆ ◆

are ◆ ◆ ◆ ◆ ◆   *are* ◆ ◆ ◆ ◆ ◆

$3 + 2$ *are* 5 $2 + 3$ *are* 5
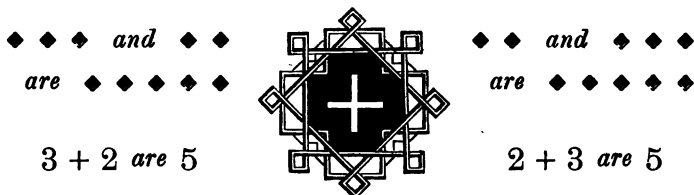
2. This sign, $+$, named ***plus***, which means *more*, is used in the place of the word *and*.

Thus, instead of writing, 2 *and* 3 are 5, we may write, $2 + 3$ are 5, and read, 2 *plus* 3 are 5.

◆ ◆ ◆ ⎱ *are*   ◆ ◆ *and* ⎱ *are*

and ◆ ◆ ⎰ ◆ ◆ ◆ ◆ ◆   ◆ ◆ ◆   ⎰ ◆ ◆ ◆ ◆ ◆

$3 + 2 = 5$ $2 + 3 = 5$

3. This sign, $=$, named ***equality***, is used in place of the word *are*.

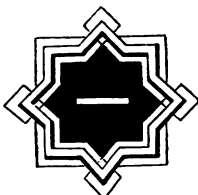Thus, instead of writing, 3 *and* 2 *are* 5, we may write, $3 + 2 = 5$, and read, 3 *plus* 2 *equals* 5.

Read the following:

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

◆ ◆ ◆ ◆ ◆ } *are* ◆ ◆ ◆   ◆ ◆ ◆ ◆ ◆ } *are* ◆ ◆
less ◆ ◆ }   *less* ◆ ◆ ◆ }

$$5 - 2 = 3 \qquad\qquad 5 - 3 = 2$$

4. This sign, —, named ***minus,*** which means *less,* is used in place of the word *less.*

Thus, instead of writing, 5 *less* 2 *are* 3, we may write, $5 - 2 = 3$, and read, 5 *minus* 2 *equals* 3.

Read the following:

$8 - 2 = 6$	$6 - 6 = 0$	$8 - 3 = 5$
$7 - 3 = 4$	$9 - 4 = 5$	$6 - 5 = 1$

3 *fours* are 12   4 *threes* are 12

◆◆ ◆◆ ◆◆   ◆   ◆   ◆   ◆
◆◆ ◆◆ ◆◆   ◆◆ ◆◆ ◆◆ ◆◆

3 *times* 4 are 12   4 *times* 3 are 12

$$4 \times 3 = 12 \qquad\qquad 3 \times 4 = 12$$

5. This sign, ×, is called the sign of ***multiplication,*** and is used in place of the words *multiplied by,* or *times.*

Thus, instead of writing, 4 *multiplied by* 3, or 3 *times* 4 *are* 12, we may write, $4 \times 3 = 12$, and read, 3 *times* 4 *are* 12.

When we read the word *times* in place of the sign ×, we should read from *right* to *left.* Thus, 3×2 is read, 2 *times* 3, or 2 threes; $\$4 \times 3$ is read, 3 *times* 4 dollars, etc.

Read the following:

$0 \times 2 = 0$	$3 \times 2 = 6$	$6 \times 2 = 12$
$1 \times 2 = 2$	$4 \times 2 = 8$	$7 \times 2 = 14$
$2 \times 2 = 4$	$5 \times 2 = 10$	$8 \times 2 = 16$

4 in 12, 3 times.   1 *third* of 12 is 4
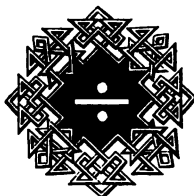
$$12 \div 4 = 3$$ $$\frac{12}{3} = 4$$

6. This sign, ÷, is called the sign of ***division,*** and is used in place of the words *divided by*, or *in.*

Thus, instead of writing, 12 divided by 4, or 4 *in* 12, 3 times, we may write, $12 \div 4 = 3$, and read, 12 *divided by* 4 *equals* 3.

This sign is often used by putting the two numbers in the place of the dots, which is a more compact and convenient form. Thus, $12 \div 4 = 3$ is better written, $\frac{12}{4} = 3$.

Both forms should be familiar to the eye.

Read the following :

$0 \div 2 = 0$	$8 \div 2 = 4$	$4 \div 2 = 2$	$12 \div 2 = 6$
$2 \div 2 = 1$	$10 \div 2 = 5$	$6 \div 2 = 3$	$14 \div 2 = 7$
$\frac{6}{3} = 2$		$\frac{9}{3} = 3$	$\frac{10}{5} = 2$

7. This sign, $, is called the ***dollar*** sign, and is used in place of the word *dollars,* and is always written *before* the number. Thus, instead of writing 5 *dollars,* we may write $5, and read 5 *dollars.*

Read the following :

$$\$12 + \$4 = \$16 \qquad \$5 \times 3 = \$15 \qquad \frac{\$12}{\$4} = 3$$

$$\$10 - \$5 = \$5 \qquad \$9 \times 2 = \$18 \qquad \frac{\$8}{\$2} = 4$$

$$8 \, feet \times 6 = 48 \text{ feet} \quad 25 \text{ feet} \div 5 = 5 \text{ feet} \quad \frac{25 \text{ feet}}{5 \text{ feet}} = 5$$

LESSON V.

As soon as pupils have learned the signs of operations, and their meaning, they should be taught to write in *mathematical language* combinations similar to the following, and to read the same without hesitation.

Thus, $2 + $2 = $4; $8 — $3 = $5.

Read, $2 and $2 are $4, or $2 *plus* $2 *equals* $4 ; $8 less $3 are $5, or $8 *minus* $3 *equals* $5.

3 cents × 4 = 12 cents; $12 ÷ 2, or $\dfrac{$12}{2}$ = $6.

Read, 4 times 3 cents are 12 cents ; $12 divided by 2, or *one half* of $12, is $6.

In the same manner, read

$$3 - 2 = I.$$
$$V \times 2 = X.$$
$$3 + 4 = VII.$$
$$6 \div 2 = III.$$
$$\frac{6}{3} = 2.$$
$$\frac{10 \text{ cents}}{2} = 5 \text{ cents.}$$

$$10 \div 2 = V.$$
$$\frac{7 - 3}{2} = 2.$$
$$2 \text{ books} \times 3 = 6 \text{ books.}$$
$$\frac{12 \text{ days}}{2} = 6 \text{ days.}$$
$$9 \text{ cats} - 5 \text{ cats} = 4 \text{ cats.}$$
$$XX \div X = 2.$$

The *fractional* form of expressing division should be made perfectly familiar; and *halves, thirds, fourths, fifths,* and so on to *tenths,* should be *counted,* and illustrated in connection with all the "Table Exercises."

The *symbols* for these *parts* are as follows:

½, read *one half.* ⅕, read *one fifth.* ⅛, read *one eighth.*
⅓, " *one third.* ⅙, " *one sixth.* ⅑, " *one ninth.*
¼, " *one fourth.* ⅐, " *one seventh.* ⅒, " *one tenth.*

LESSON VI.

DEFINITIONS.

1. Counting two or more numbers of the same kind to-
gether is called *adding*, or **addition.**

The number obtained by adding is named the **sum.** Thus,
9 is the *sum* of 5 and 4, or $5 + 4$.

Read the following, and give the *sum:*

$4 + 3 =$ $2 + 6 =$ 9 men $+ 2$ men $=$

2. Taking one number from another of the same kind is
called *subtracting*, or **subtraction.**

The number obtained by subtracting is named the **differ-
ence.** Thus, 5 is the *difference* between 9 and 4, or $9 - 4$.

Read the following, and give the *difference:*

$7 - 2 =$ $9 - 2 =$ 12 miles $- 2$ miles $=$

3. Taking *one* of two numbers as many times as there are
units in the *other* is called *multiplying* or **multiplication.**

The number obtained by multiplying is named the **prod-
uct.** Thus, 20 is the *product* of 4 times 5, or 5×4.

Read the following and give the *product:*

$5 \times 2 =$ $9 \times 2 =$ 4 quarts $\times 2 =$

4. Finding *how many times* one number is contained in an
other of the same kind, or finding *one* of the *equal parts* of a
number is called *dividing*, or **division.**

The number obtained by dividing is named the **quotient.**
Thus, 4 is the quotient of 20 divided by 5, or $20 \div 5$, or $\frac{20}{5}$.

Read the following and give the *quotient:*

$8 \div 2 =$ $\frac{14}{2} =$ $\frac{12}{3} =$ $\frac{16 \text{ pounds}}{2} =$

LESSON VII.

COUNTING.

1. Count 2.   Count 10 by 2's.   *Ans.* 2, 4, 6, 8, 10.

2. Count 16 by 2's; 20 by 2's; 30 by 2's.

3. Count by 2's back from 10 to 0.   *Ans.* 10, 8, 6, 4, 2, 0.

4. Count by 2's back from 12 to 0; from 20 to 0.

5. Count 5 by 2's, and how many over; 9; 11; 13.

6. Count the *lines* on this page by 2's.

7. Count the *words* in each of the first ten lines by 2's.

8. Count 2 by $\frac{1}{4}$'s.   *Ans.* $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2.

9. Give the sum of each group of two numbers *at sight,* reading rapidly from right to left, and reverse, 5 times.

1	2	V	3	C	I	4	X	5
1	2	V	3	C	I	4	X	5

SIGNS.

10 cents (cts.)	make	1 dime,	d.
10 dimes	"	1 dollar,	$.
12 inches (in.)	"	1 foot,	ft.
3 feet	"	1 yard,	yd.

10. 1 dime + 2 dimes =   2 dimes — 1 dime =

1 ft. + 1 ft. =   2 in. — 2 in. =

2 yd. + 2 yd. =   3 yd. — 2 yd. =

11. 1 cent × 2 =   6 ÷ 2 = $\frac{1}{2}$ of 2 cents =

3 in. × 2 =   4 ÷ 2 = $\frac{1}{2}$ of 6 in. =

6 ft. × *2* =   10 ÷ 2 = $\frac{1}{2}$ of 8 yd. =

TABLE EXERCISES.

I. BY DIAGRAM.

1. Read rapidly the *sum* of the central figure and each figure in the margin, first to the right, then to the left.

2. In the same manner, read the *difference*, then the *product*.

3. Beginning with 1, read thus: First pupil says, *sum*, 3; second pupil, *difference*, 1; third pupil, *product*,

2; fourth, *sum*, 4; fifth, *difference*, 0; sixth, *product*, 4, etc.
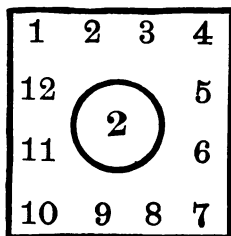
II. BY STRAIGHT LINES.

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

1. Read *sums* from left to right, and from right to left.

2. Read *differences* in same way; thus, 1, 0, 1, 2, 3, etc.

3. Read *products*; thus, 2, 4, 6, 8, etc.

4. All the directions for use of *diagram* apply to this device.

III. BY DIVISION.

$$\frac{2}{2} \quad \frac{8}{2} \quad \frac{16}{2} \quad \frac{10}{2} \quad \frac{14}{2} \quad \frac{12}{2} \quad \frac{8}{2} \quad \frac{18}{2} \quad \frac{20}{2} \quad \frac{4}{2}$$

1. From the *open book* read rapidly; thus, 2 in 2, once; 2 in 8, 4 times; 2 in 16, 8 times, etc.

2. Then, 1 *half* of 2 is 1; 1 *half* of 8 is 4; 1 *half* of 16 is 8, etc., until *equal parts* are well in mind.

3. Name quotients rapidly, *at sight;* thus, 1, 4, 8, 5, etc.

Train the eye to see these rapidly, without the use of pointer or finger.

IV. BY COLUMNS.

1. Read rapidly the *sum* of each number and the one at its left.

2. Read *difference,* in same way.

3. Read *product,* in same way.

4. Give *sum, difference,* and *product,* in same way as directed in diagram; thus, *sum,* 7; *difference,* 3 ; *product,* 10; *sum,* 3; *difference,* 1 ; *product,* 2 ; etc.

The *manner* of *recitation* from the *open book* will determine the way in which the pupil will study the book.

$$5 \quad 2$$
$$1 \quad 2$$
$$3 \quad 2$$
$$8 \quad 2$$
$$2 \quad 2$$
$$9 \quad 2$$
$$6 \quad 2$$
$$4 \quad 2$$
$$7 \quad 2$$

In connection with the " Table Exercises," the pupil should *write out* on slate or paper the tables for *each number* as far as **10,** using the proper *signs.*   Thus, for the number **2** :

ADDITION.	SUBTRACTION.	MULTIPLICATION.
$0 + 2 = 2$	$2 - 2 = 0$	$0 \times 2 = 0$
$1 + 2 = 3$	$3 - 2 = 1$	$1 \times 2 = 2$
$2 + 2 = 4$	$4 - 2 = 2$	$2 \times 2 = 4$
$3 + 2 = 5$	$5 - 2 = 3$	$3 \times 2 = 6$
$4 + 2 = 6$	$6 - 2 = 4$	$4 \times 2 = 8$
DIVISION, 1st form	**DIVISION, 2d form.**	**EQUAL PARTS.**
$0 \div 2 = 0$	$\frac{0}{2} = 0$	$\frac{1}{2}$ of $2 = 1$
$2 \div 2 = 1$	$\frac{2}{2} = 1$	$\frac{1}{2}$ of $4 = 2$
$4 \div 2 = 2$	$\frac{4}{2} = 2$	$\frac{1}{2}$ of $6 = 3$
$6 \div 2 = 3$	$\frac{6}{2} = 3$	$\frac{1}{2}$ of $8 = 4$

and so on, extending each table to the largest *sum, difference,* and *product* of the central and marginal numbers, using the *products* to make the *division* table.

ORAL EXERCISES.

1. Harry caught 10 fish, and James caught 2 fish. How many fish did both catch?

2. Jessie is 12 years old, and Frank is 2 years younger.

3. How many tops at 2 cents each will 8 cents buy?

4. How many 2's in 4? In 6? In 8?

5. How do you find *one* of 2 *equal parts* of anything?

6. What is *one* of 2 equal parts of anything called?

7. How many *halves* in 1? In 2? In 3? In 4?

8. $\frac{1}{2}$ of 2 = $\frac{1}{2}$ of 8 = $\frac{1}{2}$ of 10 cents =

  $\frac{1}{2}$ of 4 = $\frac{1}{2}$ of 10 = $\frac{1}{2}$ of 14 eggs =

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

9. 40 ft. and 2 ft.   =   40 ft.   — 2 ft.   =

  50 yd. + 2 yd. =   50 yd. — 2 yd. =

  60 in. + 2 in. =   60 in. — 2 in.   =

  70 oxen + 2 oxen =   70 oxen — 2 oxen =

10.   \$5 × 2 =   4 ÷ 2 = $\frac{1}{2}$ of \$20 =

      \$10 × 2 =   6 ÷ 2 = $\frac{1}{2}$ of 200 =

      \$100 × 2 =   8 ÷ 2 = $\frac{1}{2}$ of 100 =

  20 cents × 2 =   10 ÷ 2 = $\frac{1}{2}$ of 40 cts. =

  200 cents × 2 =   12 ÷ 2 = $\frac{1}{2}$ of 60 ft. =

  6 dimes × 2 =   14 ÷ 2 = $\frac{1}{2}$ of \$400 =

11. Two horses make 1 pair of horses. How many pairs of horses are 4 horses? 6 horses? 10 horses?

12. How many times 2 horses are 8 horses? 12 horses?

13. How many 2's in 6? In 10? In 8? In 12?

14. *What part* of 4 horses is 2 horses? Of 4 pints is 2 pints?

15. *What part of 1* dime is 5 cts.? Of \$1 is 5 dimes?

FOR WRITTEN SOLUTION.*

1. 2 men and 2 men and 2 men are how many men ?

SOLUTION. 2 men + 2 men + 2 men = *whole number of men.*

2. What will 2 acres of land cost, at $10 an acre?

SOLUTION. $10 × 2 = *cost of the land.*

3. A man paid $16 for 2 tons of coal. What did he pay for 1 ton ?

SOLUTION. $\frac{\$16}{2}$, or $\frac{1}{2}$ of $16 = *what he paid for 1 ton.*

4. A boy paid $7 for a suit of clothes, and $3 for a pair of boots, and $2 for shirts. How much did he pay for all?

5. John bought a pencil for 2 cents and gave the man a dime. How much change should he receive?

6. Find the cost of 2 horses, at $100 each?

7. How many are 2 trees and 14 trees ?

8. A boy had 8 pens, and lost 2 pens. How many pens had he left ?

9. What will 2 oranges cost, at 5 cents each ?

10. If 10 apples are divided equally between 2 boys, how many apples does each boy receive ?

11. A man sold a lamb for $2, and a horse for $80. What did he receive for both ?

12. What is the cost of 2 cords of wood, at $8 a cord ?

13. A boy had 26 cents and earned 2 cents more, and then paid out 20 cents. How many cents had he left ?

---

* 1. The pupil should be required, first to prepare and read from the slate or paper the solution of each question in *mathematical language*, without filling in the result. Afterward he may solve *orally*, and give the numerical result.

2. These are first lessons in *reasoning*, and must not be confounded with *number work.*

14. In a tree were 4 birds; ½ of them flew away? How many were left?

15. If a man earn $2 a day, in how many days can he earn $10? $20? $200?

16. At $10 a barrel, what is the value of 2 barrels of flour? Of ½ barrel?

17. Bought goods worth $2, and gave a ten-dollar bill in payment. How much change should be returned?

18. Paid $200 for 2 acres of land. How much is that an acre?

19. How many dimes in a dollar? In 2 dollars?

20. How many inches make a foot? 2 ft.? ½ ft.?

21. I had $20, and paid $10 for coal. What part of $20 did I pay for the coal? How much had I left?

22. George gave 10 cents for 2 pencils. What did he give for each? What is ½ of ten cents?

23. If I give $12 to some laborers, giving $2 to each, how many laborers are there? How many 2's in 12? $2 in $12?

24. Charlie had 2 cents, and his father gave him 6 more; how many cents had he in all?

25. He spent 2 cents, and gave 2 cents more to his sister. How many cents had he left?

26. A laborer received $2 a day for 7 days' work. How many dollars did he receive in all?

27. At $2 each, how many chairs can be bought for $14? For $20?

28. How many pints in 1 qt.? In 2 qt.? In 4 qt.?

29. How many are ½ of 12 in.? ½ of 10 dimes?

30. How many plums are ½ of 8 plums? What part of *4 plums* is 2 plums? How many 2's in 4? How many times *can you take 2* from 4?

LESSON VIII.

COUNTING.

1. Count 3.   Count 9 by 3's ; 12 ; 18 ; 24.

2. Begin with 1 and count by 3's to 10; to 19; to 25.

3. Count by 3's back from 12 to 0; from 19 to 1.

4. Count to 13 by 3's, and tell how many over ; to 17.

5. Count the lines on this page by 3's.

6. Count the words in each of the first ten lines by 3's.

7. Count by 2's and then by 3's the panes of glass in one window of this room.

8. Count 1 by $\frac{1}{3}$'s.   Count 2 by $\frac{1}{3}$'s.

9. *At sight* give the *sum* of each group :

5	I	2	V	4	II	3	X	10
5	I	2	V	4	II	3	X	10
5	I	2	V	4	II	3	X	10

SIGNS.

2 pints (pt.)	make	1 quart.	qt.
4 quarts	"	1 gallon,	gal.

10. $\$2 + \$1 + \$1 =$ $\$3 - \$2 =$

2 yd. + 2 yd. =   3 yd. − 1 yd. =

3 pt. + 2 pt. =   6 in. − 3 in. =

11. 1 qt. × 3 = $\frac{2}{3} =$ $\frac{2}{3}$ pt. = $\frac{1}{3}$ of 3 qt. =

2 gal. × 3 = $\frac{2}{3} =$ $\$\frac{3}{3} =$ $\frac{1}{3}$ of 6 gal. =

3 men × 3 = $\frac{6}{3} =$ $\frac{8}{3}$ rd. = $\frac{1}{3}$ of 9 men =

12. Express by signs the sum of 2 ft. and 3 ft. and 3 ft.

13. Express the *difference* between 6 qt. and 3 qt. by signs.

14. Express the *product* of three times 3 gallons.

TABLE EXERCISES.

I. BY DIAGRAM.

1. Read *at sight* the *sum* of the central figure and each figure in the margin, first to the right, then to the left.

2. In the same manner, read the *difference ;* then the *product.*

3. Read the operations as directed in diagram for **2.**

4. Pupils in their seats should write the tables on paper or slate, using the proper signs.
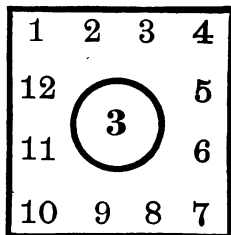
1	2	3	4
12		3	5
11			6
10	9	8	7

II. BY STRAIGHT LINES.

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

1. *At sight,* read the *sum, difference,* and *product* of each of the above sets, as before directed, in the diagram.

2. Write results on the slate or paper as quarts (qt.), or gallons (gal.), always using the abbreviations.

3. Express the products in Roman numerals.

III. BY DIVISION.

$$\frac{6}{3} \quad \frac{12}{3} \quad \frac{27}{3} \quad \frac{33}{3} \quad \frac{9}{3} \quad \frac{15}{3} \quad \frac{30}{3} \quad \frac{21}{3} \quad \frac{18}{3}$$

1. Read as follows: 3 in 6, twice ; 3 in 12, 4 times ; 3 in 27, 9 times, etc.

2. Next, two 3's, four 3's, nine 3's, eleven 3's, etc.

3. Then as *equal parts,* as of quarts, or yards ; thus, $\frac{1}{3}$ of *6 qt. is 2 qt.; $\frac{1}{3}$ of 12 qt. is 4 qt*, etc.

4. Lastly, read the quotients rapidly; thus, 2, 4, 9, 11, etc.

IV. BY COLUMNS.

1. Exercise the same as on number 2.
2. Count or add outside column, beginning first with 3, then with 1, then with 2.
3. Read each number of the inside column as 1 more ; as 2 more.
4. Read the inside column as 2 times as many.
5. Repeat this exercise, until results are given without hesitation.

$$
\begin{array}{cc}
3 & 3 \\
1 & 3 \\
6 & 3 \\
8 & 3 \\
2 & 3 \\
4 & 3 \\
9 & 3 \\
5 & 3 \\
7 & 3 \\
\end{array}
$$

ORAL EXERCISES.

1. In a class are 7 girls and 3 boys. How many of both ? How many more girls than boys ?

2. There are 3 feet in 1 yard; how many feet in 2 yd. ? In 3 yd. ? In 4 yd.?

3. How many 3's in 9? How many times can 3 cents be taken from 9 cents? What is 1 *third* of 9 cents?

4. If a yard of ribbon cost 5 cents, what will 3 yards cost?

5. How do you find *one* of 3 *equal parts* of anything ?

6. What is *one* of 3 equal parts of a number or thing called?

7. How many *thirds* in 1? In 2? In 3? In 5 ?

8.
40 yd. + 3 yd. =	40 yd. — 3 yd. =
60 ft. + 3 ft. =	60 ft. — 3 ft. =
30 in. + 3 in. =	30 in. — 3 in. =
40 qt. + 3 qt. =	26 qt. — 3 qt. =

9.
$5 × 3 =	$\frac{1}{3}$ of $15 =	1 ft. = 12 in.
$10 × 3 =	$\frac{1}{3}$ of $30 =	3 ft. = — in.
$100 × 3 =	$\frac{1}{3}$ of $300 =	$\frac{1}{3}$ ft. = — in.
200 ft. × 3 =	$\frac{1}{3}$ of 600 ft. =	$\frac{1}{3}$ ft. = — in.

FOR WRITTEN SOLUTION.*

1. A table is 3 ft. long and 2 ft. wide. How many feet around the table?

SOLUTION.   3 ft. + 2 ft. + 3 ft. + 2 ft. = *distance around the table.*

2. A boy bought 12 papers and sold 3 of them; how many papers had he left?

SOLUTION.   12 papers — 3 papers = *the papers he had left.*

3. If 3 clocks cost $30, what is the cost of each clock?

SOLUTION. $\frac{\$30}{3}$, or $\frac{1}{3}$ of $30 = *the cost of each clock.*

4. How many hours of the forenoon remain at 9 o'clock A. M.? How many have passed?

5. At $3 a cord, what is the cost of 2 cords of wood? Of 3 cords? Of 4 cords? Of 5 cords?

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

7. How many inches in 1 *third* of a foot?

8. A boy had 6 cents, he earned 2 cents more, then gave 3 cents to his sister. How many cents had he left?

9. Paid $15 for 3 cords of wood. What was the cost of 1 cord?

10. How many inches in 2 feet? Express in two ways.

11. If 18 boys sit, an equal number on 3 benches, how many boys sit on each bench?

12. How many are 5 times 3 cents, less 10 cents?

13. There are 9 sheep and 3 cows in a yard. How many are there of both? How many more sheep than cows?

14. If a man earn $4 a day, how much will he earn in 3 days? Express in two ways.

---

* *The solutions to be written without the numerical results.*

LESSON IX.

COUNTING.

1. Count 4.   Count 12 by 4's; 20; 24; 40.

2. Count to 16 by 4's and back; to 20 and back.

3. Begin with 1 and count by 4's to 25; to 33.

4. Count the lines on this page by 4's.

5. Count the words by 2's, then by 3's, then by 4's, in the first *six* lines of this page, and see if the counts agree.

6. Count to 2 by $\frac{1}{4}$'s.   *Ans.* $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{2}{4}$, $1\frac{3}{4}$, 2.

7. Give the *sum* of each column *at sight*, reading rapidly from right to left, and reverse, 4 times.

3	II	4	V	6	C	5	X	2
3	II	4	V	6	C	5	X	2
3	II	4	V	6	C	5	X	2
3	II	4	V	6	C	5	X	2

SIGNS.

8 quarts (qt.)	make	1 peck.	pk.
4 pecks	"	1 bushel.	bu.

8.

$3 + $2 =	$5 − $4 =	6 = —— 2's.
2 yd. + 2 yd. =	4 yd. − 2 yd. =	12 = —— 3's.
4 in. + 3 in. =	7 in. − 3 in. =	20 = —— 4's.
30 bu. + 4 bu. =	34 bu. − 4 bu. =	24 = —— 4's.

9.

$2 × 4 =	$\frac{1}{2}$ of $8 =	$\frac{1}{3}$ of $30 =
$20 × 4 =	$\frac{1}{2}$ of $80 =	$\frac{1}{3}$ of $300 =
100 men × 4 =	$\frac{1}{4}$ of 400 men =	$\frac{1}{4}$ of 400 bu. =
50 cents × 4 =	$\frac{1}{8}$ of 200 cents =	$\frac{1}{4}$ of 40 pk. =

TABLE EXERCISES.

I. BY DIAGRAM.

1. Read, *at sight*, from the open book, as before directed.

2. Then read the same as quarts, pecks, or bushels.

3. Let the pupil bring, on slate or paper, the tables, neatly prepared, as directed on page 11.

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

II. BY STRAIGHT LINES.

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

Exercises same as by diagram; also practice as with the numbers **2** and **3.**

III. BY DIVISION.

$$\frac{24}{4} \quad \frac{16}{4} \quad \frac{28}{4} \quad \frac{36}{4} \quad \frac{8}{4} \quad \frac{40}{4} \quad \frac{12}{4} \quad \frac{20}{4} \quad \frac{32}{4}$$

1 Read the quotients as *equal parts* of feet, yards, etc.

2. Then read quotients rapidly *at sight ;* thus, 6, 4, 7, 9, etc.

IV. BY COLUMNS.

1. Read rapidly from open book the *sum, difference,* and *product* of each set of two numbers.

2. Read the sum as $, feet, bushels, etc.

3. Add or count the outside column, beginning with 1; then with 2; then with 3.

4. Read each number of the inside column as twice as large; 3 times as large.

5. Read each number of the inside column as *1 greater; 2 greater;* 3 greater.

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

ORAL EXERCISES.

1. There are 4 books on one shelf and 8 on another. How many books on both shelves? How many more on the one, than on the other? How many times 4 books, on both shelves? How many times can 4 books be taken from 12 books?

2. How many 4's in 8? In 12? In 16?

3. How do you find *one* of the 4 *equal parts* of any number or thing?

4. What is *one* of the 4 equal parts of anything called?

5. How many *fourths* in 1? In 2? In 4? In 5?

6. $\frac{1}{4}$ of 4 = $\frac{1}{4}$ of \$12 = $\frac{1}{4}$ of 20 boys =

$\frac{1}{4}$ of 8 = $\frac{1}{4}$ of \$16 = $\frac{1}{4}$ of 24 balls =

7. 20 bu. + 4 bu. =   24 books — 4 books =

60 pk. + 4 pk. =   16 girls — 4 girls =

80 ft. + 4 ft. =   64 gal. — 4 gal. =

30 cts. + 4 cts. =   28 cents — 4 cents =

8. \$5 × 4 =   16 cts. ÷ 4 = $\frac{1}{4}$ of \$20 =

50 × 4 =   20 ft. ÷ 4 = $\frac{1}{4}$ of 40 ft. =

100 pt. × 4 =   40 in. ÷ 4 = $\frac{1}{4}$ of 400 =

20 cents × 4 =   80 bu. ÷ 4 = $\frac{1}{4}$ of 12 yd. =

\$200 × 4 =   \$400 ÷ 4 = $\frac{1}{4}$ of \$80 =

9. There are 4 pecks in 1 bushel? How many pecks in 2 bu.? In 3 bu.? In 4 bu.? In $\frac{1}{2}$ bu.? In $\frac{1}{4}$ bu.?

10. Which is the larger, $\frac{1}{4}$ a dollar, or \$$\frac{1}{4}$?

11. Four is greater than what numbers?

12. Four is less than what numbers under ten?

13. A boy had 8 marbles and lost 4 of them. What part of his marbles did he lose? How many had he left? How many 4's in 8? What part of 8 is 4?

FOR WRITTEN SOLUTION.

1. One side of a square garden measures 10 rods (rd.). What is the distance around it ? Express in two ways.

SOLUTION.   10 rd. + 10 rd. + 10 rd. + 10 rd. = *distance around it.*
Or, 10 rd. × 4 = *distance around it.*

2. Paid \$10 for coal and \$4 for wood ; how much did I pay for both ? How much more for the coal than for the wood ?

SOLUTION.   \$10 + \$4 = *cost of both.*
\$10 − \$4 = *what I paid for the coal, more than for the wood.*

3. Twenty things make a score. How many things in 4 score? In ½ score ?

SOLUTION.   20 × 4 = *number of things in 4 score.*
$\frac{20}{2}$, or ½ of 20 = *number of things in ½ score.*

4. What is the cost of 4 hats, at \$6 each ?

5. At \$9 each, what is the cost of 4 charts ?

6. At \$200 an acre, what is the cost of ½ an acre of land?

7. How many miles can I travel in 4 days, if I travel 20 miles each day ? Express in two ways ?

8. How many books, at \$4 each, can be bought for \$20 ? For \$40 ? For \$80 ?

9. How old were you 4 years ago ? How old will you be 4 years hence ?

10. Charles paid 8 cents apiece for 4 pencils, and had 4 cents left. How many cents had he at first ?

11. If 24 peach trees are planted in 4 equal rows, how many trees in each row?

12. *How many are 4 times 6 eggs, plus 10 eggs ?*

13. *How many are 4 times 7 days, minus 4 days?*

LESSON X.

COUNTING.

1. Count 5.   Count 30 by 5's ; 50 by 5's; by 10's.

2. Begin with 1, and count by 5's to 26 ; to 31; to 41.

3. Begin with 2, and count by 5's to 27; to 32; to 47.

4. Count by 5's to 35, and back ; to 45, and back.

5. Count the lines on this page by 5's.

6. Count the words in the first 8 lines by 2's, then by 3's, by 4's, and by 5's, and see if the counts agree.

7. Count 1 by $\frac{1}{5}$'s.   *Ans.* $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{5}$, or 1.

8. Give the *sum* of each column *at sight :*

I	10	3	X	4	V	2	C	5
I	10	3	X	4	V	2	C	5
I	10	3	X	4	V	2	C	5
I	10	3	X	4	V	2	C	5
I	10	3	X	4	V	2	C	5

SIGNS.

60 pounds (lb.) of wheat make 1 bushel.   bu.

50 pounds of corn-meal   "   1 bushel.   bu.

---

9. $\$4 + \$2 + \$1 =$ 12 cts. $-$ 5 cts. $=$

$\$5 + \$3 + \$2 =$ 10 ft. $-$ 5 ft. $=$

20 lb. $+$ 5 lb. $+$ 2 lb. $=$ 40 nails $-$ 5 nails $=$

10 bu. $+$ 5 bu. $+$ 1 bu. $=$ 20 cars $-$ 5 cars $=$

10. $0 \times 5 =$ $\frac{1}{2}$ of 10 gal. $=$ $15 = ——$ 3's.

$\$2 \times 5 =$ $\frac{1}{5}$ of 25 qt. $=$ $25 = ——$ 5's.

20 ft. $\times 5 =$ $\frac{1}{2}$ of 50 boys $=$ $20 = ——$ 4's.

100 yd. $\times 5 =$ $\frac{1}{3}$ of 30 horses $=$ $50 = ——$ 5's.

TABLE EXERCISES.

I. BY DIAGRAM.

1. The *oral* and *dictation* exercises, as well as the *written* work for the number **5**, should be the same as for the preceding numbers, **2**, **3**, and **4**.

2. Write the *sums, differences,* and *products* in Roman numerals.

3. Prepare the tables, using the appropriate signs.

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

II. BY STRAIGHT LINES.

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

Practice same as by diagram, and before instructed.

III. BY DIVISION.

$$\frac{5}{5} \quad \frac{35}{5} \quad \frac{45}{5} \quad \frac{15}{5} \quad \frac{20}{5} \quad \frac{40}{5} \quad \frac{60}{5} \quad \frac{30}{5} \quad \frac{25}{5}$$

Exercises the same as for preceding numbers.

IV. BY COLUMNS.

1. Read rapidly from open book the *sum, difference,* and *product,* of each set of two numbers, first as *dollars,* then as *cents.*

2. Count or add the outside column by 5's, etc.

3. Read each number of the inside column as 3 times as many, and write results on slate or paper in Roman numerals. 4 times as many.

4. *Read each* number of the inside column as *4 greater;* then as 10 greater.

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

ORAL EXERCISES.

1. John having 20 cents, gave 5 cents for a pencil ; how many cents had he left? Then 5 cents for a writing-pad; how many cents remained ? Then 5 cents for a skate-strap ; how many cents then remained? He gave 5 cents to a beg gar; how many cents had he left ?

2. How many times can you take 5 cents from 20 cents? How many 5's in 20 ? 5 in 20, how many times? How many times $5 are $20 ? What is $\frac{1}{4}$ of $20?

3. Count 20 by 2's; by 4's; by 5's ; by 10's.

4. If a box hold 5 pounds of honey, how many such boxes will hold 30 pounds? 40 pounds? 50 pounds?

5. How many times can 5 pounds be taken from 30 pounds ?

6. What is $\frac{1}{2}$ of 10? 20? 18? 200? 400? 800?

7. What is $\frac{1}{3}$ of 15? 30? 60? 300? 90? 600 ?

8. What is $\frac{1}{4}$ of 8 ? 80 ? 400? 800? 40 ? 200 ?

9. What is $\frac{1}{5}$ of 10 ? 20? 50? 500? 30? 300?

10. What piece of money is worth 5 cents?

11. What coin is worth 5 times 5 cents? 5 times 10 cents?

12. What part of $10 is $5? Of $5 is $1 ?

13. If 5 sheep cost $15, what is the cost of 1 sheep?

14. How many 5's in 10? In 15? In 30? In 40 ?

15. How do you find *one* of 5 *equal parts* of a number or thing? What is the part called?

16. Count 2 by $\frac{1}{2}$'s. Count 3 by $\frac{1}{3}$'s.

17. Read each of the following numbers 5 times as great :

100   300   200   500   900   700

18. How many pounds in $\frac{1}{2}$ bushel of wheat? In $\frac{1}{4}$ of a bu. ?

19. How many pounds in $\frac{1}{2}$ bu. of corn-meal? In 2 bu.? In 4 bu. ?

FOR WRITTEN SOLUTION.

1. Express the sum of 5 dimes and 7 dimes.

2. What is the sum of $9 and $5, less $4?

3 Express by signs, the sum of the numbers, from 2 to 5; from 3 to 6 inclusive.

4. If from a board 12 ft. long I saw off 5 ft., how many feet are left?

5. If a man save $5 a week, in how many weeks will he save $30? $40? $50?

6. How many cents are 1 fifth of 25 cents?

7. Take 5 cents from a quarter of a dollar.

8. What is the length of one side of a square room that measures 40 ft. around it?

9. Paid 60 cents for oranges, at 5 cents each. How many oranges did I buy?

10. How many barrels of flour, at $5 a barrel, can be bought for $20? For $35? For $45?

11. Willie had 39 cents, and bought 7 pictures at 5 cents each. How many cents had he left?

SOLUTION. 5 cts. × 7 = *cost of pictures.*
39 cts. — 5 cts. × 7 = *No. cents he had left.*

12. From $60 I paid out $40. How many dollars were left?

13. How many cents in $1? In $2? In $1½? In $1¼?

14. How many days remain of this week?

15. How many feet in 5 yards? Quarts in 5 pecks?

16. How many 5-cent pieces are equal to half a dollar?

17. From a pile of 25 marbles, how many groups of 5 marbles each can be made?

18. How many times can 5 peaches be taken from 20 *peaches?* From 30 peaches?

LESSON XI.

COUNTING.

1. Count 6. Count 6 by 2's; by 3's.

2. Count by 6's to 18; to 24; to 30; to 42.

3. Begin at 1 and count by 6's to 19; to 31.

4. Begin at 2 and count by 6's to 26; to 32; to 44.

5. Count by 6's to 24 and back; from 2 to 32 and back.

6. Count by 6's to 36 and back; from 1 to 37 and back.

7. Count by $\frac{1}{6}$'s to 1. *Ans.* $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{5}{6}$, $\frac{6}{6}$ or 1.

8. In the same manner, count by $\frac{1}{6}$'s to 2; to 3.

SIGNS.

60 minutes (min.)	make	1 hour.	hr.
24 hours	"	1 day.	da.

9. $\$4 + \$2 =$ $\$12 - \$6 =$

3 ft. + 2 ft. + 1 ft. =   46 trees — 6 trees =

2 bu. + 4 bu. + 2 bu. =   24 birds — 6 birds =

20 da. + 6 da. + 4 da. =   6 barrels — 6 barrels =

40 hr. + 6 hr. + 2 hr. =   56 cans — 6 cans =

10. $\$2 \times 6 =$ $\dfrac{\$30}{6} =$ $\frac{1}{6}$ of 12 min. =

0 gal. × 6 = $\dfrac{60 \text{ bu.}}{6} =$ $\frac{1}{4}$ of 12 hr. =

10 da. × 6 = $\dfrac{600 \text{ ft.}}{6} =$ $\frac{1}{6}$ of 12 da. =

3 wk. × 6 = $\dfrac{36 \text{ in.}}{6} =$ $\frac{1}{6}$ of 18 yd. =

11. $\$4 + \$6 - \$3 =$ $\$6 \times 3 - \$4 =$

10 ft. + 2 ft. — 6 ft. =   5 min. × 6 — 10 min. =

15 bu. — 5 bu. + 4 bu. =   10 yd. × 6 — 20 yd. =

TABLE EXERCISES.

I. BY DIAGRAM.

1. Read rapidly, from the open
book, the *sums, differences,* and *prod-
ucts,* as before directed.

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

2. Read the same as minutes, hours,
or days.

3. Prepare the tables neatly on slate
or paper, as directed on page 11.

II. BY STRAIGHT LINES.

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

Drill in the same manner as with preceding numbers.

III. BY DIVISION.

$$\frac{6}{6} \quad \frac{18}{6} \quad \frac{42}{6} \quad \frac{12}{6} \quad \frac{60}{6} \quad \frac{30}{6} \quad \frac{48}{6} \quad \frac{24}{6} \quad \frac{36}{6}$$

1. Write the quotients as *equal parts* of hours, or days.

2. Name the quotients rapidly *at sight.*

IV. BY COLUMNS.

1. Read the sum, difference, and product of
each set of two numbers as days, or feet.

2. Add the outside column by 6's.

3. Read each number of the inside column as
4 times as many; as 5 times as many.

4. Write the results on slate or paper, in Roman
numerals.

5. *Read* each number of the inside column as 4
more; then 5 more; then 10 more.

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

ORAL EXERCISES.

1. How many are 6 boys and 4 boys? 12 boys less 6 boys? 3 times 6 boys?

2. How many boys are ¼ of 18 boys? 18 boys are how many times 6 boys? How many 6's in 18?

3. How do you find *one* of the 6 *equal parts* of a number?

4. What is *one* of 6 equal parts called?

5. What is ¼ of 12 bells? ¼ of 18 bees? ¼ of 24 hours?

6. How many *sixths* in any number? *Fifths? Fourths?*

7. How many ¼'s in 1? How many ⅓'s? ¼'s? ½'s?

8. How many inches make 1 foot? ½ a foot? ¼ of a ft.?

9. What part of a foot is 6 in.? Is 4 in.? Is 3 in.?

10. Name all the numbers in sets of two each that make 4.

$$Ans. \ 3+1 = 4; \ 2+2 = 4; \ 1+3 = 4.$$

11. What are the numbers of each set called?

Ans. Parts of 4.

12. In like manner, name the parts that make 5; 6.

13. What two equal numbers make 6? What three equal numbers?

14. What two numbers *multiplied* together make 6?

15. What are these numbers called? *Ans. Factors* of 6.

16. Are *parts* and *factors* the same?

17. By what signs are *parts* separated? *Ans.* + and —.

18. By what signs are *factors* connected? *Ans.* ×.

19. Express 6 as composed of *factors;* of *parts.*

20. 6 is one *part* of 11; what is the other part?

21. 7 is one part of 12; what is the other part?

22. How many times 6 in 12? How many times 2?

23. 6 is one *factor* of 12; what is the other factor?

24. Name a set of two factors of 24. Of 30. Of 25.

FOR WRITTEN SOLUTION.

1. In an orchard are 6 rows of trees, and 7 trees in each row; how many trees are there in the orchard?

SOLUTION. 7 trees × 6 = *No. of trees in the orchard.*

2. Find the cost of 6 coats, at $5 each.

3. A man having $18, gave $6 for a barrel of flour. How many dollars had he left?

4. If a boy having 14 marbles buys 6 more, how many will he then have?

5. If afterwards he lose 5, how many will he have left?

6. Paid $6 for a hat, $3 for a vest, and $9 for a coat. What did they all cost?

7. At $6 a yard, how many yards of cloth can be bought for $24? For $30? For $60?

8. If 6 acres of land cost $60, what is the cost of 1 acre?

9. What is the cost of 6 books, at $4 each?

10. How many are 6 times 8 cents, and 6 cents more?

11. How many are 6 times 7 pounds, less 5 pounds?

12. At $6 a ton, what is the cost of 5 tons of coal? Of 4 tons? Of 6 tons?

13. How many times 6 minutes are 60 minutes?

14. Separate 6 into 3 equal parts in two ways?

15. A boy bought a book for 20 cents, and a pencil for 6 cents. What did he pay for both? How much more for the book than for the pencil?

16. Express 6 by its *factors*; by its *parts*.

17. How many baskets will be required to hold 36 melons, if only 4 melons are put into a basket? If 6 melons are put *in a basket?*

18. Express by Roman numerals, 18, 21, 27, 32, 40, 55.

LESSON XII.

COUNTING.

1. Count 7. Count 7 by 2's. *Ans.* 2, 4, 6, and 1 are 7.

2. Count 14 by 7's ; 21; 28; 35; 49 ; 56.

3. Begin at 1 and count to 15 by 7's; to 22; to 29.

4. Begin at 2 and count by 7's to 30 and back ; to 37 and back ; to 51 and back.

5. How many 7's in 21? In 35? In 49 ?

6. In 1 how many $\frac{1}{7}$'s? How many $\frac{1}{6}$'s? $\frac{1}{5}$'s? $\frac{1}{4}$'s?

7. Count 3 by $\frac{1}{3}$'s; by $\frac{1}{4}$'s; by $\frac{1}{5}$'s; by $\frac{1}{6}$'s.

8. Count 1 by $\frac{1}{7}$'s. Count 2 in the same manner.

SIGNS.

7 days (da.)	make	1 week,	wk.
12 months (mo.)	"	1 year,	yr.
100 years	"	1 century,	C.

9. $\$4 + \$3 + \$1 =$ $\$14 - \$7 =$

2 da. + 3 da. + 2 da. =   21 qt. — 7 qt. =

20 bu. + 7 bu. =   37 ft. — 7 ft. =

40 hr. + 7 hr. =   67 cans — 7 cans =

10. $\$2 \times 7 =$ $\frac{1}{7}$ of 7 trees =   21 = —— 7's.

4 balls × 7 = $\frac{1}{7}$ of 21 bu. =   49 = —— 7's.

3 men × 7 = $\frac{1}{7}$ of 35 yd. =   42 = —— 7's.

5 mo. × 7 = $\frac{1}{7}$ of 28 yr. =   35 = —— 7's.

7 yr. × 7 = $\frac{1}{7}$ of 49 boys =   56 = —— 7's.

11. $3, $2, and V dollars = $\frac{1}{4}$ of 28 bu. =

6 ft., IV ft., and 3 ft. = $\frac{1}{5}$ of 40 gal. =

10 sparrows × 6 = $\frac{1}{6}$ of 60 tons =

100 barrels × 6 = $\frac{1}{7}$ of 700 bu. =

TABLE EXERCISES.
I. BY DIAGRAM.

1. Practice as directed for preceding numbers.

2. Write the results on slate or paper, as days and months.

3. Begin at any corner and add half way round, and reverse.

4. Write out the tables, with signs.

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

II. BY STRAIGHT LINES.

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

Consult previous work for variety of practice.

III. BY DIVISION.

$$\frac{7}{7} \quad \frac{49}{7} \quad \frac{28}{7} \quad \frac{14}{7} \quad \frac{35}{7} \quad \frac{70}{7} \quad \frac{21}{7} \quad \frac{84}{7} \quad \frac{63}{7}$$

Exercise the same as on preceding numbers.

IV. BY COLUMNS.

1. Exercise the same as for numbers **5** and **6**.

2. Write the products of each set of two figures in Roman numerals.

3. Count or add the outside column by 7's.

4. Read each number of the inside column as 3 times as many; as 5 times as many.

5. Read each number of the same column as 3 greater; 5 greater; 6 greater.

6. As 4 times as many and 10 more.

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

ORAL EXERCISES.

1. Memorize and repeat the months, and the number of days of each month in the year:

January,	*Jan.*,	31.	July,	*July*,	31.
February,	*Feb.*,	28.	August,	*Aug.*,	31.
March,	*Mar.*,	31.	September,	*Sept.*,	30.
April,	*Apr.*,	30.	October,	*Oct.*,	31.
May,	*May*,	31.	November,	*Nov.*,	30.
June,	*June*,	30.	December,	*Dec.*,	31.

2. James bought a ball for 7 cents. How much change should he receive for a dime?

3. If a hat cost $7 and a coat $8, what do both cost?

4. If a man earn $3 a day, how much will he earn in 7 da.?

5. How do you find *one* of 7 *equal parts* of any number or thing?

6. How many pecks in 7 bushels? Feet in 7 yd.?

7. How many days in 6 weeks? In 7 wk.?

8. How many weeks in 35 days? In 56 da.?

9. How many more months in this year?

10. Compose 7 by units. *Ans.* $1+1+1+1+1+1+1$.

11. Compose 7 by parts. *Ans.* $4+3=7$; $5+2=7$, etc.

12. 7 is one *part* of 11; what is the other part?

13. 7 is one *factor* of 14; what is the other factor?

14. 3 is one *factor* of 21; what is the other factor?

15. How many 7's in 28? How many 4's?

16. How many times can 7 yd. be taken from 28 yd.? 4 yd. from 28 yd.?

17. What part of a week is 1 day? Of 14 cents is 7 cents?

18. If your slate is 6 in. wide, and 7 in. long, how many inches around the slate?

FOR WRITTEN SOLUTION.

1. Express the *sum* of 10 and 7.

2. Express the *difference* between $12 and $5.

3. Express the *product* of 9 and 7; of 10 and 7.

4. Express the $\frac{1}{7}$ part of 49 days; of 63 yr.

5. Find the cost of 6 quarts of milk, at 7 cents a quart.

6. How many days in 7 wk.? In 5 wk.?

7. How many pecks in 7 bu.? In 10 bu.?

8. How many feet in 6 yd.? In 7 yd.?

9. If 8 horses cost $800, what is the cost of 1 horse?

10. If 5 acres of land produce 500 bushels of potatoes, what is the yield of an acre?

11. If 600 bu. of wheat are put into 6 bins of equal size, how many bushels are put into each bin?

12. What is the cost of 7 yards of cloth, at $5 a yard?

13. How many days in 7 wk. and 4 da.? In 3 wk. and 5 da.? In 4 wk. 6 da.?

14. If there are 6 school hours in a day, how many hours in a school week of 5 da.?

15. How many yards long is a wall that measures 30 ft.?

16. Seven times 9 and 7 more, equal what number?

17. If a bushel of chestnuts is worth $7, what are 6 bushels worth? 7 bushels?

18. How many 5-cent pieces are equal to 35 cents?

19. Seven pigeons are sitting on one limb of a tree, and 15 on another. How many pigeons on both limbs? How many more on the one, than on the other?

20. Belle had 37 cents. She gave 20 cents for a fan, and 10 cents for some ribbon. How many cents had she left?

21. Express in Roman numerals 65, 84, 97, 110, 220.

LESSON XIII.

COUNTING.

1. Count 8.   Count 8 by 2's; by 4's; by $\frac{1}{4}$'s.

2. How many 1's in 8 ?   2's ?   4's ?

3. Count 24 by 2's ; by 3's ; by 4's ; by 6's ; by 8's.

4. Count by 8's to 16 ; to 24; to 32 ; to 48.

5. Count by 8's to 24, and back to 0.

6. Begin at 2, and count by 8's to 26, and back to 2.

7. How many 8's in 24?   In 32 ?   In 40?   In 56 ?

8. Count 1 by $\frac{1}{8}$'s.   *Ans.* $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$, $\frac{4}{8}$, $\frac{5}{8}$, $\frac{6}{8}$, $\frac{7}{8}$, $\frac{8}{8}$ or 1.

9. In the same manner, count 2 by $\frac{1}{8}$'s.

SIGNS

16 ounces (oz.)	make	1 pound,	lb.
100 pounds	"	1 hundred-weight,	cwt.

---

10. 4 oz. + 4 oz. =   \$8 — \$4 — \$2 =

   4 lb. + 2 lb. + 2 lb. =   12 qt. — 4 qt. — 4 qt. =

   \$10 + \$8 + \$2 =   15 da. — 3 da. — 8 da. =

   20 barrels + 8 barrels =   60 ft. — 40 ft. — 10 ft. =

11. \$8 × 5 = $\frac{1}{2}$ of 20 ft. = $\frac{1}{6}$ of 60 oz. =

   5 lb. × 8 = $\frac{1}{3}$ of 15 lb. = $\frac{4}{7}$ of 70 bu. =

   8 in. × 0 = $\frac{1}{4}$ of 44 da. = $\frac{1}{8}$ of 800 cts. =

   10 bu. × 8 = $\frac{1}{5}$ of 45 gal. = $\frac{1}{8}$ of 80 men =

12. 7 pk. × 5 + 5 pk. = $\frac{1}{4}$ of 24 hr. + 4 hr. =

   8 in. × 6 — 8 in. = $\frac{1}{5}$ of 50 posts + 20 posts =

   10 pt. × 7 + 10 pt. = $\frac{1}{6}$ of 60 min. — 5 min. =

   100 lb. × 8 — 50 lb. = $\frac{1}{8}$ of \$800 — \$20 =

TABLE EXERCISES.

I. BY DIAGRAM.

1. Drill as before directed.

2. Let the pupil express the *sum*, *difference*, and *product* of the central number and each marginal number.

3. Write the results as pounds, or years, using the abbreviations.

4. Let the tables be neatly written, using the proper signs.


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

II. BY STRAIGHT LINES.

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

Same variety of practice as before directed.

III. BY DIVISION.

$$\frac{8}{8} \quad \frac{16}{8} \quad \frac{24}{8} \quad \frac{40}{8} \quad \frac{64}{8} \quad \frac{48}{8} \quad \frac{56}{8} \quad \frac{72}{8} \quad \frac{32}{8}$$

1. Name quotients as *equal parts* of lb., oz., or ft.

2. Name the quotients rapidly *at sight,*

IV. BY COLUMNS.

1. Practice as before instructed.

2. Read each number of the inside column rapidly as 4 more; then as 5 more; then as 10 more, expressing results as measures, or things.

3. Express by Roman numerals the product of each figure of the inside column by the opposite figure in the outside column.

4. Read each number of the inside column as *5 times as large* and 4 more.

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

ORAL EXERCISES.

1. Memorize and repeat the following measures :

12 things	make	1 dozen,	doz.
· 20 things	"	1 score,	sc.
24 sheets	"	1 quire of paper,	qr.
20 quires	"	1 ream,	rm.

2. If 8 oranges are taken from 14 oranges, how many oranges remain ?

3. Jane had 8 apples and 7 peaches in her basket. How many had she of both ?

4. What is the cost of 8 chairs, at $4 each ? At $3 each ?

5. How many sheets in $\frac{1}{2}$ quire of paper ? In 2 quires?

6. How many things make a score ? $\frac{1}{2}$ a score ?

7. How do you find *one* of 8 *equal parts* of anything?

8. What is $\frac{1}{8}$ of 48 pins ? $\frac{1}{8}$ of 56 rods ? $\frac{1}{8}$ of 64 oxen ?

9. How many hours in a day ? In $\frac{1}{2}$ a day ? In $\frac{1}{3}$? In $\frac{1}{4}$?

10. What part of a dozen eggs is 6 eggs ? 4 eggs ?

11. How many pecks in a bushel ? In 4 bu. ? In $\frac{1}{2}$ bu. ?

12. How many inches in 6 ft. ? In 10 ft. ? In $\frac{1}{2}$ a ft.?

13. What is $\frac{1}{8}$ of 9 acres ? $\frac{1}{8}$ of 90 acres ? $\frac{1}{8}$ of 900 acres?

14. What is $\frac{1}{4}$ of 40 gal. ? $\frac{1}{4}$ of 80 doz. ? $\frac{1}{4}$ of $400 ?

15. What is $\frac{1}{8}$ of 80 rods ? $\frac{1}{8}$ of 400 miles? $\frac{1}{8}$ of 800 bu. ?

16. Compose 8 by units.	*19.* Resolve 8 into parts.
17. Compose 8 by parts.	*20.* Resolve 8 into factors.
18. Compose 8 by factors.	*21.* Count 8 by $\frac{1}{2}$'s; by $\frac{1}{4}$'s.

22. 8 is one *factor* of 32; what is the other factor?

23. 8 is one *part* of 13 ; what is the other part ?

24. How many times can 8 pounds of tea be taken from a box *containing 56* pounds ? 56 are how many 8's? 7's?

FOR WRITTEN SOLUTION.

1. How many years are 3 score and 10 years?

2. What is the difference between 4 score and 100?

3. How many quires of paper in 3 reams?

4. If 8 clocks cost $80, what is the cost of 1 clock?

5. How many quarts in 1 pk.? In 2 pk.? In 1 bu.?

6. At $5 a ton, what is the cost of 8 tons of coal?

7. From a piece of cloth containing 20 yd., 2 suits were cut, each containing 5 yd. How many yards were left?

8. George had 10 cents and John had 8 times as many. How many had both? How many more had John than George?

9. How many dimes are equal to 80 cents?

10. At $10 a barrel, what is the cost of 6 barrels of flour? Of 7 barrels? Of 8 barrels?

11. How many are 6 times 8 bu., and 10 bu. more?

12. How many are 8 times 5 doz., less 8 doz.?

13. Paid $42 for 7 cords of wood. How much was that a cord?

14. If a man work 8 hours each day, how many hours will he work in 9 days?

15. How many times can 8 bushels of wheat be taken from a bin containing 60 bushels, and how many bushels will be left?

16. What number equals 7 times 8 and 4 more?

17. Gave $\frac{1}{4}$ of $32 for 2 books. What was the cost of each?

18. What part of 16 boxes is 8 boxes? Of 32 trees is 8 trees?

19. How many times can 8 bu. of grain be taken from 40 bu.? From 64 bu.?

20. Express in Roman numerals 8, 80, 88, 800.

LESSON XIV.

COUNTING.

1. Count 9.   Count 9 by 2's; by 3's.

2. How many ones in 9?   How many 2's?   3's?   4's?

3. Count 18 by 2's; by 3's; by 6's; by 9's.

4. Count by 3's to 27 ; count by 9's.

5. Begin at 1 and count 28 by 9's; at 2, and count 38 by 9's; at 3, and count 48 by 9's.

6. Count back from 27 to 0 by 9's; from 28 to 1.

7. Count by 9's to 45 and back; from 2 to 47 and back.

8. Count 1 by ⅓'s.   Count 2 in the same manuer.

SIGNS.

9 square feet (sq. ft.)	make	1 square yard,	sq. yd.
27 cubic feet (cu. ft.)	"	1 cubic yard,	cu. yd.
128 cubic feet	"	1 cord,	Cd.
8 cord feet	"	1 cord,	Cd.

9. 5 sq. ft. + 4 sq. ft. =   12 sq. ft. — 9 sq. ft. =

  6 cu. ft. + 3 cu. ft. =   15 cu. ft. — 9 cu. ft. =

  20 cd. ft. + 9 cd. ft. = $20 — $5 — $5 =

  8 lb. + 4 lb. + 3 lb. =   19 cd. ft. — 9 cd. ft. =

  10 Cd. + 5 Cd. + 3 Cd. =   15 Cd. — 5 Cd. — 2 Cd. =

10. 0 × 9 =   ½ of 12 sq. ft. =   ⅓ of 63 bu. =

  3 sq. ft. × 9 =   ⅓ of 15 cu. ft. =   ⅐ of 63 bu. =

  9 bu. × 6 =   ⅙ of 60 lb. =   ⅛ of 64 miles =

  10 ft. × 9 =   ⅓ of 45 oz. =   ⅙ of 90 balls =

  100 yd. × 9 =   ⅓ of 27 cu. ft. =   ⅓ of 900 bu. =

  6 cd. ft. × 9 =   ⅛ of 24 cd. ft. =   ⅐ of 63 Cd. =

TABLE EXERCISES.

I. BY DIAGRAM.

1. Read rapidly from open book, as before directed, first to the right, then to the left.

2. Write results, as before directed, as months, feet, or dozens, using the abbreviations.

3. Prepare the usual tables on slate or paper, as before directed.

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

II. BY STRAIGHT LINES.

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

Exercises, oral and written, as before directed.

III. BY DIVISION.

$$\frac{18}{9} \quad \frac{36}{9} \quad \frac{54}{9} \quad \frac{90}{9} \quad \frac{45}{9} \quad \frac{81}{9} \quad \frac{72}{9} \quad \frac{63}{9} \quad \frac{27}{9}$$

Name quotients as *equal parts* of feet, cords, or days.

IV. BY COLUMNS.

1. Practice all the variety of combinations, as before instructed.

2. Let the reading of the *sums, differences,* and *products* be repeated, until the same can be given at a glance.

3. Time spent to secure this result will be re-gained many times over, in the subsequent work.

4. This completes the drill in all the possible *combinations* of the Arabic characters.

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

ORAL EXERCISES.

1. Memorize and repeat the following measures:*

320 rods (rd.)	make	1 mile,	mi.
160 square rods (sq. rd.)	"	1 acre,	A.
640 acres	"	1 section,	sec.

2. A park is 200 rd. long and 100 rd. wide. How far around the park? How much does the length exceed the width?

3. Edwin had 11 marbles, and Robert had 9 marbles. How many marbles had both?

4. From a bin containing 36 bu. of corn, how many times can 9 bu. be taken? 6 bu.? 4 bu.? 3 bu.?

5. 36 are how many 3's? 4's? 6's? 9's? 12's?

6. How do you find *one* of 9 *equal parts* of anything?

7. What is $\frac{1}{2}$ of 86 pens? $\frac{1}{3}$ of 45 blocks? $\frac{1}{2}$ of 54 rods?

8. What is $\frac{1}{3}$ of 9 mi.? Of 90 mi.? Of 900 mi.?

9. What is $\frac{1}{4}$ of 60 lb.? Of 24 hr.? Of 1 hr.? Of 1 doz.?

10. How many inches in 1 yard? In $\frac{1}{2}$ of a yard? In $\frac{1}{4}$ of a yard? In $\frac{1}{3}$ of a yard?

11. How many square feet in 1 sq. yd.? In 3 sq. yd.?

12. How many cubic feet in 1 cu. yd.? In $\frac{1}{3}$ of a cu. yd.?

13. How many $\frac{1}{4}$'s in 1? In 2? How many $\frac{1}{3}$'s? $\frac{1}{2}$'s?

14. Compose 9 by units.	*17.* Resolve 9 into parts.
15. Compose 9 by parts.	*18.* Resolve 9 into factors.
16. Compose 9 by factors.	*19.* Count 9 by $\frac{1}{3}$'s; by $1\frac{1}{2}$'s

20. Name two factors of 18; of 24; 27; 30; 36.

21. 9 is one factor of 45; what is the other factor?

22. 9 is one part of 19; what is the other part?

23. Which is greater, 9 times 4, or $\frac{1}{2}$ of 90?

---

* *All the* Denominate Tables are given in Book Number Two.

FOR WRITTEN SOLUTION.

1. What is the cost of 9 acres of land, at $20 an acre?

SOLUTION. $20 × 9 = *cost of the land.*

2. Paid $90 for 9 boxes of oranges. What was the price a box?

SOLUTION. $\frac{$90}{9}$, or ⅑ of $90 = *price per box.*

3. Sold a horse for $100, and received $40. How much was still due?

4. A certain field is 40 rods long and 20 rods wide. How many rods around the field?

5. How many months of the year remain after May?

6. 3 score and 5 sparrows are how many sparrows?

7. What is the cost of 9 tons of hay, at $10 a ton?

8. How many are 9 times 9 bottles and 9 bottles more?

9. 9 dimes are how many cents?

10. In one lot are 8 sheep, in another 7 times as many. How many sheep in both lots? How many more in the one, than in the other?

11. Paid $300 for a horse, and ⅓ as much for a harness. What did I pay for the harness? For both?

12. Express 9 by its factors; by its parts.

13. From a bushel of peaches, 3 pecks were sold. What remained? What part of a bushel?

14. The wind struck a group of a score of trees, and prostrated 9 of the group. How many trees were left standing?

15. Minnie bought a yard of ribbon for 15 cents, and a spool of thread for 5 cents. How much change should she receive from 50 cents?

16. Express in Roman numerals, 9, 90, 99, 900, 110, *120, 135.*

LESSON XV.

COUNTING.

1. Count 10.   Count 100 by 10's ; by 5's.

2. Begin with 1 and count by 10's to 91.

3. This is called naming the *decades.*

4. Name the decades ending with 2, 3, 4, 5, 6, 7, 8, 9, 0.

5. Ccunt 100 by 5's forward and back.

6. Count 1 by $\frac{1}{10}$'s; 2 by $\frac{1}{2}$'s ; by $\frac{1}{4}$'s; by $\frac{1}{3}$'s.

7. Count 100 by 20's ; by 25's; 200 by 50's.

SIGNS.

60 pounds of potatoes	make	1 bushel.	bu.
100 pounds of grain or flour	"	1 cental.	C.
196 pounds of flour	"	1 barrel.	bbl.

8. $10 + $5 + $5 = $10 — $10 =

20 bu. + 10 bu. + 3 bu. = $100 — $10 =

50 ft. + 10 ft. + 6 ft. =   35 ft. — 10 ft. =

10 men + 40 men =   50 gal. — 10 gal. =

9. $10 × 10 = $\frac{1}{5}$ of $50 =   30 = —— 5's.

$40 × 10 = $\frac{1}{5}$ of $500 =   40 = —— 8's.

100 ft. × 10 = $\frac{1}{10}$ of 60 ft. =   90 = —— 10's.

20 doz. × 10 = $\frac{1}{10}$ of 40 boys =   100 = —— 20's.

10. How do you find *one* of the 10 *equal parts* of anything?

11. What is one of 10 equal parts called ?

12. What is $\frac{1}{10}$ of 70 sheep ? $\frac{1}{10}$ of 60 men ? $\frac{1}{10}$ of $100?

13. How many pounds make a cental ? $\frac{1}{2}$ a cental? $\frac{1}{5}$ of a cental ? · $\frac{1}{10}$ of a cental ?

14. *How many pounds is $\frac{1}{2}$ a bu. of potatoes? $\frac{1}{10}$ of a bu.?*

FOR ORAL AND WRITTEN SOLUTION.

Memorize the following:

4 inches (in.)	make	1 hand.
6 feet	"	1 fathom.
2 things of a kind	"	1 pair.
6 things of a kind	"	1 set.

1. How many are 10 tons and 10 tons and 10 tons?

SOLUTION.   10 T. + 10 T. + 10 T. = *whole number of tons.*

2. What is the cost of 10 acres of land, at $2 an acre?

SOLUTION. $2 × 10 = *cost of the land.*

3. Paid 40 cents for 10 oranges.   What cost 1 orange?

SOLUTION. $\frac{40 \text{ cts.}}{10}$, or $\frac{1}{10}$ of 40 cents = *the cost of 1 orange.*

4. Bought books to the amount of $7.   How much change should I receive for a ten-dollar bill?

SOLUTION. $10 − $7 = *change due.*

5. What is the cost of 12 barrels of apples, at $3 a barrel?

6. What is the value of 10 five-cent postage-stamps?

7. If there are 8 trees in 1 row, how many trees in 10 rows?

8. Paid 90 cents for 10 yards of muslin.   How much was that a yard?

9. Paid 5 cents a pound for $\frac{1}{10}$ of a cental of flour.   What did the whole cost?

10. Compose 10 by units.

11. Compose 10 by parts.

12. Compose 10 by factors.

13. Resolve 10 into parts.

14. Resolve 10 into factors.

15. Resolve 20 into factors.

16. From 2 score of chickens, 10 chickens were sold.   How many chickens were left?

17. In a box of 5 dozen lemons, $\frac{1}{10}$ were rotten.   How many *were sound?*

REVIEW.

ORAL AND SLATE EXERCISES.

1. Any two numbers less than 100, one of which contains tens, may be added *at sight* (or orally). Thus, $32 + 24 = 56$.

Observe, that 30 and 20 are 50, and 4 and 2 are 6, which added to 50 make 56.

2. At sight, name the *sums* of the following:

21	32	44	62	53	75	36	83
21	32	44	41	53	71	40	14

3. In the same way, name the *differences* of the following:

21	32	44	24	50	70	56	38
11	22	· 24	14	30	40	20	31

4. Give *sum* and *difference, at sight :*

31	44	55	35	62	80	75	46
31	22	33	11	40	20	30	22

5. Also, *at sight,* name the differences of the following:

50	40	30	60	70	20	80	50
8	4	6	7	9	3	2	5

Observe, that 50 is 40 and 10, and 8 from 10 leaves 2; hence, 40 and 2 or 42, is the *difference.*

6. Name rapidly the results to the following:

$20 + 8 =$	$40 + 14 =$	$50 + 18 =$	$80 + 17 =$
$30 + 12 =$	$40 + 26 =$	$60 + 33 =$	$70 + 27 =$
$30 + 16 =$	$40 + 42 =$	$60 + 25 =$	$20 + 36 =$
$19 - 8 =$	$31 - 6 =$	$50 - 4 =$	$70 - 7 =$

8. Write *neatly* in even columns the following. Then add rapidly and silently, first by *columns*, then by *lines*, and give the sum of each. To secure rapidity, note the *time* taken.

1	1	2	3	2	5	5	5	4
2	3	2	3	2	5	5	5	4
3	2	2	1	1	2	2	3	5
1	4	1	2	1	2	2	3	5
2	4	1	2	3	3	2	5	3
3	2	1	2	3	3	5	5	· 3
1	1	3	4	4	2	5	3	1
2	4	3	4	4	2	2	3	1
3	3	3	4	5	4	2	2	4
1	2	4	3	5	4	2	2	4
2	1	4	3	2	3	5	1	2
1	2	4	3	2	3	5	2	2
2	3	2	1	1	2	4	3	3

9. Multiply, reading products *at sight:*

40	30	60	80	50	70	20	90
5	5	5	5	5	5	5	5

10. Write the above on the slate or board, and use 2, 3, 4, 6, etc., to 12 inclusive, as multipliers.

11. Place on the slate or board a row of figures variously arranged; thus,

4   8   5   1   6   3   7   2   9   8

12. First, name quickly the product of each two; thus, 32, 40, 5, etc.

13. Next, name the *sum*, then the *difference* of each two.

14. Read promptly *at sight*, and express by *figures:*

V, VII, IX, XL, XC, LX, CX, DX, CCL, DCC.

14. Let the pupil, at sight, name at least one set of two factors of each number. Thus, 24.

Ans. 6 times 4, or 3 times 8, etc.

12	20	28	40	56	81
14	21	30	42	60	84
15	24	32	48	63	90
16	25	35	50	64	96
18	27	36	54	72	100

15. Divide, reading quotients *at sight :*

$18 \div 3 =$	$28 \div 7 =$	$36 \div 9 =$	$40 \div 8 =$
$27 \div 9 =$	$36 \div 6 =$	$45 \div 5 =$	$56 \div 7 =$
$28 \div 4 =$	$42 \div 7 =$	$48 \div 6 =$	$54 \div 9 =$

16.
$\$64 \div 8 =$	70 cts. $\div 10 =$	84 da. $\div 7 =$
$\$72 \div 9 =$	56 qt. $\div 8 =$	81 bu. $\div 9 =$
$\$63 \div 7 =$	60 min. $\div 5 =$	48 hr. $\div 6 =$

17. Also read rapidly the quotients of the following :

$\frac{36}{9} =$	$\frac{42}{7} =$	$\frac{54}{6} =$	$\frac{56}{8} =$	$\frac{60}{5} =$
$\frac{63}{7} =$	$\frac{72}{6} =$	$\frac{48}{8} =$	$\frac{50}{10} =$	$\frac{44}{4} =$

18.
$\frac{45}{9} =$	$\frac{77}{7} =$	$\frac{56}{7} =$	$\frac{84}{12} =$	$\frac{100}{10} =$
$\frac{81}{9} =$	$\frac{64}{8} =$	$\frac{70}{7} =$	$\frac{60}{6} =$	$\frac{66}{12} =$

19. Then read the above thus: four 9's; seven 7's; nine 6's, etc.

20. Then as equal parts ; thus, $\frac{1}{9}$ of 36 is 4; $\frac{1}{7}$ of 49 is 7; $\frac{1}{6}$ of 54 is 9, etc.

21. Read results by columns, then by lines :

$\frac{1}{2}$ of 20 =	$\frac{1}{6}$ of 36 gal. =	$\frac{1}{10}$ of $\$100 =$
$\frac{1}{3}$ of 30 =	$\frac{1}{7}$ of 63 yd. =	$\frac{1}{2}$ of $\$400 =$
$\frac{1}{4}$ of 40 =	$\frac{1}{8}$ of 72 mi. =	$\frac{1}{4}$ of $\$500 =$
$\frac{1}{5}$ of 50 =	$\frac{1}{9}$ of 90 bu. =	$\frac{1}{8}$ of $\$800 =$

22. How many dimes in $1? In $5? In $6?

23. How many cents in $¼? In $⅓? In $2¼?

24. How many feet around a room 15 ft. long and 12 ft. wide?

25. How many inches in 1 foot? In 2 ft.? In 1 yd.?

26. How many ft. in 1 yd.? In 2 yd. and 2 ft.?

27. Mary is 8 years old and her mother 30 years old. What is the difference in their ages?

28. A school-boy having 25 cents in his pocket, gave 10 cents for a melon, and 5 cents to a blind man. How many cents had he left?

29. How many quarts in 1 gallon? In 4 gal.? In ½ gal.?

30. How many quarts in 1 pk.? In 4 pk.? In 1 bu.? In 10 pk.? In ½ bu.? In ¼ bu.?

31. How many yards in 9 ft.? In 27 ft.? In 36 ft.?

32. How many hours from noon until midnight? From midnight until next midnight?

33. How many days in a week? Name them.

34. If 1 orange costs 4 cents, what will 7 oranges cost?

35. What is the difference in the cost of 3 oranges at 5 cents apiece, and 5 lemons at 3 cents apiece?

36. At 8 cents a quart, what will 6 quarts of milk cost? 5 qt.? 7 qt.? 10 qt.?

37. How much greater is 4 times 5 than 3 times 6?

38. How many ounces in 1 pound? In ½ lb.? In ¼ lb.?

39. How many pounds in 1 hundred-weight? In 2 cwt.? In 5 cwt.? In 2½ cwt.?

40. How many hours in 1 day? In ⅓ a day? In ¼ da.?

41. How many gallons in 12 quarts? In 24 qt.? In 36 qt.?

42. How many months in 1 year? In 2 yr.? In ½ yr.?

43. *What is ⅓ of* 30 da.? ½ of 30 da.? ⅕ of 30 da.?

44. What is ½ of 60 min. ?   ⅓ of 60 min. ?   ¼ of 60 min. ?

45. What is ¼ of 24 hr.?   Of 20 sheets?   Of 12 mo. ?   Of 40 lb. ?   Of 36 bu. ?   Of 28 Cd.?

46. How many hours in ½ a day ?   Things in ½ a score ?

47. How many months in the year ?   Name them.

48. Name the months that have 31 days each.

49. Name the months that have 30 days each ?

50. What part of a year is 6 mo. ?   Is 4 mo.?   Is 3 mo. .

51. What part of a dollar is 50 cts.?   Is 25 cts. ?   Is 10 cts.?

52. What part of a bushel is 1 pk. ?   2 pk.?   8 qt.?   16 qt. ?

53. At 5 cents a loaf, how many loaves of bread can be bought for 20 cts. ?   For 30 cts. ?   For 40 cts. ?

54. If 12 peaches are divided equally among 3 boys, how many peaches does each receive ?   What part of the whole ?

55. At 8 cents a pound, how many pounds of rice can be bought for 24 cents?   For 48 cts.?   For 80 cts. ?

56. How many cents make 1 dime ?   ½ a dime?   5 dimes?

57. How many quarters make $1 ? $5 ? $4½ ? $2¼ ?

58. What is ½ of 6 yd. ?   Of 12 bu. ?   Of 36 mi. ?

59. What is ⅓ of a day ?   Of an hour?   Of a year ?

60. What is ¼ of a day ?   Of a pound?   Of a peck?

61. What is 1/10 of a cental of flour?   Of a bushel of wheat?

62. What is the cost of 6 tons of coal, at $5 a ton ?   At $6 ?

63. At $8 a barrel, what is the cost of 7 barrels of flour?   Of 10 bbl. ?   Of 8 bbl.?

64. Twelve bags of wheat, each containing 2 bu., were emptied into a bin.   How many bushels were in the bin?

65. How many times can 7 bu. be taken from a bin containing 42 bu. ?   Containing 63 bu. ?

66. At $7 a week, how long can I board for $56 ?   For $49 ?   For $70 ?   *For $77?*

3

67. Name the numbers that can be expressed by a single figure.

68. Name or write each number less than 100 that ends in 1 ; that ends in 3.

69. Write all the numbers less than 100 that end in 0 ; all that end in 5.

70. Write in Roman numerals the decades to 100 that end in 0 ; in 4; in 5.

71. Resolve 12 by 6's.   *Ans.* $12 = 6+6$, or 6×2.

72. In the same way, resolve 24 by 6's; 30 by 5's.

73. Resolve 9, 12, 18, 15, 27, each by 3's.

74. Resolve 3 by ½'s; by ⅓'s; by ¼'s.

75. Resolve 6 into all its *equal* parts.

Ans. $6 = 1+1+1+1+1+1$; $6 = 2+2+2$; $6 = 3+3$.

76. Resolve 8, 10, and 12, each into its equal parts.

77. What are the *factors* of 10?   Of 15 ?   Of 21 ?

78. Name *three* factors each of 8 ; of 12; of 18 ; 24.

79. How many feet in 2 yd. ?   In 4 yd. ?   In ½ yd. ?

80. How many years in 2 centuries ?   In ½ century ?

81. How many months in 2 yr.? In 2 yr. 6 mo. ? In 2½ yr.?

82. How many bushels in 12 pk. ?   In 20 pk. ?   In 40 pk.?

83. How many weeks in 21 da. ?   In 35 da. ?   In 49 da. ?

84. What part of a day is 12 hr.?   Is 6 hr. ?   Is 8 hr.?

85. What part of a dollar is 50 cts. ? Is 25 cts. ? Is 10 cts.?

86. What part of a pound is 8 oz. ?   Is 4 oz. ?

87. Count 1 by $\frac{1}{10}$'s ; 2 by ½'s; 3 by ⅓'s; 4 by ⅓'s; 3 by ¼'s.

88. How many ⅓'s in 2 ?   ¼'s in 4?   ⅓'s in 3 ?   ¼'s in 5 ?

89. What is ½ of $200?   ⅓ of 330 lb.?   ¼ of 400 mi. ?   ¼ of 600 gal. ?   ⅛ of 800 men ?
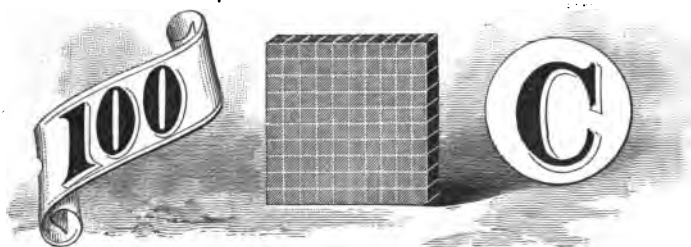
NOTATION AND NUMERATION.

1. *1.* How many rows of blocks are shown in this picture?

2. How many blocks in each row? How many in all?

3. Ten times 10 blocks are how many? $10 \times 10 = ?$

4. How many tens in one hundred? How many units?

5. What does 1 denote when it stands alone?

6. What does it denote with *one* 0 on the right of it?

7. What does it denote with *two* 00 on the right of it?

8. How do we express one *hundred* in figures?

9. Count 100 by 10's; by 5's.

10. Express 2 tens or *twenty* by figures, and by Roman numerals. Also,

11. 20 tens, or *two hundred.*　　*15.* 60 tens, or *six hundred.*

12. 30 tens, or *three hundred.*　　*16.* 70 tens, or *seven hundred.*

13. 40 tens, or *four hundred.*　　*17.* 80 tens, or *eight hundred.*

14. 50 tens, or *five hundred.*　　*18.* 90 tens, or *nine hundred.*

19. What is the *least* number that can be expressed by *three* figures? The *greatest?*

20. The numbers from one hundred to *nine hundred ninety-nine* are represented by writing the *hundreds* in the *third* place from the *right*, the *tens* in the *second* place, and the *units* in the *first* place.

ONE HUNDRED   FIFTY-   SIX.   156.

2. *1.* What does any figure standing *alone* express?

2. When *two* figures are written together, what does the one on the *right* express ?   The one on the *left ?*

3. When *three* figures stand together, what is the one on the *right* called ?   The *next* one?   The one on the *left ?*

4. What do the figures 156 represent?

Ans. 1 *hundred* 5 *tens* and 6 *units,* and is read *one hundred fifty-six.*

5. What do the figures 427 denote?

Ans. 4 *hundreds* 2 *tens* 7 *units,* read, *four hundred twenty-seven.*

6. In the same manner read the following, naming the *hundreds, tens,* and *units* in each :

207	341	184	537	782	872
572	462	265	673	394	935
426	561	626	244	927	308
147	600	235	506	879	730

7. How many *units* in 200 ?   How many *tens ?*   How many *hundreds ?*

8. How many *tens* in 210? In 220? In 340? In 450?

9. How many *units* in 225? How many *tens* and *units?*
How many *hundreds, tens,* and *units?*

10. 10 units = 1 ten; 10 tens = 1 hundred.

11. When no number is named for any place, fill the place
with a cipher; thus, seven hundred six is 7 hundred, *no* tens,
and 6 units, and is written 706.

12. Nine hundred eighty is 9 hundred, 8 tens, *no* units,
and is written 980.

13. How many *units* make 1 ten? 1 hundred?

14. How many units are 7 tens and 9 units?

15. How many tens are 4 tens and 5 tens?

16. How many hundreds are 3 hundreds and 4 hundreds?
How many tens? How many units?

Express in one number, by figures, each of the
following:

	Hund.	Tens.	Units.
17. 4 tens, 6 units, and 5 hundreds.	5	4	6
18. 5 units, 8 hundreds, and 4 tens.	8	4	5
19. Six hundreds, eight units, and 5 tens.	6	5	8
20. Seven tens, no hundreds, and six units.	0	7	6
21. Four units, no tens, and 5 hundreds.	5	0	4
22. Nine tens, seven hundreds, and no units.	7	9	0
23. Eight hundreds, no tens, and no units.	8	0	0

Write the following numbers in *columns,* placing units
under units, tens under tens, and hundreds under hundreds:

24. 366, 48, 104, 261, 407, 39, and 7.

25. 59, 116, 204, 16, 320, 40, and 10.

26. 730, 126, 75, 109, 18, 638, 49, 500, and 9.

27. 84, 907, 17, 300, 250, 199, 29, and 403.

28. *106, 480, 36, 500, 267, 39,* and 50.
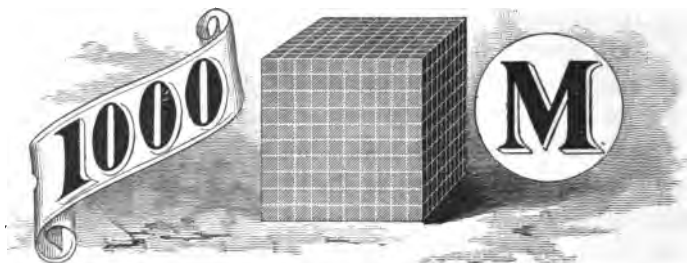
3. *1.* In the picture there are 100 small blocks in the top row or layer. How many hundred blocks are there in 2 rows or layers?

2. How many hundred blocks in 3 rows? In 4 rows?

3. How many *rows* of blocks are represented? How many *blocks* in a row? How many blocks in the *cube?*

4. 999 and 1 more equal ***one thousand,*** 1000.

5. How do we express one *thousand* by figures?

6. In like manner, represent by figures:

Two thousand.	*Six thousand.*
Three thousand.	*Seven thousand.*
Four thousand.	*Eight thousand.*
Five thousand.	*Nine thousand.*

7. In any number expressed by *four* figures, the figure at the right is *units,* the next is *tens,* the next *hundreds,* and the fourth figure from the right is *thousands.*

8. What do the figures 2345 represent?

Ans. 2 *thousands* 3 *hundreds* 4 *tens* 5 *units,* read, *two thousand three hundred forty-five.*

9. What do the figures 1040 represent?

Ans. 1 *thousand no hundreds* 4 *tens no units ;* read, *one thousand forty.*

10. In the same manner, read the following :

2406	4051	3007	1904
1572	5200	3333	6070

	Thous.	Hund.	Tens.	Units.

Write in figures the following numbers:

11. Three thousand five hundred seven. | 3 | 5 | 0 | 7 |
12. One thousand two hundred ten. | 1 | 2 | 1 | 0 |
13. Two thousand one hundred three. | 2 | 1 | 0 | 3 |

14. Four thousand thirty.

15. Five thousand forty-six.

16. Seven hundred eight.

17. Nine thousand twelve.

18. Eight thousand forty-two.

19. Five hundred ninety.

20. Seven thousand seven.

21. Six thousand fifty.

22. Eighteen hundred nine.

23. Twenty-five hundred.

24. One thousand three hundred and forty-seven.

25. Five thousand six hundred and seventeen.

26. What is the greatest number that can be expressed by four figures ?

27. 9999 and 1 more equal *ten thousand,* 10000.

28. How do we express *ten* thousand by figures ?

29. In like manner, represent by figures:

Twenty thousand.   *Sixty thousand.*

Thirty thousand.   *Seventy thousand.*

Forty thousand.   *Eighty thousand.*

Fifty thousand.   *Ninety thousand.*

TABLE.

10 units	make	1 ten,	10.
10 tens	"	1 hundred,	100.
10 hundreds	"	1 thousand,	1000.
10 thousands	"	1 ten-thousand,	10000.
10 *ten-thousands*	"	1 **hundred thousand,**	100000.

4. *1.* The places in a number are called ***orders*** of units; thus, 324 represents 4 units of the *first* order, 2 units of the *second* order, or 2 tens, and 3 units of the *third* order, or 3 hundreds.

2. Ten units of any order in a number make one unit of the next higher order.

3. A ***period*** is a group of three orders of units, counting from right to left.

4. The figures in the *first* period on the right represents *units*, in the *second* period *thousands*, in the *third* period *millions*, as shown in the following

TABLE.

PERIODS.	3d. Millions.			2d. Thousands.			1st. Units.		
NAMES OF ORDERS OF UNITS.	Hundreds.	Tens.	Units.	Hundreds.	Tens.	Units.	Hundreds.	Tens.	Units.
Numbers to be read.	1	2	7,	3	6	4,	5	4	9
			4,	2	5	1,	7	3	0
				7	0	5,	2	4	9

5. Beginning at the *right*, the order of *simple units* occupies the first place ; *tens*, the second place ; *hundreds*, the third ; *thousands*, the fourth ; *tens of thousands*, the fifth ; *hundreds of thousands*, the sixth, etc. ; a unit in each place towards the *left* being *ten times* greater than the one before it on the *right*.

6. Each *period* is read like a number of *three* figures, giving it the *name* of the period ; thus, the first number above is read, *127 million 364 thousand* **549.**

5. To assist the pupil in learning to write and to read numbers readily, use the following form:

1. The first number is read, 3 *hun-dred* 7.

2. The second is read, 2 *thousand* 4 *hundred* 60.

3. The third is read, 14 *thousand* 84.

4. The fourth is read, 205 *thousand* 6 *hundred* 2.

Mill.			Thou.			Units.		
H	T	U	H	T	U	H	T	U
						3	0	7
					2	4	6	0
				1	4	0	8	4
			2	0	5	6	0	2
		2	0	4	0	7	0	0

5. The fifth is read, 2 *million* 40 *thousand* 7 *hundred.*

When proficiency in smaller numbers is attained, this exercise may be extended to higher periods.

Copy, point off into periods, and read the following:

6. 3472 ; 17043 ; 20304. 600317 ; 108300.

7. 500037 ; 2405037; 910307; 76301; 30406.

8. Write the preceding numbers in each line, in columns, placing units under units, tens under tens, etc.

Express the following in figures:

9. Sixty thousand six hundred eight.

10. Seven hundred twenty thousand fifty-six.

11. Two hundred forty-nine thousand five hundred.

12. One million ninety-six thousand two hundred ten.

13. Two million three hundred twenty-five thousand.

14. Seven hundred fifty million six thousand nine hundred

6. Express in figures, and read the following numbers:

1. VII.	*5.* XXXV.	*9.* LXXIV.	*13.* CCXL.
2. IX.	*6.* XLI.	*10.* LXXX.	*14.* CCCL.
3. XXIV.	*7.* LXII.	*11.* XLIX.	15. DCXXX.
4. XIX.	*8.* LIX.	*12.* CXXV.	16. MDCXL

DRILL EXERCISES.

7. *1.* Write upon the slate or board any number, as the following:

$$6 , 6 6 6 , 6 6 6.$$

2. Exercise the pupil in naming the *orders* of units in the following places: Name the units of the *first* order, of the *third, second, fifth, seventh, sixth, fourth.*

3. Then name the *places* occupied by the following orders: *Hundreds, ten-thousands, thousands, millions,* etc.

4. Then name the following *periods : First, third, second.*

5. Then practice on the above number, or some other, by saying: six units; six tens, or sixty, which is ten times six units; six hundreds, or six hundred, which is ten times six tens ; six thousands, or six thousand, which is ten times six. hundred, etc.

6. Reverse the process, thus : six million ; six hundreds of thousands, which is one-tenth of six million; six tens of thousands, which is one tenth of six hundred thousand, etc.

Practice the last two exercises until the *decimal scale* of increase and decrease is well understood.

7. Next write several numbers, each consisting of three *periods.* Thus,

$$3 3 3 , 3 3 3 , 3 3 3.$$
$$5 0 0 , 5 0 0 , 5 0 0.$$

8. Drill on these in the same manner as on the orders, to fix in the mind that each period represents a value one *thousand* times as large as the period on its right, and one *thousandth* as large as the period on its left.

ADDITION AND SUBTRACTION.

8. *1.* How many are 3 boys and 4 boys? 6 books and 4 books? 5 cents and 5 cents? 7 and 2?

2. How many are 8 boys less 3 boys? 10 peaches less 4 peaches? 7 cents less 2 cents? 9 less 4?

3. How many are 7 more than 5? 6 more than 4?

4. Can 5 books and 3 boys be added or counted together?

5. Can 5 balls and 3 balls be added?

6. Can you take 5 cents from 8 marbles?

7. Can you take 5 marbles from 8 marbles.

STATEMENT.—*Only numbers representing things of the same kind can be united, or compared.*

8. How many pens are 5 pens and 4 pens? 5 + 4?

9. How many units are 7 units and 5 units? 7 + 5?

10. How many tens are 8 tens less 3 tens? 8 — 3?

11. How many hundreds are 3 hundreds and 6 hundreds?

12. Seven tens are how many tens more than 4 tens?

13. How many are 4 tens and 2 tens? How many units?

14. How many are 6 tens less 3 tens? How many units?

15. How many units are 2 tens and 5 units? 5 tens and 3 units? 6 tens and 4 units?

16. A farmer sold 12 sheep to one man and 7 to another. How many did he sell to both? How many more to the one than to the other?

17. James gave 50 cents for a knife and 20 cents for a slate. What did he pay for both? How much more for the knife than for the slate?

ORAL AND SLATE EXERCISES.

9. *1.* Count alternately by 2's and 3's to 35.

Written,   2 + 3 + 2 + 3 + 2 + 3 + 2 + 3 + 2 + 3 + 2 + 3 + 2 + 3.
Counted,   2, 5, 7, 10, 12, 15, 17, 20, 22, 25, 27, 30, 32, 35.

Count

2. By 2's and 3's to 40.   *5.* By 2's and 5's to 28.
3. By 3's and 4's to 28.   *6.* By 3's and 5's to 32.
4. By 2's and 4's to 36.   *7.* By 4's and 5's to 36.

8. Count by 7's from 0 to 49; from 1 to 43; from 2 to 44.
9. Count by 8's from 0 to 48; from 1 to 49; from 2 to 50.
10. Count back by 7's from 49 to 0; 46 to 4; 43 to 1.
11. By 8's from 48 to 0; from 42 to 2; from 47 to 7.
12. By 9's from 45 to 0; from 40 to 4; from 41 to 5.

10. Copy, add, and give the sum of *each* column: *

(1.)			(2.)			(3.)			(4.)		
3	3	3	3	3	3	3	3	3	4	4	4
3	3	3	3	3	3	3	3	3	4	4	4
3	3	3	3	3	3	3	3	3	4	4	4
3	3	3	3	3	3	3	3	3	4	4	4
3	2	1	6	5	4	9	8	7	3	2	1

(5.)			(6.)			(7.)			(8.)		
4	4	4	4	4	4	5	5	5	5	5	5
4	4	4	4	4	4	5	5	5	5	5	5
4	4	4	4	4	4	5	5	5	5	5	5
4	4	4	4	4	4	5	5	5	5	5	5
6	5	4	9	8	7	3	2	1	6	5	4

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* This exercise should also be read rapidly from the *open book.*

(*9.*)	(*10.*)	(*11.*)	(*12.*)
6 6 6	6 6 6	7 7 7	7 7 7
6 6 6	6 6 6	7 7 7	7 2 7
6 6 6	6 6 6	7 7 7	7 7 7
6 6 6	6 6 6	7 7 7	7 7 7
3 2 1	6 5 4	3 2 1	7 6 5

(*13.*)	(*14.*)	(*15.*)	(*16.*)
8 8 8	8 8 8	9 9 9	9 9 9
8 8 8	8 8 8	9 9 9	9 9 9
8 8 8	8 8 8	9 9 9	9 9 9
8 8 8	8 8 8	9 9 9	9 9 9
3 2 1	6 5 4	4 3 2	7 6 5

FOR ORAL AND WRITTEN SOLUTION.

11. *1.* A farmer sold a sheep for $6 and a calf for $8. What did he receive for both ?

WRITTEN SOLUTION. $6 + $8 = *what he received for both.*

ORAL SOLUTION. He received the *sum* of $6 and $8, which is $14.

2. A boy had 16 marbles and his mother gave him 5 more; how many marbles had he then ?

3. James paid 6 cents for a pencil, 5 cents for an orange, and 8 cents for a ball; what did he pay for all ?

4. Mary had 15 cents and lost 9 cents; how many cents had she left ?

WRITTEN SOLUTION. 15 cents — 9 cents = *No. of cents she had left.*

ORAL SOLUTION. She had left the *difference* between 15 cents and 9 cents, which is 6 cents.

5. A farmer bought 24 sheep, and sold 9 of them. How many *sheep had he left ?*

6. If a pound of sugar cost 10 cents, a pound of rice 12 cents, and a melon 9 cents, what do all cost?

7. If a box of starch weigh 7 pounds, a bag of salt 9 pounds, and a ham 11 pounds, what do all weigh?

8. A man borrowed $15 and paid $7. How much remained unpaid?

9. If you take 6 pears from a basket containing 25 pears, how many pears will remain?

10. From a piece of silk containing 30 yards, 9 yards were cut. How many yards remained?

11. A farmer sold a cow for $25, that cost him $31. What was his loss?

12. There are 9 shade trees in one row, 11 in another, and 8 in another. How many trees in all?

13. There are 9 geese and 9 ducks swimming in a pond. How many of both?

14. Sold some sheep for $18, which cost me $12. What was my gain?

15. In a school are 32 boys and 23 girls. How many more boys are there than girls?

16. Dick spent 11 cents, gave a beggar 5 cents, and had 9 cents left. How many cents had he at first?

17. Carrie having 25 cents, gave 4 cents for a pencil and 5 cents for a spool of thread. How many cents had she left?

18. Martin had 15 cents and earned 10 cents more, then gave 8 cents to a beggar. How many cents had he left?

19. Bought a ton of coal for $6, and a barrel of flour for $9, and paid $7. How much did I still owe?

20. If I buy a set of chairs worth $10, and a table worth *$7, and* have but $9, how much more money do I need to pay *for both?*

21. Charles is 19 years old, and his brother is 6 years younger. How old is his brother?

22. George has 22 cents, and his sister has 9 cents more than George? How many cents has his sister?

23. If a yard of muslin cost 11 cents, a spool of thread 7 cents, and a thimble 9 cents, what do all cost?

24. If a ton of coal cost $6, a barrel of flour $8, and a cord of wood $5, what is the cost of the whole?

25. From a cask containing 26 gallons of water, 9 gallons leaked out. How many gallons remained?

26. To 12 add 4, subtract 5, add 7, subtract 6, add 5, subtract 3. What is the result?

WRITTEN EXERCISES.

12. *1.* What is the sum of 324, 213, and 431?

324 = 3 *hunds.* 2 *tens* 4 *units.*		Each of these num-
213 = 2 " 1 " 3 "		bers is made up of
431 = 4 " 3 " 1 "		hundreds, tens, and

Sum,   968 = 9 *hunds.* 6 *tens* 8 *units.*   units.

Adding each, the sum is 9 hundreds 6 tens 8 units, or 968.

In a similar manner, add the following:

(*2.*)	(*3.*)	(*4.*)	(*5.*)	(*6.*)
213	304	503	104	504
425	123	172	302	670
160	562	223	493	125

(*7.*)	(*8.*)	(*9.*)	(*10.*)	(*11.*)	(*12.*)
235	112	421	304	142	170
140	231	205	132	210	218
211	354	162	261	134	201

13. When numbers are so large that the *difference* cannot be found at once, units may be taken from units, tens from tens, and hundreds from hundreds, etc.

1. Subtract 644 from 968.

Minuend, $968 = 9$ *hunds.* 6 *tens* 8 *units.*

Subtrahend, $644 = 6$ " 4 " 4 "

Difference, $324 = 3$ *hunds.* 2 *tens* 4 *units*, or 324.

PROOF.—Add the difference to the subtrahend. If the work is right, the sum will equal the minuend. Thus, $968—644 = 324$, the *difference;* and $324+644 = 968$, the *minuend.*

In like manner, subtract, and prove the following:

	(*2.*)	(*3.*)	(*4.*)	(*5.*)	(*6.*)
Minuend,	835	769	578	274	857
Subtrahend,	423	634	453	121	524
Difference,	412				

	(*7.*)	(*8.*)	(*9.*)	(*10.*)	(*11.*)
From	936	792	478	891	527
Take	214	351	436	170	204

	(*12.*)	(*13.*)	(*14.*)	(*15.*)
From	546 yards.	438 cents.	637 men.	$764
Take	234 "	321 "	431 "	$423

	(*16.*)	(*17.*)	(*18.*)
From	2467 feet.	4825 pounds.	$6041
Take	1024 "	2103 "	$3011

Also the following:

19. 4206 from 9876.   *21.* $8989 — 4736.$

20. 3027 from 7158.   *22.* $1764 — 431.$

FOR WRITTEN SOLUTION.*

14. *1.* How many bushels of apples in 3 piles, the first containing 260 bushels, the second 300 bushels, and the third 29 bushels ?

SOLUTION.   260 bu. + 300 bu. + 29 bu. = *whole number of bushels.*

2. There were 796 bu. of oats in an elevator. After shipping 350 bu., how many bushels remained ?

SOLUTION.   760 bu. − 350 bu. = *No. of bushels remaining.*

3. A poultry dealer sold some turkeys for $460, some geese for $230, and some chickens for $207. What did he receive for all ?

4. A man had $175, and gave $121 for a horse. How much had he left ?

5. What is the sum of $625 and $425 ? The difference ?

6. In an orchard are 800 peach trees, 400 apple trees, 200 cherry trees, and 150 plum trees. How many trees in all ? How many less plum trees than apple trees? How many more peach trees than all the others ?

7. A farmer sold 380 bu. of wheat, 260 bu. of corn, 100 bu. of rye, and 200 bu. of barley. How many bushels of grain did he sell ?

8. How many years since Perry's victory on Lake Erie in the year 1813 ?

9. A man has two farms, one containing 570 acres, the other 220 acres. How many acres in both ? In the one, more than in the other ?

10. How many pigeons are 230 pigeons, 520 pigeons, and 618 pigeons ?

---

* The pupil should first express the solution in mathematical language, *without giving* the result.   Then solve and give the result.

11. A man bought a lot for $340, and sold it for $960. How much did he gain ?

12. What is the sum of 740 feet, 228 feet, and 121 feet ?

13. What is the sum of the numbers represented on the face of a clock ?

14. A man traveled 461 miles by railroad, 310 miles by steamboat, and 125 miles by stage. What was the total number of miles traveled ?

15. A grocer had 797 boxes of soap, from which he sold in lots as follows : 230 boxes, 123 boxes, and 132 boxes. How many boxes had he left ?

16. Express this year in Roman numerals.

17. A father divided his estate among his four sons, giving each $2102. What was the amount of his estate ?

18. If I were born in 1825, when will I be 63 years old ?

19. A woman sold 35 pounds of butter at one time, 42 pounds at another, and 50 pounds at another. How many pounds did she sell in all ? .

20. A carpenter built a house for $3150, a barn for $525, and fences for $214. What did he receive for building all ?

21. A has $4648, and B has $2320. How many dollars have both ? How many more has A than B ?

22. A gentleman at his death possessing $8684, gave to each of his two sons $2130, and the remainder to his daughter. How much did the daughter receive ?

23. A man bought a farm for $5250, and expended $1325 for improvements and $2314 for stock. What was the total amount expended ?

24. A merchant gave $1526 for a case of goods, and paid *$75 for* freight and insurance. For how much must he sell *them to gain $137 ?*

DEFINITIONS.

15. *1.* Counting, or uniting two or more numbers or groups of objects of the same kind into *one* is called *adding*, or *addition.*

2. The number obtained by adding is called the *sum.*

3. Comparing two numbers of the same kind, to find how many units the one is greater than the other, is called *subtracting* or *subtraction.*

4. The result obtained by subtracting is called the *difference.*

When a part is taken from the whole, the *difference* is called the **remainder.**

5. The greater number, or the number to be made less, is called the *minuend.*

6. The less number, or the number to be taken from another, is called the *subtrahend.*

STATEMENT.—*The minuend must be equal to the sum of the subtrahend and the difference.*

WRITTEN EXERCISES.

16. *1.* What is the sum of 524, 345, and 473?

Write units of the same order in the same column.

Begin at the bottom of the units' column, and add each column separately, and instead of saying 3 units and 5 units are 8 units, and 4 units are 12 units, name the successive *results* only; thus, 3, 8, 12, the sum of the *units*, equal to 1 ten and 2 units. Write the 2 units in units' place, and add the 1 ten to the lower number in the tens' column; then, 1, 8, 12, 14, the sum of the *tens*, equal to 1 hundred and 4 tens. Write the 4 tens in tens' place, and add the 1 hundred to the hundreds' column; then, 1, 5, 8, 13, the sum of the *hundreds*, equal to 1 thousand and 3 hundreds, which write in the hundreds' and thousands' places.

```
        524
        345
        473
        ———
Sum,   1342
```

In the same manner, copy and add:

(2.)	(3.)	(4.)	(5.)	(6.)	(7.)
423	304	210	514	75	716
542	718	634 ·	301	610	84
365	532	184	198	393	205

(8.)	(9.)	(10.)	(11.)
134 men.	384 boys.	300 pounds.	2036 days.
250 "	92 "	480 "	462 "
675 "	807 "	78 "	84 "

12. What is the sum of $203, $176, and $510?

13. What is the sum of 124 bu., 403 bu., and 271 bu.?

14. What is the sum of 785 tons, 948 tons, and 370 tons?

15. What is the sum of 267 rods, 565 rods, and 97 rods?

16. What is the sum of 342 feet, 706 feet, and 680 feet?

17. *1.* From 953 subtract 674.

ANALYSIS.—Write the less number under the
greater, so that units of the same order stand in
the same column.

                    8 14 13

Minuend, 9 5 3

Subtrahend, 6 7 4

Remainder, 2 7 9

Since 4 units cannot be subtracted from 3 units,
increase the 3 units by a unit from the next higher
order, or 10 units, making 13 units.   4 units from 13 units leave 9 units,
which write in the units' place.

Since 1 of the tens was united with the units, there are 4 tens left.
As 7 tens cannot be subtracted from 4 tens, increase the 4 tens by a unit
from the next higher order, or 10 tens, making 14 tens.   7 tens from 14
tens leave 7 tens, which write in the tens' place.

Since 1 of the hundreds was united with the tens, there are 8 hun-
dreds left.   6 hundreds from 8 hundreds leave 2 hundreds, which write
in the hundreds' place.   Hence the remainder is 279.

PROOF.—The remainder 279 added to the subtrahend 674, equals 953
the minuend.

In like manner, solve the following:

	(2.)	(3.)	(4.)	(5.)	(6.)
Minuend,	473	719	645	456	394
Subtrahend,	156	645	261	192	275
Remainder,	317				

	(7.)	(8.)	(9.)	(10.)
From	645 qt.	387 lb.	963 da.	630 doz.
Take	564 "	348 "	406 "	206 "

	(11.)	(12.)	(13.)	(14.)	(15.)
From	4571	5274	7345	9876	2925
Take	2786	1548	5456	4894	1673

	(16.)	(17.)	(18.)	(19.)
From	3246 bu.	4713 mi.	2704 acres.	$8463
Take	1328 "	2430 "	1524 "	$5372

	(20.)	(21.)	(22.)	(23.)
From	5672 gal.	1704 rods.	$4030	$3500
Take	3834 "	845 "	$3120	$2500

18. *1.* To distinguish *dollars* from *cents,* when written as *one number,* a point (.) is placed between the dollars and the cents. Thus, $6.25 is read, 6 *dollars* 25 *cents.*

2. Since 100 cents make $1.00, *cents* always occupy *two* places, and never more than two. Thus, 42 cents may be written, $.42 ; 18 cents, $.18.

3. If the number of cents is less than 10, a cipher must occupy the first place at the right of the point. Thus, 8 cents is written, $.08; 4 dollars 6 cents, $4.06.

4. In arranging for addition and subtraction, dollars should be written under dollars, and cents under cents, in such order that the *points* stand in a *vertical* line.

5. The *sign* $, and the *point* (.) should never be omitted.

19. Read the following numbers :

$456.	$.42.	$75.84.	$.05.	$1.10.
$1250.	$.08.	$125.07.	$.03.	$2.09.
$25600.	$.02.	$200.40.	$.62.	$5.00.

1. $12+$8 = $20.	*4.* $.75+$.20 = $.95.
2. $25+$10 = $35.	*5.* $.60+$.40 = $1.00.
3. $3.25+$6.75 = $10.	*6.* $14.08+$3.14 = $17.22.

20. Express the following by proper figures and signs:

1. Nine dollars thirty cents.	*9.* 7 dollars 26 cents.
2. Thirty dollars ten cents.	*10.* 9 dollars 5 cents.
3. Eighty-four cents.	*11.* 19 dollars 7 cents.
4. Seventy-eight cents.	*12.* 69 cents ; 23 cents.
5. Six dollars sixteen cents.	*13.* 10 cents ; 6 cents.
6. Twelve dollars sixty cents.	*14.* 90 dollars 90 cents.
7. Seven dollars twelve cents.	*15.* 105 dollars 40 cents.
8. Eighty-four dollars two cents.	*16.* 200 dollars 8 cents.

The teacher may exercise the class *orally*, by dictating rapidly, but distinctly, similar examples. Thus, *Sign, five, three?* The prompt response should be, " Fifty-three dollars" ($53). *Ques. Sign, point, seven, four. Ans.* Seventy-four cents ($.74). *Ques. Sign, point, naught, eight ? Ans.* Eight cents ($.08), etc.

Also, the converse ; thus, *Ques.* "Forty-five dollars" ($45)? *Ans. Sign, four, five. Ques.* Fifty-six cents ($.56)? *Ans. Sign, point, five, six. Ques. Nine dollars seven cents* ($9.07)? *Ans. Sign, nine, point, naught, seven.* etc.

21. Copy and add :

(1.)	(2.)	(3.)	(4.)
$3.04	$24.12	$105.	$200.35
2.21	3.06	32.14	46.41
.53	12.	.73	1.02

(5.)	(6.)	(7.)	(8.)
$3.50	$19.37	$6.29	$.87
12.48	.84	23.82	1.06
.75	5.09	1.10	12.63

(9.)	(10.)	(11.)	(12.)
276 miles.	876 feet.	$20.30	$145.24
307 "	94 "	7.56	36.60
638 "	142 "	13.08	105.08

Arrange in columns and add :

13. $11.36, $26.07, $9.16, $32.76, and $2.34.

14. $42.06, $10.30, $4.82, $.77, and $.93.

15. $370.21, $2.49, $3.07, and $.94.

16. $32.50, $126.08, $9.40, $15.74, and $140.

17. $307.09, $50, $6.84, $100.10, and $450.

18. $76, $400, $5.12, $17.04, $.97, and $1.62.

	(19.)	(20.)	(21.)	(22.)
From	$17.48	$73.26	$50.67	$120.80
Take	6.27	25.18	10.08	35.26

Find the *sum* and *difference*

23. Of $85.85 and $65.40.

24. Of $34.75 and $24.58.

25. Of $67.25 and $47.

26. Of $27.50 and $16.75.

27. Of $45.25 and $24.75.

28. Of $71.25 and $50.75.

29. Of $11.25 and $6.75.

30. Of $87.28 and $48.37.

ORAL AND SLATE EXERCISES.

22. *1.* A man having $20, paid $7 for a hat, and $8 for a vest. How many dollars had he left?

WRITTEN SOLUTION. $20−($7+$8) = *what he had left.**

ORAL SOLUTION. He had left the *difference* between $20, and the *sum* of $7 and $8, which is $5.

2. A boy had 30 cents, and gave 15 cents for a slate and 10 cents for some paper. How many cents had he left?

3. Ella having 16 cents, Jane gave her 9 cents more, and James gave her enough to make her number 36. How many cents did James give her?

4. Lillie had 45 cents, and gave 10 cents for a pencil, and 24 cents for a book. How many cents had she left?

5. A boy had 9 cents, he earned 10 more, then gave 7 to his sister. How many cents had he left?

6. How many dollars are $5, $7, and $10, less $6?

7. Belle had 16 pinks, and gave 3 to Mary, and 5 to Anna. How many pinks had she left?

8. Jennie had 25 cents, and bought some buttons for 8 cents, a pencil for 4 cents, and some thread for 6 cents. How many cents had she left?

9. Ned having 19 cents, lost 4, spent 5, earned 3, and gave away 6. How many cents had he then?

10. How many are 5, 7, and 4, less 2 and 3?

11. How many are 10, 3, and 6, less 5 and 7?

12. How many are 15 less 7, added to 4 and 3?

13. How many are 12 less 5, added to 10 less 3?

14. How many are 13 and 7, less 6 and 9?

---

* Whatever is included in a parenthesis (   ) is to be treated as a *single number.*

FOR WRITTEN SOLUTION.

23. *1.* Bought a horse for $154, and sold him for $189.25. What was my gain?

SOLUTION. $189.25 − $154 = *the gain.*

2. A man owing $1250, paid at one time $450, and at another $327. How much did he still owe?

SOLUTION. $1250 − ($450 + $327) = *what he still owed.*

3. A man sold a house and lot for $41763, that cost him $30242. What was his gain?

4. George Washington was born in 1732, and died in 1799. How old was he at his death?

5. Queen Victoria was born in 1819. What will be her age in 1885?

6. A lady paid $45.40 for a dress, $15.37 for a bonnet, $6 for a pair of gaiters, and $1.62 for a pair of gloves. What did she pay for all?

7. A farmer sold a cow for $36.50, a ton of hay for $14.25, and a tub of butter for $20.80. What did he receive for all?

8. Bought a hat for $4.75, a pair of shoes for $5.12, a pair of gloves for $.87, and an umbrella for $2.75. What was the cost of the whole?

9. The first newspaper published in America was issued at Boston in 1704. How many years since?

10. The Brooklyn Suspension Bridge was commenced in 1869, and finished in 1883. How long was it in building?

11. Bought a sack of flour for $1.75, a pound of tea for $.90, and some sugar for $2.25. How much must I receive in change for a five-dollar bill?

12. A drover bought 3245 sheep, and sold 1200 of them. How many had he left?

13. The great fire in Chicago was in 1871.   How many years since ?

14. A man having $2575.75, gave $1250 for a house, and paid $570.64 for repairs.   How much had he left?

15. Two men bought a piece of property for $358.50.   One paid $146.30.   How much did the other pay ?

16. A farmer raised 2584 bu. of wheat.   He sold 860 bu. to one man, and 1075 bu. to another.   How many bushels had he left ?

17. If a man's income is $175 a month, and he pays $25 for rent, $44 for provisions, and $18 for other expenses, how much will he have left ?

Copy and add the following :

(*1.*) men.	(*2.*) feet.	(*3.*) days.	(*4.*) feet.	(*5.*) miles.	(*6.*) pounds.
542	820	153	1450	2157	1740
176	507	208	1234	1528	2031
628	418	759	2357	1372	1507
473	256	380	1567	2143	1423

(*7.*)	(*8.*)	(*9.*)	(*10.*)	(*11.*)	(*12.*)
$12.47	5020	1305	3172	1526	$42.14
20.72	1513	6040	1094	5017	20.30
42.89	3156	3708	7165	2157	53.27
30.70	1208	1159	2082	1215	14.56

Find the value of

13. $104.47 — $73.92 =

14. $100.37 — $40.09 =

15. $416.08 — $208.67 =

16. $57.46 — $18.00 + $24.25 =

17. $50.20 + $76.31 — $4.01 =

18. $98.76 — $30.41 + $43.04 =

DRILL TABLE No. 1.

	A	B	C	D	E	F
1.	2	3	8	4	20	300
2.	3	4	2	10	40	100
3.	4	7	3	3	60	700
4.	1	5	6	11	30	500
5.	7	1	9	6	80	200
6.	6	4	5	2	10	800
7.	2	6	1	12	90	400
8.	5	8	4	8	70	600
9.	8	3	7	5	50	900

By *columns, at sight,* give the sum of each number and the one below it. Then, taking two columns, give the sum of each pair of numbers.

Next start with 1, and add each column; then with 2, 3, 4, etc. to 10.

Then read each number in each column 20 greater; then 30, 40, 50, and so on to 100.

Read the *sum* of the numbers in each line in columns F, E, D, from *right* to *left* rapidly ; thus, 324, 150, etc.

By *column* give the *difference* of each number and the one below it. By *lines* give the difference of each number and one to *right* of it. In column A give difference of each number and 1. 2, 3, etc., to 20. Same with each column.

Then between the *sum* of two consecutive numbers and the number next on the right, in each line.

ADDITION AND SUBTRACTION AT SIGHT.

24. Give *sum,* and *difference, at sight :*

1.	50	500	5000	70	700	7000
	20	200	2000	50	500	5000
2.	80	500	8000	800	5000	9000
	40	100	2000	300	2000	4000

It will be observed that the sum or difference of 5 and 2, *abstractly,* is the same, whether it represents units, tens, hundreds, or thousands.

Let the pupil also, at sight, read and write the sum of the above by *line,* from right to left. Thus, 5000, 500, 50, written 5550.

3.	20	40	400	606	404	504
	8	12	150	303	202	505
4.	444	555	888	333	777	
	222	333	111	111	222	
5.	809	6008	507	908	9008	
	504	3002	304	507	5007	

Give the *sum* of each group of numbers *at sight :*

6.	20	200	2000	30	300	3000
	20	200	2000	30	300	3000
	20	200	2000	30	300	3000
7.	204	602	306	501	306	402
	204	602	306	501	206	402
	204	602	306	501	106	402

Practice on the above to secure rapidity and accuracy.

8. From the open book, add by *column*, and then by *line:*

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

The above is intended to train the eye and mind to add, at sight, *groups* of two, three, or more figures as a *single number.*

9. Give the sum of the following, at sight:

$.25	$1.25	$2.25	$20.25	$25.25
.25	1.25	2.25	20.25	25.25
.25	1.25	2.25	20.25	25.25

10. Add the following, at sight:

25	50	100	125	150	225
25	50	100	125	150	225
25	50	100	125	150	225
25	50	100	125	150	225

11. Give *sum*, and *difference*, at sight:

$20.50	$40.50	$100.50	$125.50	$10.50
20.25	10.25	50.25	25.25	5.25

12. $45.75	$275	$125.40	$200.50	$65.65
20.50	250	25.40	100.25	30.30

ORAL AND SLATE EXERCISES

25. *1.* William having a half-dollar, gave 10 cents for a book and 15 cents for a slate.   How many cents had he left?

WRITTEN.   50 cts. —(10 cts. + 15 cts.) = *what he had left.*

ORAL.   He had left the *difference* between 50 cents and the *sum* of 10 cents and 15 cents, which is 25 cents.

2. Mary gave 6 cents for a spool of thread, and 10 cents for some buttons.   How much change should she receive for a quarter-dollar?

3. A man having $40, paid $15 for a coat, $10 for a vest, and $9 for a pair of boots.   How much had he left?

4. A farmer gave a cow and $15 in money for a wagon valued at $60.   How much did he get for his cow?

5. If your slate is 10 in. long and 6 in. wide, how many inches around the slate?   How many more inches in length than in width?

6. A man gave his watch and $10 in money for a harness valued at $75.   How much did he get for his watch?

7. A man paid $10.75 for sugar, and $5.25 for coffee. What did he pay for both?   How much more for the sugar than for the coffee?

Supply the proper *number* in place of (?):

8. $18 - 7 + 6 = ?$

9. $20 + 18 - ? = 28.$

10. $9 + 11 = 10 + ?$

11. $24 - ? = 7 + 9.$

12. $21 - 9 + ? = 19.$

13. $23 + ? = 12 + 18.$

14. $40 - 18 = 12 + ?$

15. $32 + 10 = 50 - ?$

16. $? + 16 = 26 - 6.$

17. $10 + 13 = ? + 11.$

18. $27 - 7 = 17 + ?$

19. $36 + 4 = ? + 20.$

20. $11 + 7 = 26 - ?$

21. $23 - 5 = ? + 2.$

22. $9 + 28 - 10 = 30 - ?$

23. $60 - 30 + 15 = 36 + ?$

SLATE OR BLACKBOARD DRILL.

26. Write the two numbers 344 and 579, and add them without drawing a line, and write their sum 923 as the *third* number; then add the three numbers, and write their sum, 1846, as the *fourth* number; and so on.

The same example may be used for exercise in *subtraction*, by subtracting from the last result each of the preceding numbers in succession, until *nothing* remains.

(1.)

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

In the same manner, copy, add, and *prove* the following, extending each to the *sixth* number:

(2.)	*(3.)*	*(4.)*	*(5.)*	*(6.)*
327	674	384	540	1257
918	241	609	703	720

27. Write upon the board, or read from the *open book:*

Let some pupil add the right-hand column, thus, "9, 17, 24, 27, 33, 42 *units*, equal to 4 tens and 2 units; write the 2 units under the column added, and add the 4 tens to the next column." The next pupil promptly begins the second column with the 4 tens reserved, thus, "4, 12, 14, 18, 23, 26, 34 *tens*, equal to 3 hundreds and 4 tens, etc." So in quick succession let each column be added upwards, then downwards, then from right to left, etc., until the whole class have been exercised upon this example.

(1.)

```
2 6 7 1 8 9
4 8 5 7 3 6
9 1 8 7 5 3
5 9 2 8 4 7
7 0 3 9 2 8
5 6 4 7 8 9
3 5 3 3 2 4 2
```

In like manner, drill upon the following:

(2.)	*(3.)*	*(4.)*	*(5)*
68046	13222	74564	217345
46258	12313	27892	166459
86048	31359	83571	225224
05137	22441	13456	306892
47346	14321	35683	102555
99008	22720	30907	214653

ORAL AND SLATE EXERCISES.

27. *1.* Martin, having 27 marbles, gave 12 to Albert, and lost 5. How many had he left?

WRITTEN SOLUTION. $27-(12+5) =$ *the marbles he had left.*

2. Amasa has 45 cts. in three boxes; in the first are 15 cts., in the second 20 cts. How many cents are in the third box?

3. James had 35 cents, which was 1 dime more than Etta had. How many cents had Etta?

4. A drover bought 8 sheep of one man, 12 of another, and 15 of another. He afterwards sold 10 and butchered 5. How many sheep had he left?

5. George was sent to the store with 50 cents, and returned with 15 cents, and tea costing 20 cents, rice 8 cents, and sugar 10 cents. Did he receive the right change?

6. From a piece of calico containing 26 yd. Jane bought a dress of 9 yd., and Josephine another of 10 yd. How many yards were left in the piece?

7. A man bought a watch for $40, a chain for $15, and a key for $3, and he sold the whole for $50. How much did he lose by the bargain?

8. In an orchard are 500 apple trees, 300 peach trees, 100 pear trees, and 50 cherry trees. How many trees in the orchard? How many less pear trees than apple trees? How many more apple trees than all the others together?

9. Two men being 850 miles apart, start and travel towards each other. When one travels 300 miles and the other 250 miles, how far apart are they?

10. Richard, receiving $45 for labor, paid $20 for a cow, *$7 for a barrel* of flour, and $9 for three cords of wood. How *much had he left?*

FOR WRITTEN SOLUTION.

28. *1.* Sold a book for $3.75 that cost $2¼. What was my gain?

SOLUTION. $3.75 − $2.50 = *the gain.*

2. A man gave his note for $32.45. He paid at one time $7.80, and at another $4.84. How much remained unpaid?

3. A man paid $140 for a horse and $165 for a carriage. He sold them both for $300. How much did he gain or lose?

4. A father divided his property among his children as follows: He gave to Charles $17510, to Henry $21437, to William $15198, to Amelia $13087, to Sarah $15193, and to Susan $11981.

(*a.*) How much did he give to his three sons?

(*b.*) How much to his three daughters?

(*c.*) How much to all his children?

(*d.*) How much more did he give to his sons than to his daughters?

5. A flour merchant having 700 barrels of flour on hand, sold 278 barrels to one man, and 142 barrels to another. How many barrels had he left?

6. How many feet around a piece of land that is 1824 feet long and 1137 feet wide?

7. I owe three notes; one for $400, one for $150, and one for $50.75. Having paid $450, how much do I still owe?

8. Alaska contains 577000 square miles, and Texas 265780. Which is the larger, and how much?

9. California contains 158360 sq. mi., and Texas 265780 square miles. How much larger is Texas than California?

10. 670 − 5 + 40 − 175 + 25 − 215 + 23 − 75 =

11. 18 + 126 − 75 + 51 + 96 − 38 + 200 − 60 =

12. A farmer sold a ton of hay for $12.50, and a cord of wood for $3.25. He received in payment, a barrel of flour worth $7.60, and the remainder in money. How much money did he receive?

13. A grocer sold some tea for 80 cents, some butter for $2.30, some eggs for 53 cents, and some sugar for $1.15. How much change should he return for a five-dollar bill?

14. Mary went shopping and had 2 five-dollar bills. She bought a dress for $7.25, trimmings for $2.37, some thread for $.15, and some tape and needles for twenty cents. How much money had she left?

15. Henry gave one dollar and a half for a pair of skates, seventy-five cents for a cap, thirty-seven cents for a ball, half a dollar for a knife, two dollars and a quarter for a sled, and had one dollar left. How much money had he at first?

16. A man owed $427.50. He paid at one time $125.75, at another $100, and at another $50.25. What remained unpaid?

17. A grain dealer bought 5075 bu. of wheat at one time, and 12300 bu. at another. He sold 3763 bu. to one customer, and 4000 bu. to another. How many bushels had he left?

18. A man having $12470, paid $4070 for a house, $927 for furniture, and $1000 for improvements. How much money had he left?

19. Gave $150 for a horse, $175.84 for a carriage, and $62.50 for a harness, and sold the whole for $390.50. What did I gain?

20. A man bought four city lots, for which he paid $15760. For the first he paid $2175, for the second $3794, and for the third $4587; how much did he pay for the fourth?

21. A speculator gained $5760, and afterward lost $2746; at another time he gained $3575, and then lost $4632. How *much did his gains* exceed his losses?

MULTIPLICATION.

29. *1.* If 5 boys can sit upon one bench, how many boys can sit upon 3 benches ? 5 and 5 and 5 are how many?

2. If a man earn $3 a day, how many dollars will he earn in 5 days ? $3 + $3 + $3 + $3 + $3 are how many? Five 3's, or 5 times 3, are how many?

3. What is the *sum* of $3 taken *five* times ?

4. Count to 15 by 3's. By 5's. How many 3's in 15 ? How many 5's?

5. There are 7 da. in 1 wk. How many days are there in 4 wk. ? 7 da. + 7 da. + 7 da. + 7 da. = ? Four 7's, or $7 \times 4 = ?$

6. Should we repeat 7 da. four times, or 4, seven times? Why?

7. Count by 4's to 28. By 7's. How many 4's in 28? How many 7's ?

8. Is the result of 4 times 7 and of 7 times 4 the same ?

9. At $4 a barrel, what is the cost of 6 barrels of apples ?

SOLUTION. Six barrels cost 6 times $4, or $24.

10. If $4 is written 6 times in a column and *added,* what i the *sum ?* If 6 is written 4 times and added, what is the sum ?

11, If $4 is multiplied by 6, what is the *product ?*

12. If 8 bu. is written 5 times in a column and *added,* what is the *sum ?* If 8 bu. is *multiplied* by 5, what is the *product ?*

13. What will the unit of the number produced by addition or multiplication always be like ?

Ans. Like the unit of the number repeated.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	**4**	6	8	10	12	14	16	18	20	**22**	24
3	6	**9**	12	15	18	21	24	27	30	**33**	36
4	8	12	**16**	20	24	28	32	36	40	**44**	48
5	10	15	20	**25**	30	35	40	45	50	**55**	60
6	12	18	24	30	**36**	42	48	54	60	66	72
7	14	21	28	35	42	**49**	56	63	70	77	84
8	16	24	32	40	48	56	**64**	72	80	88	96
9	18	27	36	45	54	63	72	**81**	90	99	108
10	20	30	40	50	60	70	80	90	**100**	110	120
11	22	33	44	55	66	77	88	99	110	**121**	132
12	24	36	48	60	72	84	96	108	120	132	**144**

ORAL AND SLATE EXERCISES.

30. *1.* If 1 hat cost $7, what is the cost of 5 hats?

WRITTEN SOLUTION. $7 × 5 = *cost of the hats.*

ORAL SOLUTION. Five hats cost 5 times $7, or $35.

2. At 6 cents each, what will 5 pencils cost ?

3. At 8 cents a pound, what will 6 pounds of soap cost? 9 pounds? 10 pounds? 12 pounds?

4. What is the cost of 5 books, at $4 each? At $5?

5. Repeat the table from 0 times 2 to 12 times 2.

6. Repeat back from 12 times 2 to 0 times 2. Thus, 12 times 2 are 24, 11 times 2 are 22, 10 times 2 are 20, etc.

7. James gave 5 cents each for 6 oranges. How much *change should he* receive from 50 cents?

Recite the following, rapidly from the *open book*, thus:
9 cords of wood at $4 a cord will cost $36; 6 pairs of boots at
$8, will cost $48; at $9, will cost $54, etc.

8. At $4 a cord, what will 9 cords of wood cost?

9 What cost 6 pairs of boots, at $8 a pair? At $9?

10. At 8 cents each, what cost 9 books? 10 books?

11. What cost 9 barrels of flour, at $9 a barrel? At $10?

12. If a man earn $12 in 1 wk., what will he earn in 8 wk.?

13. At $9 a pair, what is the cost of 7 pair of boots?

14. What is the cost of 8 pencils at 6 cts. each? At 7 cts.?

15. At 11 cents a pound, what is the cost of 11 lbs. of sugar?

16. At 12 cents a yard, what cost 9 yards of calico?

17. What cost 10 pounds of ginger, at 11 cents a pound?

18. At $11 a hundred, what will 11 hundred posts cost?

19. What is the cost of 6 tons of coal at $7 a ton? At $8?

20. How many are 8 times $4, minus $7?

21. How many are 7 times 9 pounds, plus 10 pounds?

22. How many are 6 times 12 rods, less 20 rods?

23. How many units are 4 times 9 units? How many tens?
                              Ans. 3 tens and 6 units.

24. How many are 5 times 12 units? How many tens?

25. How many tens are 6 times 5 tens? How many hundreds? How many units?

26. How many are 4 times 6 tens? How many hundreds
and tens? How many units?

What is the cost of

27. 9 coats, at $9 each?

28. 11 hats, at $5 each?

29. 7 robes, at $12 each?

30. 9 tops, at 8 cents each?

31. 12 tables, at $8 each?

32. 10 desks, at $11 each?

33. 9 maps, at $12 each?

34. 12 globes, at $12 each?

35. At 12 cents a pound, what cost 6 pounds of butter?

36. At $9 a head, what is the cost of 11 head of sheep?

How many are

37. 9 times 11, less 10 ?	*41.* 8 times 11, plus 12 ?
38. 8 times 9, less 7 ?	*42.* 6 times 12, less 7 ?
39. 12 times 7, plus 6 ?	*43.* 12 times 10, less 10 ?
40. 9 times 9, plus 9 ?	*44.* 7 times 9, plus 8 ?

45. Give the result, *at sight,* of

3×7	5×3	6×3	9×7	6×7
7×5	$- 8 \times 8$	9×9	4×6	8×3
4×9	7×6	8×7	5×8	3×9
9×3	8×9	4×7	2×10	6×6

The pupil should make *oral* problems for the above. Thus, for "3×7." 'What will 7 lemons cost, at 3 cents each?" Another pupil may solve the same by a simple analysis ; thus, 7 lemons will cost 7 times 3 cents, or 21 cents.

46. Also, *at sight,* supply the missing number :

$$8 \times 12 = ? \qquad 6 \times ? = 72 \qquad ? \times 7 = 84 \qquad 9 \times ? = 81$$
$$9 \times 6 = ? \qquad ? \times 5 = 45 \qquad 12 \times ? = 60 \qquad ? \times 11 = 77$$

12	?	12	?	7	12	?	?	11
8	8	?	9	?	?	9	12	?
?	96	96	72	63	84	81	60	99

47. Read, and write the result in place of (?) :

$$8 \times 7 + 4 = ? \qquad 9 \times 8 - 12 = ? \qquad 7 \times 0 + 10 = ?$$
$$7 \times 9 + 10 = ? \qquad 8 \times 6 - 9 = ? \qquad 8 \times 11 - 8 = ?$$
$$6 \times 6 + 8 = ? \qquad 9 \times 9 - 10 = ? \qquad 7 \times 10 + 12 = ?$$
$$0 \times 4 + 9 = ? \qquad 10 \times 8 - 7 = ? \qquad 11 \times 6 - 9 = ?$$

WRITTEN EXERCISES.

31. *1.* How many are 4 times 73?

To obtain the result by addition.　　　　　　BY ADDITION

First find the sum of four 3's, or *4 times* 3 units,　　73
which is 12 units, equal to 1 ten and 2 units. Write
the 2 units in the units' place, and reserve the 1 ten to　73
be added to the sum of the tens.　　　　　　　　　73

Next, the sum of four 7's, or *4 times* 7 tens, is 28　　73
tens, plus 1 ten reserved are 29 tens, or 2 hundreds and　────
9 tens, which write in the hundreds' and tens' place.　Sum,　292
Hence, the *sum* is 292.

In this operation, the multiplicand 73 is writ-　　BY MULTIPLICATION.
ten but once ; and as it is to be taken 4 times,　　Multiplicand,　73
write the multiplier 4 under it, and commence at
the right to multiply. 4 times 3 units are 12　　Multiplier,　　4
units, or 1 ten and 2 units. Write the 2 units in　　　　　　────
units' place and reserve the 1 ten to add to the　Product,　　292
product of the tens.

Next, 4 times 7 tens are 28 tens, plus 1 ten reserved are 29 tens, or
2 hundreds and 9 tens, which write in the hundreds' and tens' places.
Hence, the product is 292, equal to the *sum.*

Solve by both methods,

2. 3 times 84. | *4.* 5 times 234. | *6.* 4 times $204.
3. 4 times 135. | *5.* 6 times 352. | *7.* 5 times $425.

8. Multiply 4621 by 4; by 5; by 6; by 7.

9. Multiply 3062 by 6; by 7; by 8; by 9.

What is the product

10. Of $5642 by 6? by 5? by 7? by 9?

11. Of 20372 feet by 7 ? by 9? by 5? by 6 ?

12. Of 428175 bushels by 4 ; by 6; by 5; by 7 ; by 8.

13. Of 932674 cents by 6; by 7; by 4; by 8; by 5.

14. If there are 52 weeks in 1 year, how many weeks are
there in 8 years ?

15. If a steamer run 265 miles a day, how many miles will she run in 7 days at the same rate?

16. A man bought 4 houses, and paid $4385 for each. What did he pay for all?

17. In 1 mile are 5280 feet. How many feet in 3 miles?

18. Multiply 4567 pounds by 5; $837.62 by 6; by 5.

19 Multiply 38462 acres by 4; 62938 rods by 5; by 6.

20. If there are 1648 oranges on one tree, how many oranges on 4 trees? On 7 trees?

21. If a railroad train runs at the rate of 387 miles a day, how far will it run in 5 days? In 6 days?

22. If it cost $27465 to build one mile of railroad, what will it cost to build 4 miles of railroad? 6 miles? 8 miles?

23. What are 5 building lots worth, at $1950 each?

24. If a man's yearly income is $5675, what will it be for 6 years? For 7 years? For 5 years?

25. If it cost $8500 to build one house, what will it cost to build 4 houses? 6 houses? 9 houses?

26. At a cost of $985 a mile, what will be the cost of building a line of telegraph 7 miles long? 8 miles?

27. If an acre of land produce 1429 pounds of seed-cotton, how much will 6 acres produce? 7 acres? 8 acres?

28. At $8276 each, what will be the cost of 5 railway coaches? Of 6? Of 7? Of 8?

29. What is the cost of 7 acres of land, at $29.50 an acre!

30. If a man's income is $2648 a year, what will it be for 4 years? For 10 years? For 8 years?

31. If a man wills $2250 to each of his 4 sons, what does he give to all?

32. In 1 mile are 320 rods. How many rods in 3 mi.? *In 5 mi.? In 9 mi.?*

DEFINITIONS.

32. *1.* Taking one of two numbers as many times as there are units in the other is called *multiplication*.

2. The number taken or multiplied is called the *multiplicand*.

3. The number to multiply by, or that shows *how many times* the multiplicand is to be taken, is called the *multiplier*.

4. The result obtained by the multiplication is called the *product*.

5. The multiplicand and multiplier are *factors* of the product.

Thus, $8 \times 6 = 48$.   8 is the *multiplicand*, 6 is the *multiplier*, 48 is the *product*, and 8 and 6 are the *factors*.

ORAL AND SLATE EXERCISES.

33. *1.* 9 times $12 are $108.   Which number is the multiplicand?   The multiplier?   The product?

2. Charles paid 8 cents apiece for 12 pencils, and had 4 cents left.   How much money had he at first?

WRITTEN. $8 \text{ cts.} \times 12 + 4 \text{ cts.} = $ *the money he had at first.*

ORAL.   He had the *sum* of 12 times 8 cts., and 4 cts., which is 100 cts., or $1.

3. What will 7 oranges at 4 cents apiece, and 6 lemons at 2 cents apiece cost?

4. How much less than $50 must be paid for 9 yards of cloth, at $5 a yard?

5. Belle paid 7 cents a spool for 9 spools of thread, and 10 cents for some buttons.   What did she pay for both?

6. James has 12 cents, and John has 5 times as many.   How many cents has *John?*   How many have both?

WRITTEN EXERCISES.

34. *1.* Multiply 362 by 24.

Write the multiplicand, and	Multiplicand,	362
under it the multiplier, the unit	Multiplier,	24

Write the multiplicand, and under it the multiplier, the unit in units' place, and the tens in tens' place, and multiply by each figure separately.

Multiply 362 by the 4 units, and then by the 2 tens ; add the prod-

Multiplicand, 362
Multiplier,   24
        1448   4 times.
         724   20 times.
Product, 8688   24 times.

ucts, and the sum is the entire product, 8688.

In multiplying by the units, write the first figure of the product in units' place. In multiplying by the tens, write the first figure of the product in tens' place.

In like manner,

	(2.)	(3.)	(4.)	(5.)	(6.)
Multiply	618	2405	3241	2046	4317
By	18	19	16	25	42

Multiply

7. 5164 by 34; by 28.	12. 10782 by 21 ; by 26.
8. 4605 by 36; by 25.	13. 56043 by 27 ; by 44.
9. 30621 by 45; by 54.	14. 28340 by 38 ; by 63.
10. 51324 by 62; by 75.	15. 730081 by 49 ; by 84.
11. 16072 by 58; by 33.	16. 186302 by 55 ; by 29.

17. Multiply 415036 by 75 ; by 63 ; by 54; by 82.

18. Multiply 630400 by 46 ; by 57; by 68; by 74.

19. Multiply 297182 by 77 ; by 94; by 95; by 89.

20. Multiply 710345 by 68 ; by 77; by 81; by 93.

21. Multiply 859756 by 47 ; by 68; by 73; by 59.

22. Multiply 596873 by 82 ; by 75; by 91; by 85.

23. *Multiply* 584762 by 56 ; by 38; by 66; by 93.

35. When *either* factor contains cents, the *product* is *cents*, and may be changed to dollars and cents by putting the point (.) *two* places from the *right*, and prefixing the sign ($).

Multiply	$43.72	$136.04	87 cents.	$2.06
By	8	7	9	6
Product,	$349.76	$952.28	$7.83	$12.36

5. What will be the cost of 23 tons of coal, at $9 a ton ?

Although $9 is the *true multiplicand,* for convenience we may use it as the multiplier, and 23 as the multiplicand ; but the *product* is *dollars,* because the true multiplicand is dollars.   The *written* solution would be, $9 × 23 = *cost of the coal.*

6. What is the cost of 75 pounds of nails, at 7 cents a pound ?

SOLUTION.   7 cents × 75 = *cost of the nails.*

Find the cost

7. Of 175 pounds of rice, at 6 cents a pound.

8. Of 7 yards of cloth, at $4.37 a yard.

9. Of 5 acres of land, at $124.50 an acre.

10. Of 8 building lots, at $2015 a lot.

11. Of 22 yards of cloth, at $4.35 a yard.

12. Of 40 bushels of wheat, at $1.75 a bushel.

13. Of 13 pounds of tea, at $1.10 a pound.

14. Of 27 pounds of butter, at 33 cents a pound.

15. Of 34 barrels of potatoes, at $3.75 a barrel.

16. Of 46 railway coaches, at $7034.75 each.

17. Of 56 tubs of butter, at $28.32 each.

18. Of 18 boxes of oranges, at $4.15 a box.

19. What will be the cost of building a line of telegraph 74 miles long, at $967 a mile ?

DRILL TABLE No. 2.

	A	B	C	D	E	F	G
1.	3	8	6	7	20	400	5000
2.	4	2	7	5	40	600	2000
3.	7	3	9	10	70	300	6000
4.	5	6	3	6	30	800	3000
5.	1	9	2	12	50	100	9000
6.	4	5	6	9	80	500	4000
7.	6	1	4	11	60	700	1000
8.	8	4	6	7	90	200	7000
9.	3	7	3	5	10	900	8000

1. First, by columns, *at sight*, give the product of each number and the one below it, in each of the columns A, B, C, and D. Then taking any two columns of A, B, C, and D, give the product of each pair of numbers.

2. Next, multiply the numbers in each line and column by 2, 3, 4, 5, etc., to 9, in every case naming only the products.

3. Next, multiply each number in column A by the number at the right in column B, and to the product add the number in column C. Do the same with columns B, C, and D.

4. Multiply each number in column G, by 2, and add each number of the same line in columns F, E, and D, thus: 10427, 4645, etc.

Multiply and add in the same way by 3, 4, 5, 6, 7, 8, and 9.

5. Read rapidly by columns, A, B, C, D, E, and F, each number, in each column, 10 times as large as now represented.

The above, and all other *drill* and *oral exercises* are designed for *daily practice in numbers*, and ordinarily should not occupy more than from *two to five minutes* in connection with the regular lesson.

DRILL EXERCISES.

36. Read rapidly, *at sight,* the products :

1. 1×2; 10×2; 100×2; 1000×2.

2. 20×2; 30×2; 40×2; 50×2; 60×2; 80×2.

3. 5×4; 50×4; 500×4; 5000×4; 60×4; 600×4.

4. 7×5; 70×5; 700×5; 7000×5; 80×5; 800×5.

It will be observed that the product of 7 by 5 is the same, whatever order of units 7 may represent.

5. 700×6; 600×7; 900×4; 500×9; 400×8.

6. 2000×4; 5000×7; 3000×8; 8000×5.

7. Multiply 20, 200, 2000, each by all the numbers from 3 to 9 inclusive.

8. Multiply 30, 300, 3000, by same multipliers as in the preceding example.

9. In the same manner proceed with all the similar numbers to 90, 900, 9000.

10. Also, at sight, give the products:

300	400	500	600	800	900
4	7	5	6	3	2

305	409	504	608	805	907
4	7	5	6	3	2

$24 \times 10 =$ $36 \times 100 =$ $18 \times 1000 =$ $146 \times 10 =$

$20 \times 20 =$ $20 \times 200 =$ $20 \times 2000 =$ $12 \times 2000 =$

The Drill Table on the opposite page will furnish abundant exercise of this kind in rapid oral work.

Insist upon promptness, rapidity, and accuracy. Do not continue the work until it drags.

These combinations should be made from dictation as well as at sight.

ORAL AND SLATE EXERCISES.

37. Memorize and repeat:

20 hundredweight (cwt.)	make	1 ton,	T.
2000 pounds	"	1 ton,	T.
200 pounds of pork or beef	"	1 barrel,	bbl.
100 pounds of nails	"	1 keg,	kg.

1. How many pounds in 4 hundredweight? In 6 cwt.?

2. What part of a hundredweight are 50 lb.? Are 25 lb.?

3. How many hundredweight in $\frac{1}{4}$ of a ton of hay? In $\frac{1}{2}$ T.? In $\frac{1}{4}$ T.? In $1\frac{1}{2}$ T.?

4. How many pounds in $\frac{1}{2}$ barrel of pork? In $\frac{1}{2}$ bbl. of beef? In $\frac{1}{4}$ bbl. of flour? In $\frac{1}{4}$ a keg of nails?

5. How many barrels are 600 lb. of pork? Are 700 lb. of beef?

6. How many kegs are 800 lb. of nails? 650 lb.?

7. How many pounds in 3 bbl. of pork? In 5 bbl. of beef?

8. What is the cost of a keg of nails at 7 cents a pound?

9. At 10 cents a pound, what will $\frac{1}{4}$ a barrel of beef cost?

10. At 1 cent a pound, what will $\frac{1}{2}$ a ton of hay cost?

11. How many ft. in 10 yd.? In 100 yd.? In 1000 yd.?*

12. How many pecks in 10 bu.? In 100 bu.? In 1000 bu.?

13. How many eggs in 10 doz.? In 100 doz.? In 1000 doz.?

14. How many years in 5 score? In 10 score?

15. How many pecks in 20 bu.? In 200 bu.? In 2000 bu.?

16. How many oz. in 10 lb.? In 100 lb.? In 1000 lb.?

17. How many pints in 10 qt.? In 20 qt.? In 200 qt.?

18. How many chairs in 10 sets? In 100 sets? In 20 sets?

19. What is the cost of 10 gal. of oil, at 5 cents a quart?

20. What is the cost of 20 qt. of milk, at 3 cents a pint?

21. What is the cost of 5 bu. of plums, at 20 cents a peck?

---

* *The teacher should here instruct the class how to multiply by 10, 100, 1000, etc., and also when ciphers occur in the multiplier.*

22. How many are 5 times 42?

ORAL SOLUTION. 42 is 40 and 2. 5 times 40 is 200, and 5 times 2 is 10, which added to 200 makes 210.

WRITTEN SOLUTION. $42 = 40 + 2$; $42 \times 5 = (40 + 2) \times 5 = 200 + 10 = 210$.

In same way, solve, and write solution of the following:

How many   How many

23. Are 6 times 54?   *27.* Are 8 times 51?

24. Are 2 times 82?   *28.* Are 7 times 24?

25. Are 4 times 63?   *29.* Are 9 times 71?

26. Are 3 times 45?   *30.* Are 5 times 64?

Copy, read, and supply the missing number:

31. $4 \times 8 + 7 - 9 = ?$ *36.* $4 \times 10 + 3 + ? = 50$.

32. $5 \times 3 \times 0 + 8 = ?$ *37.* $9 \times 8 + 10 - ? = 75$.

33. $8 \times 5 + 6 + 10 = ?$ *38.* $15 \times 2 + 20 = 10 \times ?$

34. $3 \times 0 + 4 \times 7 = ?$ *39.* $9 \times 4 - 6 = 40 - ?$

35. $8 \times 9 - 9 = 7 \times ?$.   *40.* $12 \times 10 - ? = 100$.

FACTORS.

38. *1.* Name the two *equal* factors of 9; of 25; of 36.

2. What two *equal* factors produce 49? 81? 64? 100?

3. When a number is used twice as a factor, it is said to be *squared.* Thus, $2 \times 2 = 4$; 2 is *squared*, and the result, 4, is the *square* of 2.

4. What is the square of 4? Of 3? 6? 8? 9? 5? 10?

5. When a number is used 3 times as a factor, it is said to be *cubed.* Thus, $2 \times 2 \times 2 = 8$; 2 is *cubed*, and the result, 8, is the *cube* of 2.

6. Express the cube of 3. Of 5. Of 4. Of 10.

7. Name one of the *three* equal factors of 27. Of 8. Of 64.

8. Name one of the *two* equal factors of 36. Of 100.

9. Square 20; 40; 10; 30; 50; 70; 60; 80.

10. The square of 5 equals 5 used how often as a factor?

11. The cube of 4 equals 4 used as a factor how often?

12. How often is 6 used as a factor in the square of 6?

13. How often is 5 used as a factor in the cube of 5?

14. Separate 10 into all its *equal* parts.

15. By what signs are *parts* separated?

16. Resolve 12 into its factors.

17. By what sign are *factors* connected?

18. Write the *equal factors* of 36.   Of 49; 81; 100.

19. Write the *equal factors* of 8.   Of 27.   Of 64.   Of 125.

20. Write all the *equal* parts of 24.   Of 18.   Of 20.   Of 16.

21. What are common factors of 8, 16 and 20?

WRITTEN EXERCISES.

39. The following is an excellent exercise to secure rapidity in computation, and to have the work done in the shortest possible time.

Give a number, as 24618, and have each member of the class multiply it by 2, and each successive product by 2, till there are six, eight, ten, or more products, and then add them.   The example, when solved, will appear as follows:

$$
\begin{array}{ll}
24618 & \\
49236 & \textit{First} \text{ product by 2.} \\
98472 & \textit{Second} \text{ product by 2.} \\
196944 & \textit{Third} \text{ product by 2.} \\
393888 & \textit{Fourth} \text{ product by 2.} \\
787776 & \textit{Fifth} \text{ product by 2.} \\
1575552 & \textit{Sixth} \text{ product by 2.} \\
\hline
3126486 & \textit{Sum} \text{ of the whole.}
\end{array}
$$

In similar examples, use all the numbers from 2 to 9 as *multipliers.*

Treat the following numbers in like manner, extending each to the *fifth* product, and noting the *time* required to obtain each result.

(*1.*)	(*2.*)	(*3.*)	(*4.*)	(*5.*)	(*6.*)
756	1243	3165	2624	4508	23561

7. At $9 a barrel, what is the cost of 10 barrels of flour? Of 100 barrels ? Of 1000 barrels?

8. Multiply 375 by 10; by 100; by 1000; by 10000.

9. Multiply 605 by 40; by 500 ; by 1200 ; by 7000.

What is the product

10. Of $4.72 by 100 ?

11. Of $30.40 by 60 ?

12. Of $1200 by 700 ?

Find

13. 120 times 5000.

14. 600 times 21000.

15. 1000 times 104000.

16. At $150 an acre, what is the cost of 500 acres of land ?

17. What will be the cost of 100 horses, at $95 a head?

18. What is the cost of 1000 fruit trees, at 18 cents apiece ?

19. If one acre of land produce 28 bushels of wheat, how many bushels will 100 acres produce ?

20. If the freight on a barrel of flour from Chicago to New York is 47 cents, what will it be on 1000 barrels ?

21. There are 640 acres in 1 square mile. How many acres in 150 square miles ? In 200 ? In 420 ?

22. The salary of the President is $50000 a year. How much does he receive in 8 years ?

23. How many yards of shirting in 49 bales, each bale containing 26 pieces, and each piece 57 yards?

24. Bought 29 pieces of cloth, each piece containing 47 yd., at $8 a yard. What was the cost of the whole ?

25. Bought 27 cords of wood at $4 a cord, and 38 tons of *coal at $7 a ton.* What did both cost ?

26. A farmer having $3264, paid $3 a head for 536 sheep, and $27 a head for 26 cows.   How much money had he left?

27. Bought 84 hogs, each weighing 386 lb., at 9 cts. a pound, and sold the same at 12 cts. a pound.   What was gained?

28. What is the difference in the cost of 48 horses at $184 each, and 130 sheep at $5 a head?

29 A man bought 350 head of cattle at $30 a head, and 450 sheep at $5 a head.   He sold the whole for $13000.   Did he gain or lose, and how much?

30. If a steamer sail 265 miles a day, how far will she sail in 16 days?   In 18 days?   In 24 days?

31. A man bought 136 barrels of flour at $8 a barrel, and sold the whole for $1248.   What was his gain?

32. Find the cost of the following articles: 25 pounds of sugar, at 12 cents a pound; 16 pounds of tea, at 75 cents a pound; and 38 pounds of ham, at 14 cents a pound.

33. A man earns $9 a week, and his son $5.   What will both earn in 3 weeks?   In 5 weeks?

34. If a clerk earn a salary of $950 a year, and his expenses are $525 a year, how much can he save in 6 years?

35. A man bought a farm containing 175 acres, at $24 an acre.   What did the farm cost him?

36. A farmer sold 15 tons of hay at $18 a ton, and 36 cords of wood at $4 a cord.   What was the value of both?

37. Bought 13 yards of cloth, at $3 a yard; 6 cords of wood, at $5 a cord; and 3 tons of coal, at $9 a ton; gave in payment 2 twenty-dollar bills, 5 ten-dollar bills, and a two-dollar bill. How much more ought I to pay?

38. There are 36 tubs of butter, each weighing 108 pounds, and the tubs which contain the butter each weigh 19 pounds. *What is the weight* of the butter without the tubs?

DIVISION.

40. *1.* How many dollars are $12 less $6, less $6?
$12 — $4 — $4 — $4? $12 — $3 — $3 — $3 — $3?

2. How many times can $6 be taken from $12? $4 from $12 ? $3 from $12 ? $2 from $12 ?

3. How many 6's in 12? How many 4's ? 3's? 2's?

4. What is ⅙ of $12 ? ¼ of $12 ? ⅓ of $12 ? ½ of $12 ?

5. How many times can 4 pounds of honey be taken from a box containing 20 pounds? How many 4's in 20? 4 in 20, how many times? $20 \div 4 =$?

6. If 6 men earn $24, what part of $24 does 1 man earn ? How many dollars ?

7. At 9 cents a quart, how many quarts of milk can be bought for 63 cents ?

8. When the divisor and dividend are of the same name or kind, what do we do ? *Ans.* Find *how many times* the dividend contains the divisor.

9. What is the quotient?   *Ans. Times.*

10. When the divisor and dividend are not of the same name or kind, what do we do ?

Ans. Find a *certain part* of the dividend.

11. What is the quotient? *Ans.* A *part* of the dividend.

12. How many yards of cloth, at $7 a yard, can be bought for $70? For $63? For $84?

13. If you divide 84 cents among 7 children, what part of the whole do you give to each? How many cents ?

The teacher should make plain the two forms of division, and require *the proper solution for each kind of example.*

ORAL AND SLATE EXERCISES.

41. *1.* When lemons are 4 cents each, how many can be
bought for 48 cents ?

WRITTEN SOLUTION.   48 cts. ÷ 4 cts. = *No. of lemons bought.*

ORAL SOLUTION. As many lemons as 4 cents are contained times in
48 cents, which are 12 times, or 12 lemons.

2. If a man travel 6 miles an hour, how long will it take
him to travel 54 miles ?

3. How many kegs containing 9 gallons each can be filled
from a hogshead containing 63 gallons ?

4. If a man drive 8 miles an hour, in what time will he
drive 56 miles ?

5. A farmer bought some sheep for $60, paying $5 a head.
How many sheep did he buy?

6. At $9 a week, in what time will a man earn $36? $54?
$72 ? $81 ? $108?

7. If 7 barrels of flour cost $63, what is the cost of 1 bbl.?

WRITTEN SOLUTION. $\frac{\$63}{7}$, or $\frac{1}{7}$ of $63 = *cost of* 1 *barrel.*

ORAL SOLUTION.   Since 7 barrels cost $63, 1 barrel costs 1 *seventh* of
$63, or $9.

8. If 9 tons of coal cost $72, what is the cost of 1 ton ?

9. If a man travel 48 miles in 4 hours, how far does he
travel in 1 hour?

10. What is the cost of 1 ton of hay, if 8 tons cost $64?

11. If you divide 90 cents equally among 9 children, what
part of the whole do you give to each?   How many cents ?

12. If a man can build 72 rods of fence in 8 days, how many
rods can he build in 1 day ?

13. If 9 doz. eggs cost 108 cents, what is the cost of 1
dozen?

14. Divide and *prove*, reading rapidly, thus, 4 *in* 24 *six* times ; 6 *times* 4 are 24, etc.

24÷4 =	56÷8 =	45÷9 =	72÷8 =
30÷6 =	63÷7 =	56÷7 =	72÷9 =
36÷9 =	27÷3 =	54÷6 =	84÷7 =
28÷7 =	42÷7 =	49÷7 =	55÷5 =

15. And the following, thus: 1 *sixth* of 72 is 12; 12 *times* 6 is 72, etc.

$\frac{72}{6}$ =	$\frac{60}{10}$ =	$\frac{40}{8}$ =	$\frac{108}{12}$ =	$\frac{84}{7}$ =
$\frac{81}{9}$ =	$\frac{88}{11}$ =	$\frac{80}{8}$ =	$\frac{96}{12}$ =	$\frac{90}{9}$ =
$\frac{63}{7}$ =	$\frac{90}{9}$ =	$\frac{72}{12}$ =	$\frac{72}{6}$ =	$\frac{120}{10}$ =
$\frac{56}{8}$ =	$\frac{48}{12}$ =	$\frac{96}{8}$ =	$\frac{120}{12}$ =	$\frac{99}{11}$ =

In proving division, multiply the divisor by the quotient, *not* the quotient by the divisor.

16. What is 1 half of 12 ?   Of 16 ?   Of (18+6) ?
17. What is 1 third of 15 ?   Of 18?   Of (21+9)?
18. What is 1 fourth of 16 ?   Of 24 ?   Of (30+6) ?
19. What is 1 fifth of 20 ?   Of 30 ?   Of (40—5) ?
20. What is 1 sixth of 24 ?   Of 36 ?   Of (38+10) ?
21. What is 1 seventh of 84 ?   Of 42 ?   Of (60—11)?
22. What is 1 eighth of 48 ?   Of 32 ?   Of (70—6)?
23. What is 1 ninth of 54 ?   Of 63 ?   Of (60+12) ?
24. What is 1 tenth of 90 ?   Of (87—7) ?   Of (62+8)?
25. What is ⅓ of 4 times 9 ?   ⅓ of 5 times 8 ?

---

* These examples may be expressed on the slate or paper in the form of division, thus, $\frac{12}{2}$, $\frac{16}{2}$, $\frac{18+6}{2}$, etc., and rapidly read, ½ of 12 is 6 ; ½ of 16 is 8 ; ½ of 24 is 12, etc.   Then only the results should be given *at sight, thus, 6, 8, 12, etc.*

26. What is $\frac{1}{4}$ of $(60-4)$? $\frac{1}{4}$ of 12×4 ? $\frac{1}{4}$ of $(66+6)$?

27. What is $\frac{1}{4}$ of 6×6 ? $\frac{1}{4}$ of 12×6 ? $\frac{1}{4}$ of $(75-9)$?

(*28.*)	(*29.*)	(*30.*)	(*31.*)
$\dfrac{21-9}{6}=$	$\dfrac{43-7}{9}=$	$\dfrac{12\times5}{10}=$	$\dfrac{9\times8}{12}=$

(*32.*)	(*33.*)	(*34.*)	(*35.*)
$\dfrac{46+10}{7}=$	$\dfrac{71-11}{12}=$	$\dfrac{8\times9}{6}=$	$\dfrac{40+20}{5}=$

(*36.*)	(*37.*)	(*38.*)	(*39.*)
$\dfrac{20\times5}{10}$	$\dfrac{96\div8}{3}$	$\dfrac{100-20}{8}$	$\dfrac{64+20}{12}$

WRITTEN EXERCISES.

42. *1.* Divide 447 by 3.

In this example, write the divisor at the left, and the quotient at the right of the dividend, and begin at the left to divide, thus: 3 is contained in 4, 1 time and a remainder; write 1 for the first figure of the quotient and multiply the divisor 3 by it, and subtract the product 3 from 4 hundreds, and the remainder is 1 hundred, equal to 10 tens, to which add the 4 tens of the dividend, making 14 tens, expressed by bringing down the 4 to the right of the 1 hundred. Then 3 is

```
Divisor. Dividend. Quotient.
3 ) 447 ( 149
    3
   ――
   14
   12
   ――
   27
   27
   ――
    0
```

contained in 14, 4 times and a remainder. Write the 4 in the quotient, multiply the divisor by it, and subtract the product 12 from 14, and the remainder is 2 tens or 20 units, to which add the 7 units of the dividend, making 27. 3 is contained in 27, 9 times. Multiplying and subtracting as before, nothing remains. PROOF: $149\times3 = 447$.

The work may be shortened very much by what is termed *Short Division,* as follows:

3 is contained in 4, once and 1 remainder; 1 prefixed *or placed* before 4, makes 14; 3 in 14, 4 times and 2 remainder; *2* prefixed to 7 makes 27; 3 in 27, 9 times. Hence the quotient is 149.

```
3 ) 447
  ――――
    149
```

In like manner, divide and prove:

(*2.*)	(*3.*)	(*4.*)	(*5.*)
5) 875	4) 6736	6) 9870	7) 8603

6. Divide 91624 by 8 ; 68240 by 5 ; 83524 by 7.

Let the pupil solve the above first, by the *first* method, *long division.*

7. How many times is 6 contained in 1834 ?

Since 6 is not contained in 1, say, 6 in 18, 3 times and no remainder; 6 in 3, 0 times and 3 remainder; 6 in 34, 5 times and 4 remainder, which write over the divisor 6, as a part of the quotient.

Divisor. Dividend.
6) 1834
Quotient, 305$\frac{4}{6}$

PROOF. Multiply the quotient 305 by the divisor 6, and the product is 1830; 1830 plus the remainder 4 equals the dividend 1834.

The pupil should be required to work all examples by *short division,* when the divisor does not exceed 12.

In like manner,

8. Divide 24687 by 4; 30466 by 5 ; 42760 by 6.

9. Divide 72947 by 7; by 8; by 5; by 6 ; by 3.

10. Divide 213064 by 4; by 9; by 8; by 5; by 6.

How many times

11. Is 8 contained in $15096?   In 58424 ?   In $23064?

12. Is 7 contained in 330457?   In 19728 ?   In 918271?

13. Is 9 contained in 436281 ?   In 605675 ?   In 1039126 ?

What is

14. 1 *fifth* of $7420 ?

15. 1 *sixth* of 1234 pounds ?

16. 1 *eighth* of 27304 days?

17. 1 *ninth* of 9126 feet ?

What is

18. $\frac{1}{6}$ of $8760 ?

19. $\frac{1}{5}$ of 4731 men ?

20. $\frac{1}{7}$ of 14676 miles ?

21. $\frac{1}{12}$ of 60132 acres?

22. There are 320 rods in a mile. How many rods in half a mile? In one-fourth of a mile ?

23. How many barrels of flour, at $9 a barrel, can be bought for $12732? For $7065?

24. How many tons of coal, at $7 a ton, can be bought for $87605? For $36148?

25. If 36314 bushels of grain be put into 6 bins of equal size, how many bushels must each bin contain?

26. If the cost of 9 miles of telegraph is $97650, what is the cost of 1 mile?

27. If 6 acres of land are worth $366, what are 8 acres worth?

WRITTEN SOLUTION. $\frac{\$366}{6}$, or $\frac{1}{6}$ of $366 = the cost of 1 acre.$
$\frac{\$366}{6} \times 8 = the cost of 8 acres.$

28. If there are 174 lines on 6 pages of this book, how many lines on 16 pages?

29. If 8 cords of wood are worth $32, what are 27 cords worth? 36 cords?

30. What will 45 pounds of beef cost, if 8 pounds cost 96 cents? If 8 pounds cost 72 cents?

31. If 10 tons of coal are worth $70, what are 125 tons worth?

32. If a man travel 126 miles in 7 days, how far will he travel in 16 days?

33. How many tons of coal, at $8 a ton, must be given for 24 cows, worth $32 a head?

34. If 9 acres of land cost $370, what will 25 acres cost?

35. How many barrels of flour at $8 will pay for 360 bushels of wheat at $2 a bushel?

36. If a man's yearly income, received in monthly installments, is $6240, what does he receive in 10 months?

37. If 9 pounds of tea cost $6.75, what will a chest of the *same tea cost* that weighs 58 pounds?

DEFINITIONS.

43. *1.* Finding *how many times* one number is contained in another of the same kind, or finding *one* of the *equal parts* of a number, is called ***division.***

2. The number divided is called the ***dividend.***

3. The number by which we divide is called the ***divisor.***

4. The result obtained by the division is called the ***quotient.***

5. The divisor and quotient are the *factors* of the dividend.

6. When the division is not exact, the part of the dividend remaining is called the ***remainder,*** and it must always be *less* than the *divisor.*

Thus, in the example, 75÷8 = 9, and 3 over, 75 is the *dividend*, 8 is the *divisor*, 9 is the *quotient*, and 3 the *remainder*.

ORAL AND SLATE EXERCISES.

44. *1.* If 4 caps cost $12, what is the cost of 6 caps?

WRITTEN SOLUTION. $\frac{\$12}{4} \times 6 = $ *cost of* 6 *caps.*

ORAL SOLUTION.   One cap costs 1 *fourth* of $12, or $3 ; and 6 caps cost 6 times $3, or $18.   Or, 6 caps cost 6 times ¼ of $12, which is $18.

2. How many dollars are 6 times 1 fourth of $12?

3. If 6 oranges cost 18 cents, what will 8 oranges cost?

4. If 7 yards of ribbon cost 56 cents, what will 3 yards cost?

5. If a man earn $30 in 6 days, how many dollars does he earn in 4 days?   In 3 days?   In 5 days?

6. How many yards of cloth can I buy for $36, if 3 yards cost $12?   For $48?

7. If a man walk 27 miles in 8 hours, how far does he walk in 7 hours?   In 5 hours?

8. If 4 barrels of flour cost $36, what will 7 barrels cost?

9. What cost 12 yards of cloth, if 6 yards cost $24 ?

10. If a stage run 45 miles in 5 hours, how far will it run in 7 hours? In 9 hours ? In 12 hours ?

11. If 9 weeks' board cost $72, what will 7 weeks' cost?

12. What will 10 yards of ribbon cost, if 6 yards cost 72 cents ? If 4 yards cost 40 cents ?

13. How many are 8 times $\frac{1}{4}$ of 42? 9 times $\frac{1}{5}$ of 35 ? 10 times $\frac{1}{2}$ of 18 ? 6 times $\frac{1}{8}$ of 72 ?

14. How many times is 5 contained in 10×6 ?

15. How many times is 3×3 contained in 63?

16. Divide 48 by 1 sixth of 24. By 1 fourth of 32.

17. A boy gave 5 peaches to each of 6 boys, and had 1 third as many left. How many had he left ?

18. Mary has 5 cents and Susie 7. If Willie has 4 times as many as both, how many cents has he ?

19. What is 1 fourth of 6 times 8 ? 1 third of 5 times 6 ?

20. How many days' work, at $4 a day, will pay for 3 tons of coal worth $8 a ton ?

WRITTEN SOLUTION. $\dfrac{\$8 \times 3}{4} = $ *No. of days work.*

ORAL SOLUTION. At $8 a ton, 3 tons of coal will cost 3 times $8, or $24. It will require as many days' work, at $4 a day, to pay for the coal, as $4 is contained times in $24, which is 6 times ; hence, 6 days' work.

21. A man sold 8 barrels of apples at $5 a barrel. How many yards of cloth, at $4 a yard, will the money buy?

22. How many barrels of flour, worth $8 a barrel, will pay for 4 loads of hay worth $12 a load ?

23. Bought 4 cords of wood at $4 a cord, and 2 tons of hay at $10 a ton. How many days' labor, at $3 a day, will pay for *both ?*

WRITTEN EXERCISES.

45. *1.* Divide 3180 by 15.

When the divisor consists of two or more figures, the operations cannot well be carried on in the mind, and so we write the result of each separate operation.

Since 15 is not contained in 3, say 15 in 31, 2 times, and write the 2 at the right of the dividend as the first figure of the quotient. Multiply the divisor by this quotient figure, and write the product 30 under the figures divided.

```
15 ) 3180 ( 212
     30
     --
     18
     15
     --
     30
     30
     --
```

Subtract, and to the remainder 1 annex 8, the next figure of the dividend, making 18 for a new dividend.

Dividing, multiplying, and subtracting as before, we have a remainder of 3, to which annex the 0 of the dividend, and we have a new dividend of 30 ; which divide as before, and nothing remains.

2. Divide 12708 by 28.

Divisor.	Dividend.	Quotient.		PROOF.	
28)	12708 (	453$\frac{24}{28}$		453	Quotient.
	112			28	Divisor.
	150			3624	
	140			906	
	108			12684	
	84			24	Remainder.
	24	Remainder.		12708	Dividend.

1. If any remainder is *equal to* or *greater* than the divisor, the quotient is *too small* and must be *increased*.

2. If the product of the divisor by the quotient figure is *greater* than the *partial* dividend, the quotient is *too large* and must be *diminished*.

In like manner,

3. Divide 24056 by 13 ; by 19 ; by 16 ; by 21.

4. Divide *56214 by 22* ; by 32 ; by 24 ; by 17.

How many times

5. Is 25 contained in 2630 ? In 7644? In 18306 ?

6. Is 27 contained in 238? In 2465 ? In 50571?

In like manner, divide and prove the following:

Divide	Divide
7. 970640 by 23; by 21.	*13.* 186304 by 65; by 24
8. 40320 by 18; by 32.	*14.* 304071 by 46; by 26.
9. 816480 by 24; by 41.	*15.* 415036 by 75; by 56.
10. 445280 by 22; by 44.	*16.* 630400 by 46; by 48.
11. 32760 by 28; by 23.	*17.* 297182 by 77; by 45.
12. 35280 by 25; by 42.	*18.* 710345 by 68; by 52.

What is the quotient *

19. Of 47000 divided by 10? 100? 1000?

20. Of 3000 divided by 10? 100? 1000?

21. Of 137000 divided by 100 ? 1000? 10000?

22. Of 63242 divided by 40? By 600? By 800 ? By 500?

23. Of 13780 divided by 120? By 240 ? By 360 ? By 400?

24. How many horses at $100 each can be bought for $6500?

25. Bought 1000 watches for $9750. What was the cost of each ?

26. At $17 a barrel, how many barrels of molasses can be bought for $8024 ?

27. How many acres of land can be bought for $8370, at $30 an acre ?

28. How many barrels of pork, at $20 a barrel, can be bought for $35329 ?

29. How many tons of hay at $10 a ton must be given for 75 sheep worth $4 a head ?

---

* *The pupil should here be instructed how to divide by 10, 100, 1000, etc., or when the divisor has ciphers on the right.*

30. Divide $48.56 by 8 cents.

Eight cents may be written $.08. $.08 are contained in $48.56, 607 *times.* Or, 8 *cents* are contained in 4856 *cents*, 607 times.

8 cts.) 4856 cts.

607 *times.*

31. Divide $48.56 by 8.

1 *eighth* of $48.56 is $6.07.
PROOF. $6.07 × 8 = $48.56.

8) $48.56

$6.07

Solve and prove:

(32.)	*(33.)*	*(34.)*	*(35.)*
9) $217.62	7) $6.44	$7) $644	8) $124.96
$24.18	$.92	92 times.	$15.62

36. Divide $705.60 by 4 ; by 5 ; by 6 ; by 7.

What is
37. 1 *fifth* of $461.50.
38. 1 *eighth* of $17.36.
39. 1 *seventh* of $243.04.
40. 1 *sixth* of $500.10.

What is
41. ⅓ of 67344 inches ?
42. ¼ of 437868 feet ?
43. ⅓ of 134860 pounds ?
44. ⅓ of $1046.85 ?

45. Paid $57.75 for 8 sheep. What did each cost?
46. If 6 tons of coal cost $40.80, what costs 1 ton ?

Find the value
47. Of ($35.50 ÷ 4) × 12.
48. Of ($4.35 ÷ 3) × 30.
49. Of ($56.80 ÷ 8) × 19.

50. Of ($90 × 18) ÷ 12.
51. Of ($6.26 × 24) ÷ 8.
52. Of ($12.75 × 14) ÷ 7.

53. If 5 boxes of lemons are worth $23.25, what are 14 boxes worth ?

54. If 6 books cost $1.90, what is the cost of 27 books?

55. A farmer sold 96 bushels of potatoes, at 52 cents a bushel. How many pounds of coffee, at 26 cents a pound, will *pay for the potatoes?*

DIVISION.

DRILL TABLE No. 3.

	A	B	C	D	E	F	G
1.	8	6	7	2	60	500	4000
2.	2	7	5	11	10	800	3000
3.	1	9	4	6	80	300	5000
4.	6	3	2	5	40	600	2000
5.	9	1	8	4	70	200	8000
6.	5	6	9	12	20	900	1000
7.	3	4	6	8	90	100	7000
8.	4	2	7	10	50	400	9000
9.	7	3	5	9	30	700	6000
10.	6	8	3	7	40	300	10000

1. From the open book, divide 12 by each number in column A, naming rapidly only the quotient and remainder. Then use numbers greater than 12 and less than 100 for a dividend, and practice in the same manner. Also with the columns B, C, D.

2. Begin at the left and divide the product of any two numbers in columns A and B by the number at the right in column C; then of the columns B and C by the numbers in column D.

3. Also, beginning at the top, divide the product of the numbers in any two lines of columns A and B by the number in next line below of column C. Use columns B, C, and D in the same manner.

4. Then take $\frac{1}{2}$ of each number in column G and add the number in the same line in column F. The same with F and E; E and D.

5.- Take *one-half* of each number in each column E, F, and G.

6. Then, at sight, divide the same by 10; then divide each number of columns F and G by 100.

———

DRILL EXERCISES.

46. Read rapidly from the open book, naming the quotients, *at sight:*

1.	$4 \div 2 =$	$40 \div 2 =$	$400 \div 2 =$	$4000 \div 2 =$
2.	$12 \div 2 =$	$120 \div 2 =$	$1200 \div 2 =$	$1600 \div 2 =$
3.	$15 \div 5 =$	$150 \div 5 =$	$1500 \div 5 =$	$15000 \div 5 =$
4.	$450 \div 5 =$	$4000 \div 5 =$	$4500 \div 5 =$	$30000 \div 5 =$
5.	$240 \div 3 =$	$2400 \div 6 =$	$2100 \div 7 =$	$40000 \div 8 =$
6.	$56 \div 8 =$	$560 \div 8 =$	$5600 \div 8 =$	$72000 \div 8 =$

7. $\dfrac{\$16}{8} =$ $\dfrac{\$160}{8} =$ $\dfrac{\$1600}{8} =$ $\dfrac{\$16000}{8} =$

8. $\dfrac{36 \text{ da.}}{6} =$ $\dfrac{360 \text{ da.}}{6} =$ $\dfrac{3600 \text{ da.}}{6} =$ $\dfrac{36000 \text{ da.}}{6} =$

9. How many 2's in 648?

Observe, that $648 = 600 + 40 + 8$, and the number of 2's in each is at once obvious. Adding these, you have $300 + 20 + 4$, or 324, the number of 2's in 648.

10. How many 3's in 960?   In 639?   In 969?   In 660?
11. How many 4's in 440?   In 844?   In 888?   In 488?
12. How many 3's in 696?   In 369?   In 909?   In 936?

13. Read quotients rapidly:

$\frac{695}{5} =$ $\frac{848}{4} =$ $\frac{696}{3} =$ $\frac{510}{5} =$ $\frac{660}{6} =$

$\frac{707}{7} =$ $\frac{696}{2} =$ $\frac{424}{4} =$ $\frac{444}{4} =$ $\frac{888}{8} =$

14. $\$24 \div 6 =$ $\$240 \div 6 =$ $\$2400 \div 6 =$
    $21 \text{ bu.} \div 7 =$ $280 \text{ bu.} \div 7 =$ $3500 \text{ bu.} \div 7 =$

Abundant exercise of rapid oral work of this kind is presented in the *Drill Table on the opposite* page.

REVIEW.

ORAL AND WRITTEN EXERCISES.

47. *1.* Read rapidly, *at sight,* filling the blanks:

1 ft. = 12 in.	1 mi. = 320 rd.	1 hand	= 4 in.
2 " =	2 " =	10 "	=
3 " =	3 " =	4½ "	=
4 " =	10 " =	15 "	=
2½ " =	1½ " =	1 fathom	= 6 ft.
4⅓ " =	½ " =	2½ "	=
½ " =	¼ " =	5 "	=
¼ " =	⅛ " =	10½ "	=

2. And reverse, thus:

48 in. = 4 ft.	60 ft. = 10 fath.	12 ft. = 4 yd.
60 " =	90 " =	24 " =
84 " =	75 " =	30 " =
40 " =	50 " =	35 " =
38 " =	72 " =	28 " =

The pupil should prepare on slate or paper similar work, applied to pounds, ounces, bushels, gallons, quarts, dozens, and other measures, filling out the blanks.

3. Write on the slate or board, in column or line, several numbers, as,

$$2, \quad 3, \quad 5, \quad 10, \quad 7, \quad 9, \quad 12, \quad 8, \quad 30, \quad 100, \quad 20.$$

If these represent yards, how many feet will each represent? Read rapidly, 6 ft., 9 ft., 15 ft., etc.

Exercises like the above, and the following, should first be recited *from the open book ;* then from *dictation* by the teacher ; then neatly *written out* by the pupil on slate or paper, in *mathematical language.*

4. Then let them represent bushels, gallons, quarts, etc., and read in lower denominations.

5. What is the value of

$$\frac{20+40}{10}; \quad \frac{3+3+3+3}{4}; \quad \frac{30-10}{5}; \quad \frac{5+5-5}{5};$$

6. How many dollars in 100 cts. ? In 1200 cts. ?

7. How many 10-cent pieces equal 100 cts. ? 400 cts. ?

8. How many half-dimes in 25 cts. ? In 50 cts. ? In $1 ?

9. How many cents in 2 dimes? In 4 dimes? In 5½ dimes?

10. How many eggs in 5 doz. and 6? In 3¼ doz. ?

11. How many score in 20? In 200? In 2000?

12. How many yards in 30 ft. ? In 300 ft.? In 3000 ft.?

13. How many pecks in 10 bu.? In 100 bu.? In 1000 bu. ?

14. How many dozen in 120 ? In 1200? In 12000 ?

15. How many $10 bills make $100? $500? $1000?

16. How old is a man at 3 score and 10 yr.? At 4 score ?

17. If a pond of water measures 3 fathoms 2 feet deep, how many feet deep is it ?

18. Take ¼ of all numbers between 30 and 50.

19. Take ¼ of all numbers ending with 5 or 0, below 100.

20. How do you find *one-half* of anything, or number? *Twice* a number? The *sum* of two numbers ? The *difference?* The *product?* The *quotient?*

21. If 55 cents are equally divided among 11 boys, how many cents will each boy receive?

22. What is 1 eleventh of 44? Of 77? Of 99 ? Of 110 ?

23. At $8 a yard, how many yards of cloth will $96 buy ?

24. What is 1 twelfth of $84? Of 72 rods? Of 108 bu.?

25. What is 1 seventh of 35 ? Of 42 ? Of 60 — 11 ?

26. $8 \times 6 = 4 \times ?$; $3 \times 8 = 6 \times ?$; $5 \times 8 = 4 \times ?$; $9 \times 8 = 6 \times ?$; $8 \times 2 = 4 \times ?$; $10 \times 6 = 12 \times ?$.

27. A boy having 12 oranges, bought 6 more, and then sold 7. How many had he left?

28. A boy bought a book for 36 cents, a slate for 20 cents, and a pencil for 4 cents. How much change should he receive for a $1 bill?

29 Willie sold his knife for 36 cents, and received in payment 3 qt. of chestnuts at 8 cents a quart, and the remainder in money. How much money did he receive?

30. If a man can chop 16 Cd. of wood in 8 da., how much can he chop in 3 da.? In 5 da.? In 7 da.?

31. A tailor bought 11 yd. of one kind of cloth for $55, and 9 yd. of another kind for $36. What was the difference in the price per yard?

32. How many pairs of boots at $8 a pair will pay for 6 weeks' board at $7 a week, and $22 borrowed money?

33. If 5 bbl. of flour are worth $60, how many cords of wood at $4 a cord will pay for 3 barrels?

Perform the operations indicated by the signs, and write the correct number in place of (?):

34. $12 \times 6 + 8 + 10 - 5 - 4 + 6 + 6 - 4 + 20 = ?$
35. $64 \div 8 \times 3 + 6 - 10 \times 2 + 7 + 5 - 12 = ?$
36. $7 + 12 - 3 + 4 \times 11 + 6 - 10 + 8 \div 8 = ?$
37. $48 - 10 + 2 + 8 \times 2 \times 0 + 12 - 3 \times 11 = ?$
38. $(15 - 12) \times 4 + 12 \times 5 + 5 \times 5 - 5 + 9 = ?$

39. $(10 + 4) \div 7 + 20 = ?$
40. $8 \times 9 - (12 \div 6) = ?$
41. $(40 - 8) \div 4 \times 7 = ?$
42. $(25 + 10) \div 7 + 9 = ?$
43. $(72 \div 12) + 50 - 16 = ?$
44. $(48 + 12 - 10) \div ? = 5.$

45. $(14 + 7) \div 3 \times ? = 84.$
46. $(144 \div 12 - 3) \times 11 = ?$
47. $24 + 20 - 4 = 80 \div ?$
48. $56 \div 7 \times 8 = 70 - ?$
49. $(43 + 6) \div 7 \times 0 = ?$
50. $120 \div 10 \times 5 = ? \times 12.$

WRITTEN EXERCISES.

48. *1.* How many barrels of flour at $9 a barrel must be given for 27 yards of cloth at $4 a yard ?

WRITTEN SOLUTION. $\dfrac{\$4 \times 27}{\$9}$ = *No. of barrels of flour.*

2. How many bushels in 2175 pounds of wheat?

3. In 1 square foot there are 144 sq. in. How many square inches are there in 14 sq. ft. ? In 20 sq. ft.?

4. In 1 cubic foot there are 1728 cu. in. How many cubic inches are there in 7 cu. ft. ? In 12 cu. ft.?

5. A man bought two farms, one of 136 A. at $28 an acre, and another of 140 A. at $33 an acre ; and paid at one time $4000, and at another time $1875. How much remained unpaid ?

6. In an orchard, 76 apple trees yield 18 bu. of apples each, and 27 others yield 21 bu. each. What are the apples worth at 30 cents a bushel ?

7. How many barrels of flour, at $7 a barrel, will pay for 30 tons of coal, at $4 a ton, and 44 Cd. of wood, at $3 a cord ?

8. If a field containing 42 acres produce 1659 bu. of wheat, what is the number of bushels per acre?

9. A farmer sold 15 tons of hay at $9 a ton, and 25 cords of wood at $4 a cord, and wished to divide the amount equally among 5 creditors. How much would each receive ?

10. If 24 yards of cloth cost $144, what will 56 yards cost at the same rate?

11. If 9 A. of land cost $976.50, what is the cost of 1 A.?

12. How many oranges can be bought for $3.72, at 4 cents apiece ?

13. At 8 cents a yard, how many yards of ribbon can be bought for $7.28 ?

14. Bought 13 cows at $40 each, 16 sheep at $2 each, a horse for $250, and a wagon for $97. In how many months can I pay for them, in monthly payments of $18 each?

15. A farmer raised 1500 bushels of oats, and sold them for 32 cents a bushel. How many acres of land could he buy, at $20 an acre, with the proceeds?

16. Bought two kinds of coffee, one for 20 cts. and the other for 24 cts. a pound. What was the *average* cost a pound?

The *average* of *two* numbers is *one half* their sum; of *three* numbers, *one third* their sum, etc.

17. Find the average of 20 and 30; of 5, 8, and 14; of 6, 10, 12, and 8; of 5, 10, 20, 10.

18. What is the average cost of a pound of three kinds of coffee, at 18 cts., 24 cts., and 27 cts. a pound respectively?

19. A grocer bought 3 barrels of apples of different qualities, at $2.75, $3.12, and $3.25 a barrel. What was the average cost a barrel?

20. A drover received $26400 for 1200 head of cattle. How much was their average value a head?

21. If 13500 pounds of cotton be packed in 27 bales, what is the average weight of each bale?

22. A man paid $170352 for 36 city lots. What was the average cost per lot? What cost 8 lots, at the same price?

23. How many hours in a day? In a week? In a month?

24. What is the sum of the hours in a day, a week, and a month?

25. In 94185 yards of sheeting are how many pieces, each piece containing 45 yards?

26. How many pounds of sugar worth 13 cents a pound, *can be bought* for 126 pounds of butter worth 28 cents a *pound?*

27. If I receive $1500 salary, and pay $370 for board, $281.50 for clothing, $112.75 for books, and $196.65 for other expenses annually, what can I save in 3 years?

28. A merchant bought 7 hogsheads of sugar at $46.45 a hogshead, and sold it for $53.62 a hogshead. What did he gain?

29. Paid $304 for 38 barrels of flour, and sold the same ·at $9.12 a barrel. What was the gain?

30. How many rods of fence will enclose a farm $\frac{1}{2}$ a mile square?

31. An innkeeper bought a load of 40 bushels of oats, at 36 cents a bushel, and retailed them at 25 cents a peck. How much did he make on the load?

32. If a mechanic receive $1250 a year for labor, and his expenses are $765 a year, how much can he save in 5 years?

33. A farmer sold 16 cords of wood at $3 a cord, and 40 bushels of wheat at $2 a bushel. He received 15 yards of cloth, at $4 a yard, and the remainder in money. How much money did he receive?

34. What is the distance around a public square which measures 16 rods on a side?

35. How many dozen eggs, at 28 cents a dozen, will pay for 84 pounds of sugar, at 10 cents a pound?

36. A milkman bought 120 gal. of milk, at 12 cents a gallon, and sold it at 5 cents a quart. What was his gain?

37. How many barrels of apples, at $4 a barrel, must be given in exchange for 10 bags of wheat, each containing 3 bushels, at $2 a bushel?

38. A man earns $100 a month, and pays $15 a month for house-rent, and $40 a month for other expenses. How much *can he save in a* year?

Find the amount of each of the following bills:

39. M. NORTON,

Bought of J. C. BROWN.

36 bu. of corn, at $.48 a bushel.

15 barrels of potatoes, at $3 a barrel.

4 tons of hay, at $14.75 a ton.

10 cords of wood, at $3.50 a cord.

40. JAMES LEEDS,

Bought of CAMPBELL & SON.

16 yards of cloth, at $2.50 a yard.

12 pounds of tea, at $.75 a pound.

24 pounds of coffee, at 26 cents a pound.

41. Henry Wray, on May 1 had $4.50 ; May 10, he earned $.75 ; May 15, he received from his brother 40 cents; May 25, received for doing errands, 25 cents.

On May 5, he paid 50 cents for a knife; May 12, $1.12 for a hat; May 16, $.65 for a book, and May 30, he gave 30 cents to a poor boy.   How much had he on hand May 31 ?

The pupil should arrange the work as follows :

<div align="center">

RECEIPTS.

May	1,	*On hand,*		$4.50
"	10,	*Received for labor,*		.75
"	15,	" *from his brother,*		.40
"	25,	" *for doing errands,*		.25
		Amount of receipts,		$

EXPENSES.

May	5,	*Paid for knife,*	$0.50	
"	12,	" *for hat,*	1.12	
"	16,	" *for book,*	.65	
"	30,	*Gave poor boy,*	.30	$2.57
		On hand,		$

</div>

FRACTIONS.

49. *1.* A *unit* is one, or a single thing.

2. Numbers that express or represent *equal parts* of a unit or whole thing are called *fractions.*

3. A fraction is usually expressed by two numbers, called the *numerator* and the *denominator*, one written over the other, with a line between them. When so written, they are sometimes called *common fractions;* thus,

One half	is written ½.	Five sixths	is written ⅚.
One third	"	⅓.	Nine tenths	"	$\frac{9}{10}$.
Three fourths	"	¾.	Seven twelfths	"	$\frac{7}{12}$.

4. The number below the line is the **denominator.**

Thus, in the fraction ¾, 4 is the *denominator*, and shows that the unit is divided into *four* equal parts, named *fourths.*

5. The number above the line is the **numerator.**

Thus, in ¾, 3 is the *numerator*, and shows that 3 of the 4 equal parts *are taken*, or expressed, by the fraction.

Hence, the denominator expresses the *size*, and the numerator the *number* of the parts.

6. The *numerator* and *denominator* of a fraction are called the **terms** of the fraction.

Thus, 3 and 4 are the *terms* of the fraction ¾.

7. Read the following fractions, and name the *terms:*

$$\frac{2}{3} \quad \frac{3}{5} \quad \frac{5}{6} \quad \frac{4}{7} \quad \frac{5}{8} \quad \frac{4}{5} \quad \frac{5}{9} \quad \frac{1}{8} \quad \frac{2}{7} \quad \frac{3}{10} \quad \frac{7}{8}$$

8. Then read thus: ⅔; *number* of parts, 2, size of parts thirds. ⅗; number of parts, 3, size of parts fifths, etc.

50.   **Whole.**   **Equal parts.**

1. How do you find *one half* of any number? 1 *third?*
$\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$? $\frac{1}{8}$? etc.

2. What is $\frac{1}{2}$ of 6? Of 8? Of 12? Of 18? Of 20?

Prepare thus: $\frac{6}{2}$, $\frac{8}{2}$, $\frac{12}{2}$, $\frac{18}{2}$, $\frac{20}{2}$, and recite rapidly, $\frac{1}{2}$ of 6,
or 6 halves, is 3; $\frac{1}{2}$ of 8, or 8 halves, is 4, etc. Then read
the values *at sight;* thus, 3, 4, 6, 9, 10.

3. What is $\frac{1}{3}$ of 9 ? Of 15? Of 21? Of 24? Of 27?
4. What is $\frac{1}{4}$ of 12? Of 16? Of 28? Of 32? Of 40?
5. What is $\frac{1}{5}$ of 20? Of 35 ? Of 45 ? Of 50 ? Of 60?
6. What is $\frac{1}{6}$ of 18 ? $\frac{1}{7}$ of 21 ? $\frac{1}{5}$ of 30 ? $\frac{1}{6}$ of 36?
7. What is $\frac{1}{7}$ of 28? $\frac{1}{9}$ of 54? $\frac{1}{8}$ of 48? $\frac{1}{9}$ of 63?
8. What is $\frac{1}{8}$ of 40 ? $\frac{1}{9}$ of 45? $\frac{1}{7}$ of 49 ? $\frac{1}{9}$ of 72?
9. What do you understand by $\frac{2}{5}$ of any number?

Ans. *Two* of the *five equal parts* into which the number or
thing is divided.

10. What do you understand by $\frac{3}{4}$ of any number or thing?
By $\frac{2}{4}$? By $\frac{4}{5}$? By $\frac{3}{4}$? $\frac{4}{7}$? By $\frac{5}{8}$? $\frac{6}{8}$? $\frac{7}{8}$?

11. What is $\frac{2}{3}$ of 12?

SOLUTION. *One* third of 12 is 4; 2 thirds of 12 are 2 times 4, or 8

12. What is $\frac{3}{4}$ of 16? $\frac{2}{3}$ of 15 ? $\frac{3}{4}$ of 20? $\frac{4}{5}$ of 25?

Prepared, $\frac{16}{4} \times 3$, $\frac{15}{3} \times 2$, $\frac{20}{5} \times 2$, and read: 3 times $\frac{1}{4}$ of 16 is 12; twice $\frac{1}{3}$ of 15 is 10; twice $\frac{1}{5}$ of 20 is 8. They may also be read by *results,* first reading by two steps, and on a final drill have the complete result read; thus, $\frac{16}{4} \times 3$ may be read 4, 12; $\frac{15}{3} \times 2$, read 5, 10; $\frac{20}{5} \times 2$, read 4, 8, etc.

13. What is $\frac{1}{3}$ of 18? $\frac{1}{6}$ of 30? $\frac{1}{7}$ of 21? $\frac{1}{4}$ of 28? $\frac{1}{8}$ of 32? $\frac{1}{4}$ of 36?

14. What is $\frac{2}{3}$ of 27? $\frac{5}{6}$ of 18? $\frac{5}{7}$ of 42? $\frac{7}{10}$ of 40?

51. *1.* How do you find how many *halves* there are in any whole number? **Ans.** *Multiply the whole number by* 2.

2. How do you find how many *thirds* there are in any number? How many *fourths? Fifths? Sixths?* etc.

Hence, there are *twice* as many *halves* as whole ones, 3 times as many *thirds,* etc.

3. Write on the slate or board, in column or line, several numbers; as,

$$4, \quad 8, \quad 6, \quad 10, \quad 12, \quad 14, \quad 20, \quad 16, \quad 24, \quad 18.$$

4. Then read rapidly the number of *halves* in each; thus, 8 halves, 16 halves, etc. Then the *thirds,* the *fourths,* etc.

5. Also *write* the halves in each; thus, $\frac{8}{2}$, $\frac{16}{2}$, $\frac{12}{2}$, etc. Then the thirds, fourths, etc.

52. *1.* When the numerator of a fraction is less than the denominator, the *value* of the fraction is less than 1; as $\frac{3}{4}$, $\frac{5}{6}$, $\frac{1}{3}$, $\frac{9}{10}$, etc.

2. When the numerator and denominator of a fraction are equal, the *value* of the fraction is equal to 1; as, $\frac{3}{3}=1$, $\frac{4}{4}=1$, $\frac{5}{5}=1$, etc.

3. When the numerator is greater than the denominator, the *value* is greater than 1; as, $\frac{4}{3}=1\frac{1}{3}$; $\frac{8}{4}=2$, etc.

4. A whole number and a fraction written together are called a ***mixed number;*** as, $5\frac{3}{4}$, read 5 and 3 fourths.

5. Read the following *mixed numbers:*

$$3\tfrac{4}{5}, \quad 9\tfrac{2}{3}, \quad 7\tfrac{4}{5}, \quad 10\tfrac{4}{5}, \quad 8\tfrac{3}{7}, \quad 12\tfrac{7}{10}, \quad 14\tfrac{7}{12}, \quad 5\tfrac{1}{8}.$$

6. How many *fifths* are $4\frac{3}{5}$?

SOLUTION. In 1 there are 5 fifths, in 4 there are 4 times 5 fifths, or 20 fifths, and 3 fifths added make 23 fifths, $\frac{23}{5}$.

7. How many *fourths* are $9\frac{1}{4}$? Are $7\frac{3}{4}$? Are $8\frac{3}{4}$?

8. Change $4\frac{5}{8}$ to *eighths;* $9\frac{3}{7}$ to *sevenths;* $8\frac{7}{10}$ to *tenths;* $5\frac{7}{9}$ to *ninths;* $4\frac{5}{12}$ to *twelfths.*

9. How many *ones* are $\frac{12}{4}$?

SOLUTION. 4 fourths equal 1, and 12 fourths are as many 1's as 4 fourths are contained times in 12 fourths, or 3 times. $\frac{12}{4} = 3$.

10. Find the value of $\frac{15}{3}$; of $\frac{18}{6}$; of $\frac{22}{7}$; of $\frac{31}{4}$; of $\frac{36}{9}$.

First read thus: 15 *thirds* are 5; 18 *sixths* are 3; 22 *sevenths* are $3\frac{1}{7}$; 31 *fourths* are $7\frac{3}{4}$, etc. Then *only* the results, rapidly: 5, 3, $3\frac{1}{7}$, $7\frac{3}{4}$, 4.

11. In the same way, read:

$\frac{30}{5}$	$\frac{27}{6}$	$\frac{36}{5}$	$\frac{42}{7}$	$\frac{50}{10}$	$\frac{45}{8}$	$\frac{37}{4}$	$\frac{60}{12}$	$\frac{72}{9}$	$\frac{48}{5}$

12. What is the value of $\frac{44}{8}$? $\frac{56}{7}$? $\frac{72}{12}$? $\frac{60}{8}$? $\frac{67}{10}$? $\frac{70}{8}$? $\frac{76}{9}$? $\frac{66}{11}$?

13. Change to a whole or mixed number $\frac{20}{8}$; $\frac{75}{12}$; $\frac{63}{5}$. $\frac{84}{12}$; $\frac{102}{8}$; $\frac{88}{11}$; $\frac{120}{10}$.

14. Prepare tables on slate or paper, filling blanks; thus,

$2 = \frac{4}{2}$	$4 = \frac{8}{2}$	$8 = \frac{16}{2}$	$6 = \frac{-}{3}$
$2 = \frac{6}{3}$	$4 = \frac{12}{3}$	$8 = \frac{-}{3}$	$4\frac{1}{3} = \frac{-}{3}$
$2 = \frac{8}{4}$	$4 = \frac{-}{4}$	$8 = \frac{-}{4}$	$7\frac{1}{2} = \frac{-}{2}$
$2 = \frac{10}{5}$	$4 = \frac{-}{5}$	$8 = \frac{-}{5}$	$9\frac{1}{3} = \frac{-}{3}$
$2 = \frac{12}{6}$	$4 = \frac{-}{6}$	$8 = \frac{-}{6}$	$10\frac{2}{3} = \frac{-}{3}$
$2 = \frac{14}{7}$	$4 = \frac{-}{7}$	$8 = \frac{-}{7}$	$8\frac{2}{3} = \frac{-}{3}$
$2 = \frac{16}{8}$	$4 = \frac{-}{8}$	$8 = \frac{-}{8}$	$10\frac{3}{4} = \frac{-}{4}$ etc.

53. *1.* How many are 2 *fifths* and 3 *fifths?*

$\qquad\qquad\qquad$ *Ans.* 5 *fifths;* $\frac{5}{5} = 1.$

2. Can you take 3 *apples* from 5 *figs?* Why not ?

3. Can you add 3 *fourths* and 5 *sixths?* Why not?

STATEMENT.—*Only fractions having the SAME DENOMINA-TOR can be added or subtracted.*

4. From the open book give the *sum* of each fraction and the one on its right ; thus, $\frac{10}{8}$, $\frac{8}{8}$, $\frac{13}{6}$, or $1\frac{3}{6}$, etc.

5. Give the *difference;* thus, $\frac{4}{8}$, $\frac{2}{6}$, $\frac{1}{10}$, etc.

6. Write the *sums* and *differences* on the slate or paper.

7. How many are $\frac{7}{8} - \frac{3}{8}$? $\frac{9}{10} - \frac{7}{10}$? $\frac{7}{12} - \frac{1}{12}$? $1\frac{1}{14} - \frac{9}{14}$? $\frac{13}{23} - \frac{8}{23}$?

8. Subtract $\frac{5}{9}$ from $\frac{6}{9}$; $\frac{2}{11}$ from $\frac{9}{11}$.

9. How many are $\frac{3}{7} + \frac{4}{7} + \frac{5}{7} + \frac{6}{7}$?

10. How many are $\frac{5}{8} + \frac{1}{8} + \frac{3}{8} + \frac{8}{8} + \frac{10}{8}$?

11. From $\frac{5}{8} + \frac{3}{8} + \frac{7}{8}$ take $\frac{6}{8}$.

12. From $\frac{7}{12} + \frac{5}{12} + 1\frac{1}{2}$ subtract $\frac{8}{12}$.

13. John spent $\frac{3}{9}$ of his money and lost $\frac{5}{9}$ of it. What part of his money had he left ?

14. James paid $\frac{7}{8}$ of a dollar for a book, and $\frac{3}{8}$ of a dollar for a slate. How much did he pay for both? How much more for the book than for the slate?

15. If Lillie has 3 fourths of an orange and Clarence the remainder, how much has Clarence ?

16. Frank spent $\frac{3}{8}$ of his money, and lost $\frac{5}{8}$ of it. What part of his money had he left ?

17. William saved $\$\frac{5}{8}$ one week, $\$\frac{7}{8}$ the next, and $\$\frac{3}{8}$ the next. How much did he save in 3 weeks ?

18. How much less the last week than the other two ?

$\dfrac{7}{8}$	$\dfrac{8}{8}$
$\dfrac{3}{6}$	$\dfrac{5}{6}$
$\dfrac{7}{10}$	$\dfrac{6}{10}$
$\dfrac{6}{9}$	$\dfrac{5}{9}$
$\dfrac{2}{3}$	$\dfrac{1}{3}$
$\dfrac{5}{7}$	$\dfrac{3}{7}$
$\dfrac{6}{11}$	$\dfrac{9}{11}$

54. *1.* If a cake is cut into 12 equal pieces, what part of the whole cake is each piece?   *Ans.* *One twelfth.*

2. How many *twelfths* make a whole thing?

3. How do we find 1 *twelfth* of any number?

4. If a cake is divided into 3 equal parts, each part is called 1 *third.*

5. If each *third* of the cake is divided into 4 equal parts, into how many parts is the *whole cake* divided?

6. How many *twelfths* in 1 third? In 2 thirds? 3 thirds?

7. If a cake is cut into 4 equal parts, each part is called 1 *fourth.*

8. If each *fourth* of the cake is divided into 3 equal parts, into how many parts is the *whole cake* divided?

9. How many *twelfths* in 1 fourth? In 2 fourths? In 3 fourths? In 4 fourths?

10. If Eddie has $\frac{1}{3}$ of a cake, and Asa $\frac{1}{4}$ of it, what part have both? $\frac{1}{3} + \frac{1}{4} = ?$

SOLUTION.—Since $\frac{1}{3}$ is equal to $\frac{4}{12}$, and $\frac{1}{4}$ is equal to $\frac{3}{12}$, they have the *sum* of $\frac{4}{12}$ and $\frac{3}{12}$, or $\frac{7}{12}$.

11. How much more has Eddie than Asa? $\frac{1}{3} - \frac{1}{4} = ?$

12. How many twelfths in $\frac{1}{2}$? In $\frac{1}{3}$? In $\frac{2}{3}$? In $\frac{1}{4}$? In $\frac{3}{4}$?

13. Which is greater, $\frac{1}{2}$ or $\frac{1}{3}$? $\frac{1}{3}$ or $\frac{1}{4}$? $\frac{2}{3}$ or $\frac{3}{4}$?

14. If Mary has $\frac{1}{3}$, and Jennie $\frac{1}{4}$ of a melon, what part of the whole melon have both?

15. A farmer sold $\frac{1}{3}$ of his grain to one man, $\frac{1}{4}$ to another. *What part* of all his grain did he sell? What part had he *left?*

55. *1.* Draw lines upon the slate or board of *equal* length, and divide them into *twelve equal parts.*
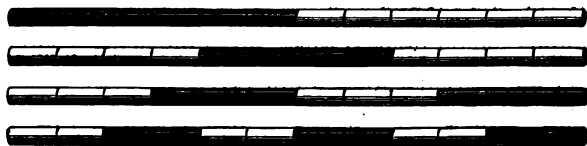
2. By a heavier mark these lines may be divided into *halves, thirds, fourths,* and *sixths,* respectively.

$$1 = \tfrac{12}{12} \qquad \tfrac{1}{3} = \tfrac{4}{12} \qquad \tfrac{1}{6} = \tfrac{2}{12}$$
$$\tfrac{1}{2} = \tfrac{6}{12} \qquad \tfrac{1}{4} = \tfrac{3}{12} \qquad \tfrac{1}{12} = \tfrac{1}{12}$$

3. It is plain that halves, thirds, fourths, sixths, and twelfths may be added or subtracted when changed to parts of *equal size.*

4. Write tables showing that $\tfrac{1}{2} = \tfrac{2}{4}$, $\tfrac{3}{6}$, $\tfrac{4}{8}$, etc., up to *twelfths ;* thus,

$$\tfrac{1}{2} = \tfrac{2}{4} \qquad \tfrac{1}{3} = \tfrac{2}{6} \qquad \tfrac{1}{4} = \tfrac{2}{8} \qquad \tfrac{1}{6} = \tfrac{2}{10}$$
$$\tfrac{1}{2} = \tfrac{3}{6} \qquad \tfrac{1}{3} = \tfrac{3}{9} \qquad \tfrac{1}{4} = \tfrac{3}{12} \qquad \tfrac{1}{6} = \tfrac{3}{15}$$
$$\tfrac{1}{2} = \tfrac{4}{8} \qquad \tfrac{1}{3} = \tfrac{4}{12} \qquad \tfrac{1}{4} = \tfrac{4}{16} \qquad \tfrac{1}{6} = \tfrac{4}{20}$$
$$\tfrac{1}{2} = \tfrac{5}{10} \qquad \tfrac{1}{3} = \tfrac{5}{15} \qquad \tfrac{1}{4} = \tfrac{5}{20} \qquad \text{etc.}$$

What is the *sum* and *difference* of

5. $\tfrac{1}{2}$ and $\tfrac{2}{3}$?	*9.* $\tfrac{4}{6}$ and $\tfrac{3}{12}$?	*13.* $\tfrac{2}{3}$ and $\tfrac{1}{6}$?
6. $\tfrac{1}{4}$ and $\tfrac{1}{2}$?	*10.* $\tfrac{2}{3}$ and $\tfrac{3}{4}$?	*14.* $\tfrac{1}{2}$ and $\tfrac{5}{6}$?
7. $\tfrac{3}{4}$ and $\tfrac{1}{6}$?	*11.* $\tfrac{1}{4}$ and $\tfrac{1}{2}$?	*15.* $\tfrac{3}{4}$ and $\tfrac{3}{8}$?
8. $\tfrac{2}{3}$ and $\tfrac{3}{4}$?	*12.* $\tfrac{3}{12}$ and $\tfrac{3}{4}$?	*16.* $\tfrac{1}{3}$ and $\tfrac{5}{6}$?

What is the value of

17. $\tfrac{1}{2} - \tfrac{1}{3}$?	*20.* $\tfrac{2}{3} - \tfrac{1}{6}$?	*23.* $\tfrac{3}{4} + \tfrac{1}{12}$?
18. $\tfrac{1}{4} - \tfrac{1}{4}$?	*21.* $\tfrac{5}{6} + \tfrac{2}{3}$?	*24.* $\tfrac{3}{4} - \tfrac{1}{4}$?
19. $\tfrac{3}{8} + \tfrac{1}{6}$?	*22.* $\tfrac{1}{4} - \tfrac{1}{8}$?	*25.* $\tfrac{3}{8} + \tfrac{1}{4}$?

56. *1.* 4 is $\frac{1}{2}$ of what number?

Ans. 4 is $\frac{1}{2}$ of twice 4, or 8.

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

2. Pupils should prepare work in the following manner, to illustrate all fractional work up to $\frac{1}{12}$:

$2 = \frac{1}{2}$ of 4	$2 = \frac{1}{3}$ of 6	$2 = \frac{1}{4}$ of 8
$3 = \frac{1}{2}$ of 6	$3 = \frac{1}{3}$ of 9	$3 = \frac{1}{4}$ of 12
$4 = \frac{1}{2}$ of 8	$4 = \frac{1}{3}$ of —	$4 = \frac{1}{4}$ of 16
$5 = \frac{1}{2}$ of —	$5 = \frac{1}{3}$ of —	$5 = \frac{1}{4}$ of —
$6 = \frac{1}{2}$ of —	$6 = \frac{1}{3}$ of —	$6 = \frac{1}{4}$ of —
$7 = \frac{1}{2}$ of —	$7 = \frac{1}{3}$ of —	$7 = \frac{1}{4}$ of —
$8 = \frac{1}{2}$ of —	$8 = \frac{1}{3}$ of —	$8 = \frac{1}{4}$ of —
$9 = \frac{1}{2}$ of —	$9 = \frac{1}{3}$ of —	$9 = \frac{1}{4}$ of —

To be filled out and read by *column* and by *line.*

Read by *line,* thus: 2 is $\frac{1}{2}$ of 4, $\frac{1}{3}$ of 6, $\frac{1}{4}$ of 8, $\frac{1}{5}$ of 10, $\frac{1}{6}$ of 12, $\frac{1}{7}$ of 14, etc.

3. George gave a beggar 6 cents, which was $\frac{1}{5}$ of all the money he had. How much money had he?

4. If $\frac{1}{4}$ of a pound of coffee cost 8 cents, what will $\frac{3}{4}$ of a pound cost?

ORAL SOLUTION. 3 fourths of a pound will cost 3 times 8 cents, or 24 cents.

WRITTEN SOLUTION. 8 cts. $\times$ 3 = *cost of coffee.*

5. If $\frac{1}{5}$ of a bushel of pears cost 9 cents, what will $\frac{4}{5}$ of a bushel cost?

6. If a man walk 6 miles in $\frac{1}{4}$ of a day, how many miles can he walk in 1 day?

7. A pencil cost 8 cents, which was $\frac{1}{5}$ the cost of a book. *What was the* cost of the book?

8. If $\frac{1}{4}$ of a melon cost 7 cents, what will $\frac{3}{4}$ of it cost?

57. *1.* If a barrel of sugar is worth $24, what is ⅓ of it worth ? 2 thirds ? 1 fourth ? 3 fourths?

2. If a boy earns $10 in a week and spends 2 fifths of it, what part is left ? How many dollars ?

3. When coal is $7 a ton, what part of a ton will $1 buy ? $2 ? $3 ? $5 ?

4. At ⅔ of a dollar a yard, what will 4 yards of cloth cost ?

SOLUTION. 4 yards will cost 4 times ⅔ or ⅔ of a dollar, equal to $2⅔.

$$\frac{2}{3} \quad \frac{5}{8} \quad \frac{3}{7} \quad \frac{4}{9} \quad \frac{5}{6} \quad \frac{8}{10} \quad \frac{9}{12} \quad \frac{3}{5} \quad \frac{7}{9} \quad \frac{8}{11}$$

Read each of the above as *twice* as large ; thus, from left to right, ⅘, ₁₀⁰, etc. Then, in the same manner, multiply by 3, 4, 5, etc., to 12.

5. At ⅔ of a dollar a pound, what will 6 pounds of butter cost ? 8 pounds ? 9 pounds ?

6. If a ton of hay cost $21, what will 3 sevenths of a ton cost ? 2 thirds of a ton ?

7. A boy having 20 marbles, gave ¼ of them to one companion, and ⅕ to another. How many had he left ?

8. Jane paid 25 cents for a book, and ⅘ as much for a slate. What did she pay for the slate ?

9. Fanny is 14 years old, and her sister is ⅘ as old. How old is her sister?

10. What will be the cost of 6 boxes of figs, at $⅝ a box ?

11. If 1 pineapple cost ⅗ of a dollar, what will 4 pineapples cost ? What will 6 cost ? 8 ? 9 ? 10 ?

12. If a basket hold ⅘ of a bushel, how much will 4 baskets hold ? 6 baskets ? 7 baskets?

13. What will 4 lb. of tea cost, at $¾ a pound ? At $⅜ ? At $⅝ ? At $⅘ ?

14. What cost ¾ lb. of coffee, at 28 cents a pound ?

58. *1.* How many oranges in $\frac{4}{2}$ of an orange? In 7 thirds? In 9 thirds? In 10 thirds?

2. How many yards in $\frac{7}{4}$ of a yard? In $\frac{5}{4}$ of a yard? In $\frac{10}{8}$? In $\frac{12}{8}$? In $\frac{14}{8}$?

3. Prepare the above, on slate or paper, in tabular form; thus,

$\frac{4}{2}$ oranges $= 2$ oranges, $\frac{7}{4}$ yd. $= 1\frac{3}{4}$ yd.,
$\frac{9}{4}$ oranges $= 2\frac{1}{4}$ oranges, $\frac{5}{4}$ yd. $= 1\frac{1}{4}$ yd.,
                        etc.   etc.

4. Extend the work to improper fractions whose denominators are 6, 7, 8, etc., to 12, and applying the fractions to bushels, gallons, miles, acres, etc.

5. If 3 books cost 12 fifths of a dollar, what is the cost of 1 book?

SOLUTION.   One book will cost 1 *third* of 12 fifths, or $\$\frac{4}{5}$.

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

6. Divide the above by 2, or take $\frac{1}{2}$ of each fraction, by dividing the numerator; thus, $\frac{1}{2}$ of $\frac{10}{11} = \frac{5}{11}$; $\frac{1}{2}$ of $\frac{2}{10} = \frac{1}{10}$, etc.

7. Prepare table-work on slate or paper; thus,

$\frac{1}{2}$ of $\frac{10}{11} =$ $\frac{1}{2}$ of $\frac{4}{5} =$ $\frac{1}{4}$ of $\frac{8}{9} =$
$\frac{1}{2}$ of $\frac{6}{11} =$ $\frac{1}{3}$ of $\frac{6}{11} =$ $\frac{1}{4}$ of $\frac{12}{13} =$
$\frac{1}{4}$ of $\frac{4}{5} =$ $\frac{1}{3}$ of $\frac{2}{10} =$ $\frac{1}{7}$ of $\frac{14}{15} =$
                etc.   etc.   etc.

8. If 4 pounds of coffee cost $\frac{4}{5}$ of a dollar, what will 1 pound cost? What will 5 pounds cost?

9. If 3 yards of muslin cost $\frac{9}{10}$ of a dollar, what will 4 yards cost? 5 yards? 7 yards? 10 yards?

10. If a man walks $\frac{3}{4}$ of 12 miles in 1 hour, how far can he *walk in 3 hours?*   How far in $\frac{1}{4}$ of an hour?

11. If 3 pounds of coffee cost $\$\tfrac{9}{10}$, what will 1 pound cost? What will 5 pounds cost?

12. If 4 yd. of ribbon cost $\$\tfrac{4}{5}$, what will 3 yd. cost? 5 yd.? 7 yd.? 10 yd.?

13. If a man walks $\tfrac{5}{6}$ of 6 mi. in 1 hour, how far can he walk in 3 hr.? How far in $\tfrac{1}{3}$ of an hour?

14. If 5 bu. of oats are worth $\$1\tfrac{4}{5}$, what is 1 bushel worth? 3 bu.? 6 bu.? 10 bu.?

15. If 3 fourths of a bushel of cranberries are worth $3, what is $\tfrac{1}{2}$ of 6 bushels worth?

16. At $4 a yard, what will $2\tfrac{1}{2}$ yd. of cloth cost?

SOLUTION. $2\tfrac{1}{2}$ yards will cost $2\tfrac{1}{2}$ times $4; 2 times $4 are $8, and $\tfrac{1}{2}$ of $4 is $2, which added to $8 make $10.

17. At $10 a barrel, what will $\tfrac{1}{2}$ bbl. of flour cost? What will $\tfrac{3}{5}$ of a barrel cost? $2\tfrac{1}{4}$ bbl.?

18. At $\tfrac{3}{4}$ of 16 cents a pound, what will $\tfrac{1}{2}$ of a pound of sugar cost? $\tfrac{1}{3}$ of a pound? $1\tfrac{1}{2}$ pounds? $2\tfrac{1}{4}$ pounds?

19. At $15 a ton, what will $\tfrac{2}{3}$ of a ton of hay cost? $\tfrac{1}{5}$ of a ton? $1\tfrac{1}{4}$ tons? $1\tfrac{2}{3}$ tons?

20. If a barrel of pork cost $15, what will $\tfrac{2}{3}$ of it cost? $\tfrac{3}{5}$?

21. What will $\tfrac{5}{6}$ of a bushel of chestnuts cost, at 10 cents a quart? $\tfrac{3}{4}$ of a bushel at 8 cents a quart?

22. If 10 lb. of sugar cost $.80, what part of 80 cts. will 3 lb. cost? 5 lb.?

23. If 3 lb. of raisins cost $\$\tfrac{4}{5}$, what will 1 lb. cost?

24. If 4 slates cost $\$\tfrac{4}{5}$, what will 1 slate cost?

25. If 5 lb. of sugar cost $\$\tfrac{4}{5}$, what will 1 lb. cost?

26. At $1\tfrac{1}{4}$ a basket, what will 2 baskets of peaches cost? 5 baskets? 10 baskets?

27. If $2\tfrac{1}{2}$ yd. of cloth cost $10, what is the cost of $\tfrac{1}{2}$ a yard? Of 1 yd.? Of 2 yd.?

FOR WRITTEN SOLUTION.

59. *1.* Harry paid $\$\frac{3}{4}$ for a knife, $\$\frac{1}{3}$ for a book, and $\$\frac{1}{4}$ for a necktie. What did he pay for all ?

WRITTEN SOLUTION. $\$\frac{3}{4} + \$\frac{1}{3} + \$\frac{1}{4} = $ *what he paid for all.*

ORAL SOLUTION.   He paid the sum of $\$\frac{3}{4}$, $\$\frac{1}{3}$, and $\$\frac{1}{4}$, which is $\$1\frac{1}{3}$.

2. A grocer sells $\frac{1}{3}$ of a box of tea from a box $\frac{3}{4}$ full.   What part of the whole box is left ?

WRITTEN. $\frac{3}{4} - \frac{1}{3} = $ *the part that is left.*

ORAL.   There was left the *difference* between $\frac{3}{4}$ and $\frac{1}{3}$, which is $\frac{5}{12}$.

3. If a man earn $\$\frac{9}{10}$ a day, what will he earn in 6 days?

WRITTEN. $\$\frac{9}{10} \times 6 = $ *what he will earn in 6 days.*

ORAL.   He will earn 6 times $\$\frac{9}{10}$, or $\$\frac{54}{10}$, equal to $\$5\frac{4}{10}$.

4. If $\frac{2}{3}$ of a barrel of flour is divided equally among 3 poor families, what part of a barrel will each receive ?

WRITTEN. $\frac{2}{3}$ bbl.$\div 3$, or $\frac{1}{3}$ of $\frac{2}{3} = $ *what each will receive.*

ORAL.   Each family will receive $\frac{1}{3}$ of $\frac{2}{3}$ bbl., or $\frac{2}{9}$ of a barrel of flour.

5. If a man earns $\$15$ a week, and spends $\frac{2}{3}$ of it, how much does he save ?

6. If 3 oranges are worth $\frac{2}{3}$ of a melon, what part of the melon is 1 orange worth ?

7. Rollin had 18 marbles, and gave $\frac{2}{3}$ of them to Martin. How many marbles did he give Martin, and how many did he keep for himself ?

8. Andrew is 18 years old, and his sister Jane is $\frac{4}{9}$ as old. How old is Jane?

9. Paid $\$36$ for 1 acre of land.   What is $\frac{1}{3}$ of it worth? $\frac{2}{3}$? $\frac{1}{4}$? $\frac{3}{4}$?

10. If 1 man consume $\frac{3}{4}$ of a pound of meat in a day, how many pounds would 6 men consume?

11. Oliver having 20 qt. of blueberries, sold $\frac{3}{5}$ of them for $\$\frac{9}{20}$.   What was that a quart?

DECIMALS.

60. The numbers 1000, 100, 10, 1, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, etc., increase from right to left, and decrease from left to right, by the same uniform scale of *ten*. Thus, 1000 is ten times 100 ; 100 is 10 times 10; 10 is ten times 1 ; 1 is ten times $\frac{1}{10}$, etc. Also, $\frac{1}{1000}$ is one tenth of $\frac{1}{100}$; $\frac{1}{100}$ is one tenth of $\frac{1}{10}$; $\frac{1}{10}$ is one tenth of 1; 1 is one tenth of 10, etc. The value of any decimal figure is always $\frac{1}{10}$ of the value of the same figure in the next place to the left.
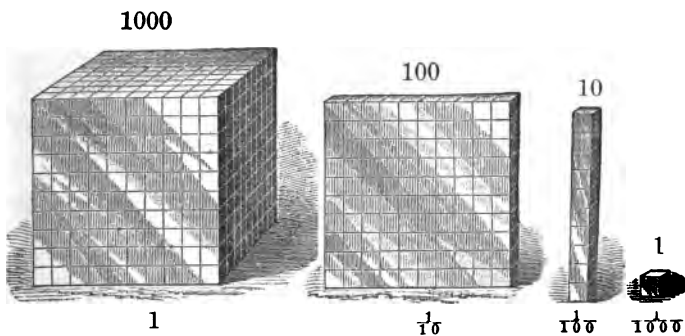
61. Decimal fractions may be written in two ways; either as *other fractions*, the denominator being expressed, or in *decimal notation*, the denominator being omitted. Thus,

$\frac{5}{10}$, or .5 is read 5 tenths, and is $\frac{1}{10}$ of 5 units.

$\frac{5}{100}$, " .05 " 5 hundredths, " $\frac{1}{10}$ " 5 tenths.

$\frac{5}{1000}$, " .005 " 5 thousandths, " $\frac{1}{10}$ " 5 hundredths.

The name of the first order at the right of units is tenths ; of the second, *hundredths ;* of the third, thousandths.

62. The unit is the standard by which we compare all numbers. Therefore, to determine the order of units at a glance, a *point* is placed on the right of the order of units, and before the order of tenths.

It is written thus, (.), and is called the ***decimal point.*** Its only purpose is to determine the place of the order of units, and it must never be omitted.

Thus, in the number 62.55, the *point* shows the order of units, 2; and as we read sixty-two *units*, so we read fifty-five *hundredths*, giving to it the name of the lowest order.

63. When an integer and decimal are written together, the expression is a ***mixed number* (52, 4).**

Mixed numbers involving decimals are read in the same manner as mixed numbers involving common fractions.

Thus, .07 is read *seven hundredths*, .58 is read *fifty-eight hundredths*, 25.34 is read, *twenty-five and thirty-four hundredths.*

64. The relation of decimals and integers is clearly shown in the following Table:

Read as follows, always using the word *"and"* between the integer and decimal:

	Ten-thousands	Thousands	Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths	Ten-thousandths
425 and 37 *hundredths.*			4	2	5	.	3	7		
1046 and 65 *thousandths.*		1	0	4	6	.	0	6	5	
32400 and 456 *thousandths.*	3	2	4	0	0	.	4	5	6	
87 and 75 *ten-thousandths.*				8	7	.	0	0	7	5
4328 and 169 *thousandths.*		4	3	2	8	.	1	6	9	
7000 and 7 *ten-thousandths.*		7	0	0	0	.	0	0	0	7

INTEGERS.   DECIMALS.

65. Read the following numbers, naming all the orders, until the names of the decimal orders are as familiar as those of the integers :

1.	.7.	*11.*	.6.	*21.*	5.5.
2.	.07.	*12.*	.67.	*22.*	50.05.
3.	.77.	*13.*	.008.	*23.*	55.55.
4.	.007.	*14.*	.327.	*24.*	500.005.
5.	.077.	*15.*	.6489.	*25.*	550.055.
6.	.777.	*16.*	.075.	*26.*	555.555.
7.	.027.	*17.*	.673.	*27.*	600.006.
8.	.037.	*18.*	.4859.	*28.*	660.066.
9.	.099.	*19.*	.0039.	*29.*	666.666.
10.	.999.	*20.*	.0476.	*30.*	999.999.

Additional examples may be given, at the option of the teacher.

DRILL EXERCISES.

66. *1.* Express in decimal form $\frac{9}{100}$. *Ans.* $\frac{9}{100} = .09$.

ORAL SOLUTION. The numerator is 9, the denominator 100 ; the decimal is expressed by a *point, naught, nine ;* thus, .09, and is read *nine hundredths.*

In like manner analyze and express,

2.	$\frac{9}{10}$.	*5.*	$\frac{49}{100}$.	*8.*	$\frac{14}{100}$.	*11.*	$\frac{20}{100}$.
3.	$\frac{24}{100}$.	*6.*	$\frac{125}{1000}$.	*9.*	$\frac{7}{1000}$.	*12.*	$\frac{8}{1000}$.
4.	$\frac{4}{10}$.	*7.*	$\frac{22}{1000}$.	*10.*	$\frac{102}{1000}$.	*13.*	$\frac{30}{1000}$.

The teacher should exercise the class *orally* by rapidly dictating similar examples, thus : " The denominator is 100, the numerator 5 ; what will express the decimal ?" The prompt response should be, " *Point, naught, five,* read *five hundredths* " (.05).

Ques. " The denominator is 1000, the numerator 26 ?"
Ans. " *Point, naught, two, six,* read *twenty-six thousandths* " (.026).

67. *1.* Express in form of a common fraction .09.

$$Ans. \ .09 = \tfrac{9}{100}.$$

ORAL SOLUTION. The numerator is 9, the denominator 100, and the fraction is $\tfrac{9}{100}$.

In like manner analyze and express,

2. .6.	*4.* .02.	*6.* .28.	*8.* .45.	*10.* .024.
3. .009.	*5.* .075.	*7.* .150.	*9.* .204.	*11.* .040.

Oral exercises similar to the following should be freely used. The teacher pronounces distinctly, "*Point, naught, five.*" The pupil promptly responds. "The numerator is *five*, the denominator *one hundred*, and the fraction is *five hundredths*" ($\tfrac{5}{100}$).

Ques. "*Point, naught, two, six?*" *Ans.* "The numerator is *twenty-six*, the denominator *one thousand*, and the fraction is *twenty-six thousandths*" ($\tfrac{26}{1000}$).

ADDITION AND SUBTRACTION.

INDUCTIVE EXERCISES.

68. *1.* What is the *sum* of 3 *tenths* and 6 *tenths?* Of $\tfrac{5}{10}$ and $\tfrac{7}{10}$? Of .6 and .4? Of .3, .4, and .5?

2. What is the *difference* between 7 *tenths* and 4 *tenths?* Between 12 *hundredths* and 8 *hundredths?*

3. What is the difference between $\tfrac{9}{10}$ and $\tfrac{5}{10}$? .7 and .4? $\tfrac{15}{100}$ and $\tfrac{12}{100}$? .15 and .11?

4. What is the *sum* of 8 *tenths* and 3 *tenths?* The difference?

5. What is the sum and difference of .07 and .12?

6. From $\tfrac{25}{100}$ take $\tfrac{16}{100}$. From .36 take .12.

7. From $\tfrac{17}{1000}$ take $\tfrac{8}{1000}$. From .028 take .010.

8. What is the sum of .12 and .20? .15 and .25?

WRITTEN EXERCISES.

69. *1.* What is the sum of 2.12, 13.07, 7.8, and .31 ?

Write the numbers so that units of the same order stand in the same column.
Add as in whole numbers.

$$\begin{array}{r} 2.12 \\ 13.07 \\ 7.80 \\ .31 \\ \hline 23.30 \end{array}$$

In like manner add the following:

(2.)	(3.)	(4.)	(5.)
42.3	12.326	4031.06	.608
13.06	204.09	108.304	.031
8.049	8.302	9.031	.803
1.6	52.007	76.739	.086
.037	324.1	250.046	.910

70. *1.* From 7.63 subtract 5.4.

Write the given numbers as in addition, the subtrahend under the minuend, and then subtract as in integers.

$$\begin{array}{r} 7.63 \\ 5.40 \\ \hline 2.23 \end{array}$$

In like manner, solve and prove the following:

	(2.)	(3.)	(4.)	(5.)
From	18.5	2.8706	.50376	.36
Subtract	2.3476	.49	.064	.127084

6. 405.327 + 64.03 + .846 + 121.8 + 7.42 = ?

7. $18.19 + $142.095 + $.96 + $5.12 + $40.50 = ?

8. 327.64 — 104.36 = ?   *10.* 610.324 — 84.036 = ?

9. $125.75 — $41.48 = ?   *11.* $500.50 — $75.45 = ?

12. A man having $1000 in bank, drew out $450.62. How *much remained in bank ?*

13. A grocer bought a barrel of sugar for $21.84, a box of tea for $42.37, a cheese for $6.08, and a tub of butter for $10.12. What was the cost of all?

WRITTEN. $21.84 + $42.37 + $6.08 + $10.12 = *cost of all.*

14. A man bought a farm for $4640, and sold it for $5027.50. How much did he gain?

WRITTEN. $5027.60 − $4640 = *what he gained.*

15. A man having $14725, gave $3560 for a store, and $7015.87 for goods. How much money had he left?

16. Borrowed $25 and returned $15.60. How much remained unpaid?

17. A man owning 475 acres of land, sold at different times 80.75 acres, 100 acres, and 125.625 acres. How much land had he left?

MULTIPLICATION.

INDUCTIVE EXERCISES.

71. *1.* How much is 4 times $\frac{1}{10}$? 3 times .2?

2. How much is 6 times $\frac{8}{100}$? 4 times .04?

3. What is the product of $\frac{2}{100} \times 3$? .02 × 3?

4. What is the product of $\frac{2}{10} \times \frac{3}{10}$? .2 × .3?

5. What is the product of $\frac{2}{100} \times \frac{3}{10}$? .02 × .3?

6. What is the product of $\frac{2}{100} \times \frac{3}{100}$? .02 × .03?

7. How much is 6 times .6 of a dollar? 7 times $\frac{8}{100}$ of a dollar? 8 times .004 of a dollar?

8. How much is 2 × .5? 2 × .05? 2 × .005? 2 × .0005?

9. How many decimal places in the product of *tenths* multiplied by *units? Tenths* by *tenths? Tenths* by *hundredths?*

STATEMENT.—The number of decimal places in any product is equal to the decimal places in both factors.

DRILL TABLE.

72. *1.* Multiply by 10, reading rapidly, giving only results; thus, 4.25 mi., 2.75 rd., etc.   .425 mi.
.275 rd.
.665 da.

2. Then multiply by 100, in the same way; thus, 42.5 mi., 27.5 rd., etc.   .750 tons.
.742 bu.

3. Write the results on slate or paper.   .443 lb.

4. Repeat: (1.) I multiply by 10, by removing the order of units *one* place to the *right.* (2.) I multiply by 100 by removing the order of units *two* places to the *right.* (3.) Any order represents units 10 times as large as the order on its right, and $\frac{1}{10}$ as large as the order on its left.   .506 pk.
.246 ft.
.284 in.
.505 A.
.555 A.
.550 A.

5. Write, and thoroughly fix in mind, that

$$\tfrac{1}{2} = .5, \qquad \tfrac{1}{4} = .25, \qquad \tfrac{3}{4} = .75.$$

6. Name, *at sight,* the number of decimals in the product:

$.07 \times 9.9$	$.33 \times 6.2$	$4.25 \times .005$
$6 \times .05$	$.003 \times 10$	1.361×1.04
$3 \times .006$	1.25×100	$.425 \times .262$

WRITTEN EXERCISES.

73. *1.* Multiply .56 by .4.

Multiply as in whole numbers, and since *hundredths* multiplied by *tenths* produces *thousandths*, the product must contain *three* decimal places, or as many as both factors contain. (STATEMENT.)

$$\begin{array}{r} .56 \\ .4 \\ \hline .224 \end{array}$$

	(*2.*)	(*3.*)	(*4.*)	(*5.*)
Multiply	4.6	43.26	.234	75.1
By	3.3	4.5	.23	.28

What is the result of

6. 4 times $3.45 ?	*10.* $6.25 × .5 ?	*14.* $4.6 × .04 ?
7. 6 times .32 ?	*11.* 3.8 × .22 ?	*15.* 743 × 6.04 ?
8. 26 times 2.07 ?	*12.* $12.05 × .07 ?	*16.* 28.7 × .25 ?
9. 15 times .28 ?	*13.* .506 × .42 ?	*17.* .18 × $.5.02 ?

Multiply and express the product in decimals:

18. 25 by 25 hundredths.	*24.* .014 by 10.
19. 136 by 3 hundredths.	*25.* .875 by .08.
20. 54 units by 9 tenths.	*26.* .046 by 46.
21. 56 hundredths by 2 and 6 tenths.	*27.* $276.75 by .75.
22. $48.50 by .25.	*28.* .8752 by 4.5.
23. 3.456 by 100.	*29.* .304 by 100.

30. What is the cost of 3000 pounds of wool, at $.37?

31. In 1 rod is 16.5 ft.   How many feet in 30 rods?

32. If a man travel 3.75 miles an hour, how far will he travel in 9.5 hours?

33. What is the cost of 25 bushels of corn, at $.75 a bushel?

34. At $2.12 a yard, what will 18 yards of silk cost?

35. At $.87 apiece, what will be the cost of 9 turkeys?

36. If a sack of salt contain 94.16 pounds, how many pounds will 17 such sacks contain?

37. If a man spend $.87 in 1 day, how much will he spend in 15.52 days?

38. Find the cost of 275 bu. of oats, at $.42 a bushel?

39. Bought 124 acres of land at $35.75 an acre, and sold the whole for $6000.   Did I gain or lose, and how much?

40. If an acre of land produce 35.7 bushels of wheat, how many bushels will 5.12 acres produce?

41. If a boy earn $.87 in 1 day, how much will he earn in *9.5 days?*

DIVISION.

INDUCTIVE EXERCISES.

74. *1.* What is $\frac{1}{3}$ of $\frac{9}{10}$? $\frac{1}{4}$ of $\frac{24}{100}$? $\frac{1}{3}$ of $\frac{45}{1000}$?

2. What is $\frac{1}{2}$ of .8? $\frac{1}{4}$ of .42? $\frac{1}{3}$ of .072?

3. Divide .8 by 4; .56 by 7; .12 by .04; .024 by .006.

4. Divide $\frac{48}{10}$ by $\frac{4}{10}$; $\frac{45}{100}$ by $\frac{9}{100}$; $\frac{36}{1000}$ by $\frac{6}{1000}$.

5. Divide .48 by 6; .48 by .06; .048 by .006.

6. Multiply $\frac{8}{10}$ by $\frac{9}{10}$ (.8 × .9). Divide .72 by .9.

7. Multiply $\frac{8}{100}$ by $\frac{9}{100}$ (.08 × .09). Divide .0072 by .09.

8. How many decimal places in the quotient when *tenths* are divided by *units? Tenths* by *tenths? Hundredths* by *hundredths? Hundredths* by *tenths?*

STATEMENT.—*The quotient must contain as many decimal places as the number of decimal places in the dividend is greater than the number of decimal places in the divisor*

DRILL TABLE.

75. *1.* Divide by 10, giving only results ; thus, 32.7 ft., 50.6 bu., etc.

2. Then divide by 100 in the same way ; thus, 3.27 ft., 5.06 bu., 8.25 rd., etc.

3. Write the results on slate or paper.

4. Repeat: I divide by 10 by removing the order of units *one* place to the *left.* I divide by 100 by removing the order of units *two* places to the *left.*

327	ft.
506	bu.
825	rd.
340	yr.
761	da.
915	gal.
284	qt.
473	yd.
800	A.

5. From the *open book,* on page 110, have the pupil divide each number in each of the columns E, F, and G, by 10, 100, and 1000, naming rapidly, only results.

Name, *at sight,* the number of decimals in the *quotient :*

$16.4 \div 4$	$3.76 \div .8$	$81.6 \div 3.6$
$2.25 \div 9$	$.624 \div .6$	$1.245 \div .27$
$.675 \div .15$	$.9520 \div .7$	$645.5 \div 5.$

WRITTEN EXERCISES.

76. *1.* What is the quotient of .624 divided by .6?

Divide as in whole numbers, and since the dividend contains *three* decimal places and the divisor *one*, the quotient must have *two* decimal places. (STATEMENT.)

$$.6 \overline{)\ .624}$$
$$1.04$$

2. Divide 3.475 by 25 ; by 2.5; by .25 ; by .025.

3. Divide 7.2 by 6 ; by 12 ; by 8; by 9.

4. How many times is 7 contained in 8.4? In .84? In .084? In .0084 ?

5. Divide 8.176 by 7.	*8.* Divide $41.45 by .5
6. Divide .675 by .15.	*9.* Divide 3.76 by .8.
7. Divide $26.64 by 8.	*10.* Divide 17.6 by 44.

11. Divide 88.476 by 1.2; by 3.6; by .25.

12. If 2.5 acres produce 534.75 bushels of wheat, how much does one acre produce ?

13. How many building lots can be made of 2.16 acres of land, allowing .18 of an acre to a lot ?

14. If 3 bbl. apples cost $19.125, find the cost of 100 bbl.?

15. A farmer sold 120 bushels of rye, at $1.125 a bushel, for which he received 27 barrels of flour. What was the cost of the flour a barrel ?

16. If a man build 812.5 rods of fence in 100 days, how many rods does he build each day ?

17. If 35 yd. of cloth cost $122.50, what will 29 yd. cost?

MEASUREMENTS.

77. *1.* We measure *lines, surfaces,* and *solids.*

2. A *line* is *length* only.

3. **Linear measure,** also called **long measure,** is used in measuring *lines.*

TABLE.

12	Inches	= 1 Foot.	16¼	Feet	= 1 Rod.
3	Feet	= 1 Yard.	5280	Feet	= 1 Mile.
5½	Yards	= 1 Rod.	4	Inches	= 1 Hand.
320	Rods	= 1 Mile.	6	Feet	= 1 Fathom.

4. The **units** of linear measure are *lines.*

5. In 10 inches, what is the *unit* of measure?

                  Ans. A line 1 inch long.

6. What is the unit of measure for 12 rd. ? 15 ft. ? 9 yd. ?

7. How many inches in 10 ft. ? In 20 ft. ? In 5 ft. ?

8. How long is this book ? How wide is it ?

In any line there are 12 times as many inches as feet.

4 ft. 8 ft. 6 ft. 5 ft. 10 ft. 7 ft. 3 ft. 9 ft.

9. Change the above to inches, by reading rapidly 48 in., 96 in., etc.

10. Express the same on the slate, thus: in 4 ft., 4 × 12 = the number of inches, etc.

Always read the numbers connected by the sign ×, from right to left. Do the same with the sign ÷, when you read it as "*in.*"

11. In any line there are $\frac{1}{12}$ as many feet as inches.

48 in. 84 in. 60 in. 120 in. 96 in. 72 in. 36 in.

12. Pupil should read rapidly, thus : 4 ft., 7 ft., etc.

13. Expressed, $\frac{48 \text{ in.}}{12}$, or $\frac{1}{12}$ of 48 in. = 4 ft., etc.

14. How many feet in 1 yd.?   How many inches?

15. How many feet in 3 yd. 2 ft.?   In 3 fathoms?   In 5½ yd.?

16. What is measured by the fathom?   By the hand?

17. How many feet deep is a river that measures 5 fathoms? 3 fath. 4 ft.?   4½ fath.?

18. How many feet high is a horse that measures 15 hands?

78.   *1.* A *surface* has *length* and *breadth.*

2. Square measure is used in measuring *surfaces.*

TABLE.

144	Square Inches (*sq. in.*) = 1 Square Foot, . .	*sq. ft.*
9	Square Feet = 1 Square Yard, . .	*sq. yd.*
30¼	Square Yards = 1 Sq. Rod or Perch,	*sq. rd.; P.*
160	Square Rods = 1 Acre, ...	*A.*
640	Acres = 1 Square Mile, . .	*sq. mi.*
36	Square Miles = 1 Township, . . .	*Tp.*

A *square mile* of land is also called a *section*, and is 1 mi. square.

3. A *rectangle* is a plane surface bounded by four straight lines, having all its angles *right angles.*

Rectangle.   Square.

4. A *square* is a rectangle whose sides are *equal.*

5. The *units* of square measure are *squares.*

6. In 10 square inches, what is the *unit* of measure.
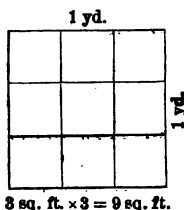
SQUARE INCH   1 inch.

1 inch.

Ans. A square, 1 inch on each side, or a square inch.

7. What is the unit of 6 sq. in.?   Of 9 sq. ft.?   Of 20 sq rods?   Of 40 acres?

The diagram represents a square yard, each side of which is 1 yd. or 3 ft. long, and the whole is divided into square feet, 1 sq. ft. being the *unit of measure.* In one row there are 3 sq. ft., in 3 rows there are 3 times 3 sq. ft., or 9 sq. ft. Hence the *surface* or *area* of 1 sq. yd. is 9 sq. ft.

1 yd.

1 yd.

3 sq. ft. × 3 = 9 sq. ft.

8. Have pupils draw a square, 1 foot on a side, and divide it into square inches.

9. Practice drawing squares until the units are well in mind.

10. What is the *unit* of 6 sq. ft. ? Of 6 sq. yd. ?

11. How many square feet in the surface of a table 3 ft. wide and 4 ft. long? Illustrate by diagram.

*12.* How many square inches in a strip of board 12 in. long and 9 in. wide?

13. How many square feet in the floor of a hall 20 ft. long and 6 ft. wide ? 10 ft. long and 5 ft. wide ?

14. How do you find the *surface* or area of a square or rectangular figure ?

Ans. By taking the *product* of the numbers denoting its *two dimensions.*

79. *1.* A *section* of land is a square mile, subdivided as follows :

I Section.

A half-section   = 320 A.
A quarter-section   = 160 A.
A half-quarter-section   = 80 A.
A quarter-quarter-section = 40 A.
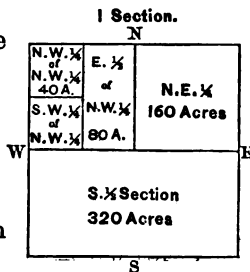
2. How many acres in 1 section ? In ½ section ? In N. E. ¼ section ?

3. A man owns one half of the N. W. quarter-section. How much land has he?

4. What part of a section is 80 A.? 160 A.? 320 A.?

5. What is the length of one side of a section of land ? How many miles around it? How many miles around a half-section? A quarter-section ?

6. How many square feet in a blackboard 12 ft. long and 3 ft. wide ? How many square yards?

7. Which is greater, 10 sq. in. or a 10 inch square? What is the difference ? Draw diagram.

8. How many squares, each equal to a square inch, are equal to a surface 1 ft. long and 9 in. wide ?

Pupils should prepare on their slates, filling out the blanks, work like the following:

1 square foot $= 144$ sq. in.	1 square yard $=$ 9 sq. ft.
2 sq. ft. $= -$ "	5 sq. yd. $= -$ "
10 sq. ft. $= -$ "	20 sq. yd. $= -$ "
20 sq. ft. $= -$ "	12 sq. yd. $= -$ "
$1\frac{1}{3}$ sq. ft. $= -$ "	$2\frac{1}{3}$ sq. yd. $= -$ "
$\frac{1}{2}$ sq. ft. $= -$ "	$\frac{1}{3}$ sq. yd. $= -$ "
$\frac{1}{4}$ sq. ft. $= -$ "	$\frac{3}{5}$ sq. yd. $= -$ "

1 Acre $= 160$ sq. rd.	1 section $= 640$ acres.
5 A. $= -$ "	2 sec. $= -$ "
10 A. $= -$ "	10 sec. $= -$ "
$2\frac{1}{2}$ A. $= -$ "	$1\frac{1}{2}$ sec. $= -$ "
$\frac{1}{2}$ A. $= -$ "	$\frac{1}{2}$ sec. $= -$ "
$\frac{1}{4}$ A. $= -$ "	$\frac{1}{4}$ sec. $= -$ "
$\frac{1}{8}$ A. $= -$ "	$\frac{1}{8}$ sec. $= -$ "

1 fathom $=$ 6 feet.	1 hand $=$ 4 inches.
5 fath. $= -$ "	5 hands $= -$ "
$10\frac{1}{2}$ fath. $= -$ "	$12\frac{1}{2}$ hands $= -$ "
$\frac{1}{4}$ *fath.* $= -$ "	15 hands $= -$ "

The teacher should *dictate,* and the pupils express solutions on slate or paper, thus:

TEACHER.—How much surface in a board 8 ft. long and 3 ft. wide?

PUPIL writes: $8 \times 3 = $ *square feet in the blackboard.*

TEACHER.—Find the surface in a pane of glass 12 inches by 9 inches.

PUPIL.—$12 \times 9 = $ *square inches in pane of glass.*

A few minutes spent in this kind of drill will practically fix surface measures in mind.*

80. *1.* A *solid* or *body* has *three* dimensions—*length, breadth,* and *thickness.*

2. **Cubic** or **solid measure** is used in measuring *solids.*

TABLE.

1728 Cubic Inches (*cu. in.*) = 1 Cubic Foot, . . *cu. ft.*
27 Cubic Feet = 1 Cubic Yard, . *cu. yd.*

3. A *rectangular solid* is a body bounded by six rectangular plane *faces.*
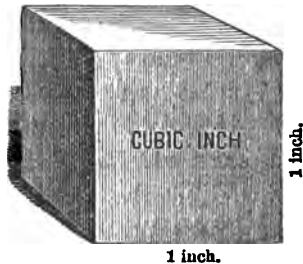
Rectangular Solid.   Cube.

The opposite sides are equal and parallel.

4. A *cube* is a rectangular body whose faces are *all equal.*

5. The *units* of cubic measure are *cubes.*

6. In 10 cubic inches, what is the unit of measure?

Ans. A cube, the edge of which is 1 inch, or a cubic inch.

CUBIC INCH

1 inch.

1 inch.

---

* If pupils are supplied with rulers showing inches, they should measure and compute from their own data, in feet or inches, not taking note of the small parts, but using the nearest whole inch.

See "*Suggestions,*" page vi, 16 and 17.

7. What is the unit of 4 cu. in.?　Of 27 cu. ft.?　Of 9 cu. yards?

*8* How many cubic inches in 1 cu. ft. 20 cu. in.?

9. How many cubic feet in 2¼ cubic yards?

10. What part of a cubic yard is 9 cu. ft.?　18 cu. ft.?

11. How many cubic feet in a piece of timber 1 foot square at the ends and 3 feet long?　In 2 such pieces?

12. A *cubic yard* is a cube each *face* of which is 1 sq. yd., and each *edge* 1 yd.. or 3 ft., long.

The diagram represents a cubic yard, each face being a sq. yd., containing 9 sq. ft.　If a section 1 ft. thick is cut from one side, it may be divided into 3 times 3 cu. ft., or 9 cu. ft., 1 cu. ft. being the *unit of measure.*　And since the cubic yard is 3 ft. thick, it contains 3 such sections, or 3 times 9 cu. ft.

9 cu. ft. × 3 = 27 cu. ft.
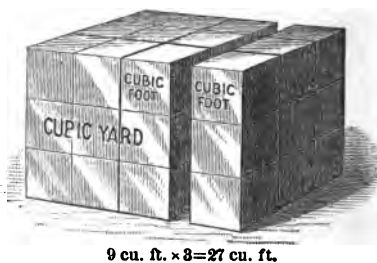
13. How many cubic feet in a block of marble 1 ft. thick, 3 ft. wide, and 6 ft. long?　2 ft. wide, 2 ft. thick, and 4 ft. long?

14. How many cubic inches in a cubic block whose edges are 3 inches long?　Are 4 inches long?

15. How do we find the *solidity*, or contents, of a cube, or of a rectangular body?

Ans. By taking the *product* of the numbers denoting the *three dimensions.*

16. What is the difference in a foot long and a foot square? In a square foot and a cubic foot?

17. How many inches long is a block in the form of a cubic *foot?　How* many wide?

16 Cu. Ft.   = 1 Cd. Ft., *cd. ft.*

8 Cd. Ft., or $\left.\begin{array}{l} \\ \\ \end{array}\right\}$ = 1 Cord,   .   *Cd.*
128 Cu. Ft.

18. A pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high, is a *cord*.

19. A *cord foot* is 1 foot in length of such a pile ; that is, 1 ft. long, 4 ft. wide, and 4 ft. high.

20. How many cubic feet in a pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high? In a pile 6 ft. long, 5 ft. wide, and 3 ft. high ?

21. If a stove burn 1 cord foot of wood in a week, in what time will it burn 1 cord? 2 cords? 3 cords?

22. How many cord feet in 2 Cd.? In 3 Cd.? In 5 Cd.?

23. How many cords in 24 cd. ft.? In 32 cd. ft.?

24. What part of a cord is a cord foot? 4 cd. ft.?

Let the pupils prepare on their slates, filling out the blanks:

1	cubic foot = 1728 cu. in.		1	cubic yard = 27 cu. ft.	
2	cu. ft.	= — "	5	cu. yd.	= — "
5	cu. ft.	= — "	2⅓	cu. yd.	= — "
10	cu. ft.	= — "	10	cu. yd.	= — "
½	cu. ft.	= — "	⅓	cu. yd.	= — "

1	Cord = 128 cu. ft.		1	cord-foot = 16 cu. ft.	
5	Cd.	= — "	5½	cd. ft.	= — "
3¼	Cd.	= — "	2¼	cd. ft.	= — "
½	Cd.	= — "	½	cd. ft.	= — "
¼	*Cd.*	= — "	¾	cd. ft.	= — "

Let the teacher *dictate* and the pupils express solutions :

25. How many cubic feet in a block of marble 4 ft. square, and 3 ft. thick ?

SOLUTION. $4 \times 4 \times 3 = $ *cubic feet in block of marble.*

26. How many cubic feet in a stick of timber 80 ft. long, 2 ft. wide, and 1 ft. thick ?

SOLUTION. $80 \times 2 \times 1 = $ *cubic feet in stick of timber.*

27. How many cubes, each equal to a cubic foot, are equal in volume to a box 6 ft. long, 4 ft. wide, and 3 ft. deep ?

28. How many cu. in. in a 4 inch cube ?   In a 5 inch cube ?

29. How many cubic feet in a pile of wood 12 ft. long, 6 ft. high, and 4 ft. wide ?

30. In a pile of tan bark 100 ft. long, 8 ft. high, and 4 ft. wide, how many cords?

31. How many cubic inches in a brick 8 in. long, 4 in. wide, and 2 in. thick?

32. How many cubic feet in a bin 60 ft. long, $4\frac{1}{2}$ ft. wide, and 3 ft. deep on the inside ?

33. How many cubic inch blocks will fill a mortise 1 ft. long, 3 in. wide, and 6 in. deep?

34. How many cords of wood in a pile containing 1280 cu. ft. ?   256 cd. ft. ?

35. How many cubic feet in a piece of timber a foot square and 20 ft. long?   What is it worth, at $.50 a cu. foot?

36. How many cubic feet in a block of granite 3 ft. square and 2 ft. thick.   What is its cost, at $1\frac{1}{2}$ a cu. foot?

37. How many cords of tan bark in a pile 24 ft. long, 8 ft. high, and 4 ft. wide?   What is the pile worth, at $5 a cord ?

38. How many cubic feet in a wall 30 ft. long, 8 ft. high, *and 1$\frac{1}{4}$ ft. thick?*

81. The number of *pounds* in a bushel, as fixed by law in the States named is as follows:

Commodities.	Cal.	Conn.	Ill.	Ind.	Iowa.	Ky.	La.	Mass.	Mich.	Minn.	Mo.	N. C.	N. J.	N. Y.	Ohio.	Or.	Penn.	Vt.	Wis.
Barley,	50		48	48	48	48	32	46	48	48	48	48	48	48	48	46	47	46	48
Buckwheat,	40	45	40	50	52	52		46	42	42	52	50	50	48		42	48	46	42
Clover Seed,			60	60	60	60			60	60	60		64	60	60	60			60
Indian Corn,	52	56	52	56	56	56	56	56	56	56	52	54	56	58	56	56	56	56	56
Oats,	32	28	32	32	35	33½	32	30	32	32	35	30	30	32	32	34	32	32	32
Rye,	54	56	54	56	56	56		56	56	56	56		56	56	56	56	56	56	56
Wheat,	60	56	60	60	60	60	60	60	60	50	60	60	60	60	60	60	60	60	60

Peas, beans, and potatoes are *usually* weighed 60 lb. to the bushel.

1. In this State, how many pounds make a half-bushel of wheat? ½ bu. of corn? ¼ bu. of oats? ⅓ bu. of barley?

2. How many pounds in a peck of oats in Ill.? In Iowa? In Conn.?

3. What is the cost of a peck of potatoes, at a cent a pound? Of a peck of beans, at 2 cents a pound?

4. What is the cost of ½ bu. of .clover-seed, at 8 cents a pound?

5. How many bushels of oats in a load weighing 1280 lbs.? Of barley weighing 1560 pounds?

6. In Mich., how many bushels are 1200 pounds of wheat? Of rye? Of corn? Of oats? Of beans? Of barley? Of buckwheat? Of clover seed?

7. What is the value of a load of oats in Conn., weighing 1860 pounds, at $.56 a bushel?

8. What will a California farmer receive for a load of corn weighing 2496 lb., at $.62 a bushel?

9. What is the value of 3 loads of potatoes, weighing respectively 1952 lb., 1860 lb., and 2128 lb., at $.50 a bushel.

10. In Ill., 1508 lb. of corn are equal to how many bushels? In *New York?* In N. Car.?

GENERAL REVIEW.

1. How many eggs in 5½ doz. ?   In 10 doz. and 8 ?

2. How many quires of paper in ½ a ream ?   In 2 reams ?

3. How many years in 4 score years and 10 ?

4. How many hours from 8 A. M. to 10 P. M. ?

5. How many minutes from 20 min. past 9 A. M. till noon ?

6. How many score in 100 ?   Pairs in 50 ?   Sets in 60 ?

7. At $2 a bushel, what must be paid for 3 bags of wheat, each containing 120 pounds ?

8. Bought ½ bu. of chestnuts for $2, and sold them for 20 cents a quart.   What was the gain ?

9. How many quart bottles can be filled from a vessel holding 2 gal. 3 qt. ?

10. How many quart boxes will 2 pk. 4 qt. fill?

11. How many cubic feet in 2 cu. yd. ?   In 3 cu. yd. ?

12. How many cubic feet in 3 cd. ft. ?   In 4 cd. ft. ?

13. In ¼ of a cord, how many cord feet ?   Cubic feet ?

14. How many cubic inches in a 10 inch cube ?

15. Find the difference between 12 cu. in. and a cubic foot.

16. If a vessel sink in 8½ fathoms of water, what is the depth in feet ?

17. How many feet in 6 yd. 2 ft. ?   Yards in 2 rods ?

18. How many rods in ½ a mile ?   In ¼ mi. ?   In ⅛ mi. ?

19. What part of a mile is 160 rd. ?   80 rd.?   32 rd. ?

20. At $⅓ a foot, what will 3 yd. 2 ft. of lead pipe cost?

21. In a lot 12 rd. long and 9 rd. wide, how many sq. rd. ?

22. Find the difference between 6 ft. square and a sq. yd.

23. Name the months that have 30 da. each ; 31 da.

24. How many days from Aug. 1 to Oct. 10 inclusive ?

25. How many days from May 6 to June 15 ?

26. What is the difference between 6 doz. and ½ doz. eggs ?

27. How many squares, each equal to a square foot, are equal to a surface 12 ft. long and 8 ft. wide ?

28. How many cubes, each equal to a cubic foot, are equal to a block 40 ft. long, 3 ft. wide, and 2 ft. thick ?

29. How many years, months, and days from your birthday to this date ; or, what is your age ?

30. If a bushel of plums cost $2, what is the cost of a peck ?

31. How many quart boxes will 3 pk. 6 qt. of berries fill? How many half-gallon measures ?

32. How long is the top of your desk ?   How wide?   How far is it around it ?   How many square inches does it contain ?

33. How many feet deep is a river, that measures 4½ fath. ?

34. At 4 cents a pint, what will 2 quarts of milk cost ?

35. At 20 cents a quart, what will be the cost of 3 gal. of molasses ?   Of 5½ gal. ?

36. A merchant bought a keg of nails for $7.50.   For what must he sell the same, to gain half a cent a pound ?

37. A grocer bought a barrel of sugar for $17.84, a box of tea for $36.12, a cheese for $4, and a tub of butter for $7.09. What was the cost of all?

38. A lady paid $45.40 for some furs, $12.40 for a dress, $5 for a bonnet and $1.25 for a pair of gloves.   What did she pay for all ?

39. How many bu. of potatoes in a load weighing 1920 lb. ?

40. How many lb. in 3 pk. of beans ?   In ¾ bu. of peas ?

41. How many barrels are 1000 pounds of beef?   Of pork?

42. *How many* pounds in 3 barrels of flour?   In 5 bbl.?

43. Which is heavier, a barrel of flour or a barrel of pork?
A keg of nails or a cental of grain?

44. Give the dimensions of a cord-foot.

45. How many cubic feet in a load of wood 8 ft. long, 4 ft.
wide, and 2 ft. high? How many cd. ft.? What part of a cd.?

46. What will be the cost of 3 miles of telegraph-wire, at
3 cents a foot?

47. What is the difference in feet between the length and
breadth of your school-room?

48. A man bought a piece of cloth containing 45 yards and
sold 69 feet. How many yards had he left?

49. In 3 tons of cheese, how many pounds? In 6½ tons?

50. Paid $20 for a barrel of beef. What is that a pound?

51. How many square feet of oil-cloth will cover an office
floor 15 ft. long and 12 ft. wide? How many square yards?

52. In 1 rod are 16.5 ft. How many feet in 8.7 rods?

53. A grocer bought 160 lb. of butter, at 14 cents a pound,
and paid 25 lb. of tea, worth 56 cents a pound, and the re-
mainder in cash. How much money did he pay?

54. What is the cost of a block of marble 4 ft. long, 4 ft.
wide, and 3 ft. thick, at $2 a cubic foot?

55. Bought 36 barrels of flour for $288, and sold the same
at $9.50 a barrel. What was gained by the bargain?

56. A bushel contains 2150.4 cubic inches. How many
more cubic inches in a bushel than in a cubic foot?

57. At $14.8 a ton, what will 5 tons of hay cost?

58. The temperature was noted in the morning at 40°, at
noon 65°, and at night 60°. What was the *average* or mean
temperature?

SOLUTION. $\dfrac{40 + 65 + 60}{3}$ = *the mean temperature.*

59. If a man work 7 hr. one day, 8 hr. the next, 5 hr. the next and 12 hr. the next, how many hours a day does he average ?

60. How many acres in $\frac{1}{2}$ of a section ?   In $\frac{1}{4}$ of a section ?

61. How many square feet in a surface 6 ft. square ?

62. How many square inches in the surface of a piece of copper 12 in. long and 9 in. wide ?

63. How many square rods in a lot 8 rd. long and 5 rd wide ?   What part of an acre does it contain ?

64. How many square yards in a floor 10 ft. long and 9 ft. wide ?   In a ceiling 12 ft. square ?   9 ft. by 12 ft. ?

65. What is the difference between 4 ft. square and 4 sq. ft. ?

66. How many half-sections in a township ?

67. At 3 cents a square foot, what is the cost of a board 15 ft. long and 2 ft. wide ?

68. Measure 5 rectangular surfaces, and compute their square contents.

69. Bought 3 barrels of flour at $6 a barrel, and sold it out at 4 cents a pound.   What was the whole gain?

70. At 4 cents a foot, what will 5 yards of wire cost ?

71. At 16 cents a yard, what will $2\frac{1}{4}$ yards of ribbon cost?

72. Find the cost of a cable 10 fath. long, at $1 a foot ; of a cable 8.5 fath. long, at $1.5 a foot.

73. Multiply 65 hundredths by 9 hundredths ; 3 and 7 hundredths by 45 hundredths.

74. Take $\frac{1}{2}$ of 800, and $\frac{1}{2}$ of the quotient, and continue until you reach $3\frac{1}{8}$.

75. Take $\frac{1}{4}$ of $2400, and $\frac{1}{4}$ of the quotient, until you reach $9.37\frac{1}{2}$.

76. Double 100 and the successive products, until you reach *6400.*

77. A dealer bought 60 gal. of milk at 12 cents a gallon, and sold it at 5 cents a quart. What did he gain ?

78. How many cubic feet in a room 18 feet long, 16 feet wide, and 10 feet high ?

79. From a *section* of land there was sold 240 acres. How much remained ?

80. How many bushels of wheat in 48 sacks, each containing 165 pounds, and what is it worth at $1.50 a bushel ?

81. How much will it cost to dig a cellar 24 ft. long, 18 ft. wide, and 6 ft. deep, at 2 cents a cubic foot ?

82. If granite weigh 175 pounds a cubic foot, what is the weight of a cubic yard ?

83. If a man buy 40 acres of land at $35 an acre, and 56 acres at $29 an acre, and sell the whole for $32 an acre, how much does he gain or lose ?

84. Bought a sack of flour for $3.12. How much change should I receive for a 5 dollar bill ?

85. Bought groceries to the amount of $1.87. How much change should I receive for a 2 dollar bill ?

86. I started on a journey with $50 and paid $10.62 railroad fare, $7.38 stage fare, $5.96 for board and lodging, and $.75 for porterage. How much money had I left ?

87. Find the cost of 50 barrels of apples, at $2¼ a barrel.

88. Paid $168.48 for 144 bu. of wheat. What was the price per bushel ?

89. If a section of land is divided equally among 10 men, how many acres does each man receive ?

90. How many inches in 2 yd. ? In 1½ yd. ? In ¼ yd. ?

91. Divide 6 score and 6 apples equally among 6 persons. *How many apples* will each have ?

92. Sold 15 tubs of butter for $195. What is that a tub ?

93. In 3 score how many dozen ?   In 5 score?

94. What is the cost of 10 tons of hay, at $8.25 a ton ?

95. If a pound of coffee cost .26 of a dollar, how many pounds can be bought for 2.08 dollars ?

96. Count by $\frac{1}{2}$'s to 10 ; by $\frac{1}{3}$'s to 4 ; by $\frac{1}{4}$'s to 2.

97. Write $\frac{1}{4}$ of each of the numbers from 20 to 40.

98. Take $\frac{1}{5}$ of each number, below 100, ending in 0 or 5.

99. What is the square of 7 ? of 9 ? of 20?   The cube of 3 ? of 4 ? of 10?

100. Express in Roman numerals $\frac{1}{2}$ of each even number between 20 and 50, inclusive.

101. Two men pay equally for a quarter-section of land, at $10 an acre.   How much does each man pay ?

102. How many rods of fence will enclose a quarter-section of land ?   What will be its cost, at $3 a rod ?

103. How much is $\frac{1}{2}$ a cental of wheat ?   2 centals of flour ?

104. At $3 a bushel, what will be the cost of 30 lb. of beans?

105. When pork is $24 a barrel, what is 25 lb. worth ?

106. What will 3 lb. 8 oz. of beef cost, at 12 cents a lb. ?

107. How long and wide is a pane of glass in the school-house window ?   How many panes in all the windows in the school-room ?   How many square inches in each pane ?

108. How many square feet of glass are there in one window of the school-room ?   How many in all the windows?

109. If 4 men can do a piece of work in 7 days, how long will it take 1 man to do it?

SOLUTION.   It will take 1 man 4 times 7 days, or 28 days.

110. In 1 gal. there are 231 cu. inches.   How many cu. in. in 10 gal. ?   In $\frac{1}{10}$ of a gal. ?   In $\frac{1}{100}$ of a gal. ?

111. How many square rods in a piece of land 30 rd. long and 25 rd. wide ?   How many rods of fence will enclose it?

112. $\frac{1}{2}+\frac{1}{3} = ?$ $\frac{5}{8}+\frac{1}{2} = ?$ $\frac{4}{7}+\frac{1}{2} = ?$ $\frac{5}{8}+\frac{5}{12} = ?$

113. $\frac{7}{8}-\frac{1}{2} = ?$ $\frac{3}{4}-\frac{5}{8} = ?$ $1-\frac{7}{10} = ?$ $1\frac{1}{2}-\frac{1}{4} = ?$

114. $\frac{8}{4}\frac{3}{4}\times 6 = ?$ $\frac{3}{4}$ bu. $\times 8 = ?$ $\frac{4}{5}$ cwt. $\times 4 = ?$ $\frac{4}{7}$ wk. $\times 5 = ?$

115. How many pecks in 300 bu.?   In $100\frac{1}{2}$ bu.?

116. There are 160 sq. rods in 1 acre.   How many sq. rods in 10 A.?   In .1 of an acre?   In .01 of an acre?

117. There are 1728 cu. inches in 1 cu. foot.   How many cu. in. in $\frac{1}{10}$ of a cu. ft.?   In $\frac{1}{100}$ of a cu. ft.?

118. At 6 cents a square foot, what will it cost to dress a stone that is 6 ft. long and 5 ft. wide?

119. There are 5280 ft. in 1 mile.   How many feet in .3 of a mile?   In .03?   In .001?   In .005?

120. There are 60 min. in 1 hour.   How many minutes in $\frac{1}{4}$ an hour?   In .5?   In $\frac{1}{4}$?   In .25?

121. How many breadths of carpeting 1 yd. wide will it require to cover a room 15 ft. wide?   18 ft. wide?

122. A room is 24 ft. long and 18 ft. wide.   How many breadths of carpeting 1 yd. wide will it take to cover the floor, if laid the long way of the room?

123. How many yards must be bought to cover the floor, allowing 2 yd. for waste in matching?

124. How many yards long must each breadth be?

125. If 2 men cut 4 cords of wood in 1 da., how much can 10 men cut in the same time?

SOLUTION.   10 men can cut 5 times as much as 2 men, or 5 times 4 cords, or 20 cords.

126. If 2 weeks board cost $10, what will 4 weeks board cost?   10 weeks?   20 weeks?

127. If 320 rd. of fence cost $600, what will 160 rd. cost?

SOLUTION.   *160* rd. will cost $\frac{1}{2}$ as much as 320 rd., or $\frac{1}{2}$ of $600, which *is equal to $300.*

128. If 30 da. board cost $12, what will 15 da. board cost?

129. If 2½ bbl. of potatoes cost $7, what will 5 bbl. cost?

130. If 5 cords of wood cost $30, what will 10 cords cost?

131. If ½ bu. of oats cost 20 cts., what is the cost of 10 bu.?

SOLUTION. 10 bu. will cost 20 times 20 cts., or 400 cts., equal to $4.

132. If 3 barrels apples cost $19.125, what will be the cost of 100 barrels?

133. A grocer·bought 12 firkins of butter, each containing 56 pounds, at 24 cents a pound; he afterward sold 5 firkins at 30 cents, and 7 firkins at 28 cents a pound. What was his whole gain?

From expressions like the following, let the pupil prepare, on slate or paper, practical examples; thus,

134. $7 + $5.

EXAMPLE. I paid $7 for a ton of coal, and $5 for a cord of wood. What did I pay for both?

135. 40 gal. — 10 gal.

Ex. From a cask containing 40 gal., 10 gal. were drawn out. How many gallons remained?

136. $8 × 6.

Ex. If a barrel of flour cost $8, what will 6 barrels cost?

137. $\dfrac{\$60}{5}$.

Ex. Paid $60 for 5 A. of land. What was the cost an acre?

In like manner, construct examples for the following:

138. 10 + 5.	*142.* 10 — 5.	*146.* $7 × 5.	*150.* $\frac{\$0}{8}$.
139. 15 + 20.	*143.* $20 — $8.	*147.* 10 × 6.	*151.* $\frac{\$0}{8}$.
140. $20 + $5.	*144.* 25 — 15.	*148.* 12 × 7.	*152.* $\frac{\$100}{10}$.
141. 40 + 10.	*145.* 50 — 10.	*149.* $50 × 3.	

153.   CHICAGO, June 20, 1884.

MR. LOUIS SCOTT,

Bought of JAMES BROWN.

67 pairs of calf boots......................@	$8.25	
75 " " gaiters ....@	1.12	
35 " " slippers........................@	.70	
50 " " rubbers........................@	1.04	
20 " " arctics.........................@	1.10	
	$400.25	

Put in the form of bills, and find the amount of each of the following:

154. Sold a lady a set of furs for $45.50 ; 10 yd. of silk at $2.50 per yd. ; a bonnet for $7.50; a pair of gloves for $1.75 ; and an umbrella for $3.50.   What is the amount of her bill ?

155. Make out bill for the following: James Smith bought of Johnson & Co., 25 lb. of coffee sugar at 11¢; 5 lb. of tea at 75¢ ; a box of crackers containing 25 lb. at 6¢; a box of soap for $1 ; and 3 lb. of coffee at 35¢.

156. E. A. Holbrook bought of Jones & Co., 5 yd. of cloth at $1.25 a yd. ; 32 yd. of flannel at 60 cents a yard ; 40 yd. of muslin at 11 cents; 1 pair of gloves for $2; 20 yd. of carpet at $1.10.   What is the amount of his bill ?

157. Rich Brothers bought of Farmer Tuthill, 20 bbl. of potatoes at $2.75 ; 85 lb. of butter at $.28 ; 16 doz. of eggs at 22 cents ; and 36 lb. of chickens, at 9 cents.   What was the amount of the bill ?

158. James Lewis & Co. sold to Robt. Herrick 36 lb. of sugar at 10 cts. ; 6 lb. of tea at $.75; 25 lb. of coffee at 27 cents ; 4 gal. molasses at $.84; 16 lb. of ham at 14 cents ; and *2 doz. cans of peaches at 30 cts. a can.*   Find the amount of *the bill ?*

FISH'S ARITHMETICAL CHART,

For Memorizing the Tables, and for Other Drill Exercises.

	A	B	C	D	E	F	G	H
1	144	45	48	49	50	54	55	56
2	132	44	0	14	15	16	18	60
3	121	42	12	1	2	3	20	63
4	120	40	11	**2**		4	21	64
5	110	36	10			5	22	66
6	108	35	9	8	7	6	24	70
7	100	33	32	30	28	27	25	72
8	99	96	90	88	84	81	80	77

This Chart is 26 in. by 24 in., and is intended not only to facilitate the *memorizing* of the various *tables,* but to train the *eye* to *see results,* and the *mind* to *act promptly,* and *accurately.*

It is adapted to a great variety of easy and useful exercises, and is not dependent upon *any text-book* on arithmetic.

Experience has proved, that no other device can be made so efficient and useful in fixing relations of numbers in the mind of the pupil, and in securing *rapidity* and *accuracy* in the performance of work, as these *drill exercises.*

EXPLANATION.

The Chart should be hung in front of the class, where all can see it.

A small circle, containing on its outer edge all the numbers from **O** to **12** is fastened to the back of the Chart, and by turning this, all these numbers are presented successively in the *center opening.*

It will be apparent at once, that these central numbers must in turn serve as *addends, subtrahends, multipliers,* and *divisors,* according to the table to be used.

It will also be observed that the numbers on the Chart include all the *products* of the multiplication table, as far as 12 times 12, and these are arranged in *three large squares,* also in *columns,* and in *lines,* and will be referred to in the exercises as the *inner* square, the *second* square, and the *outer* square; also as the *columns* A, B, C, etc., and the *lines* **1, 2, 3,** etc.

In all exercises, the pupil should be trained to read *rapidly* and *distinctly,* without the use of *pointer* or *finger,* and, *at sight,* to give only *results.*

To illustrate the tables, we will use **2** as the *central* figure.

Addition :

Promptly give, *at sight,* the *sum* of the central number and each number of the *inner* square, reading, first to the *right,* then to the *left.* Then read as 2 greater, each number of the *second* square; then of the *outer* square; and then of each *column,* and of each *line.* In like manner, use **3, 4, 5,** to **10** *inclusive,* each as the *central* number.

Subtraction:

At sight, read the *difference* between the central number and each number of the *inner* square, first to the *right,* then to the *left.* Then regarding the central number as the *subtrahend,* give the difference between *it* and each number in the *second* square, regarded as a *minuend.* Do the same with each number in the *outer* square.

Then read the *sum* and *difference* of the central number and each number of the *inner* square ; thus, *sum* 3, *difference* 1 ; *sum* 4, *difference* 0, etc. In like manner, practice with **3, 4, 5,** to **10,** each used as *central* numbers.

Finally, give the difference between each number of the *inner* square, and the adjacent number of the *second* square.

Multiplication:

Read rapidly the *products* of the central number and each number of the *inner* square, first to the *right,* thus, 2, 4, 6, etc. ; then to the *left,* thus, 24, 22, 20, etc.

Mentally, use first the central number as the *multiplier,* and each number of the inner square as a *multiplicand ;* then the *reverse.*

Next, read the *products* each as 2 greater ; thus, 2, 4 ; 4, 6 ; 6, 8, etc. ; then as 3 greater, and so on to 10 greater.

Finally read the *sum, difference,* and *product* of the central number and each number of the inner square ; thus, *sum* 3, *difference* 1, *product* 2; *sum* 4, *difference* 0, *product* 4, etc.; or simply name *results ;* thus, 3, 1, 2 ; 4, 0, 4; 5, 1, 6, etc.

Division:

First treat each number of the *inner* square as a *divisor,* and each number of the other two squares as a dividend.

Take any one of the dividends, as 14, divide successively by *each number* of the *inner* square, commencing with 1, reading thus: 14 is 14 times 1, 7 times 2, 4 times 3 and 2 over, 3 times 4 and 2 over, etc. ; or thus, 14 times 1, 7 times 2, 4 times 3 and $\frac{2}{3}$ of 3, etc.; or thus, $\frac{1}{2}$ of 14 is 7, $\frac{1}{3}$ of 14 is 4$\frac{2}{3}$, $\frac{1}{4}$ of 14 is 3$\frac{2}{4}$, etc.   Then read *only results ;* thus, 14, 7, 4$\frac{2}{3}$, 3$\frac{2}{4}$, etc.   Practice in the same way upon all the numbers used as *dividends.*

Next, use each of the *central* numbers as a *divisor*, and each number in the second and outer squares as a *dividend*, reading as above.

Then divide the numbers in the *outer* square in the same manner ; then the *columns* A, B, G, and H ; then the *lines* **1, 2, 7**, and **8.**

When the sums, differences, products, and quotients have been read *abstractly,* they may also be read as *concrete* numbers, viz., as *dollars, cents, feet, rods, acres, quarts, gallons, pecks, bushels,* etc., etc.

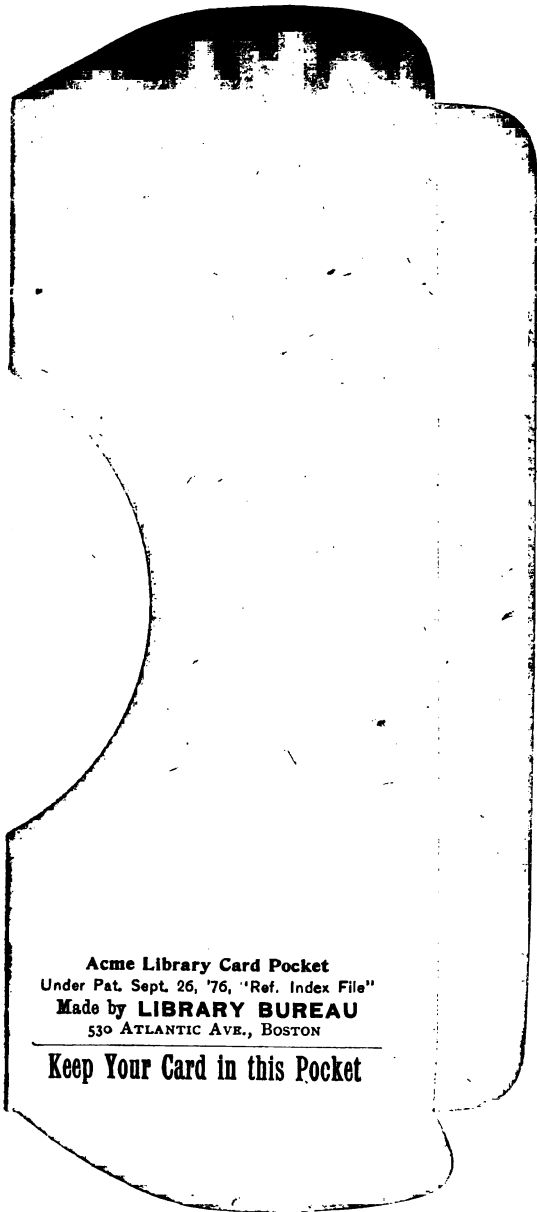The sums, differences, and products may also be read as *halves, thirds,* and so on to *tenths.*

Factoring :

Exercise the pupil also in *factoring.*   Commencing at some point, as at 45, in line **1**, read rapidly *two* factors of each number ; thus, 5 times 9, 6 times 8, 7 times 7, etc. ; or, 5 and 9, 6 and 8, 7 and 7, etc.   Treat in like manner the numbers in *lines* **2, 7**, and **8** ; also in *columns* A, B, G, and H, then the numbers of the *second* square, and also of the *outer* square.

The skillful teacher can use this chart for a great variety of exercises in Fractions, Decimals, Denominate Numbers, Percentage, etc.