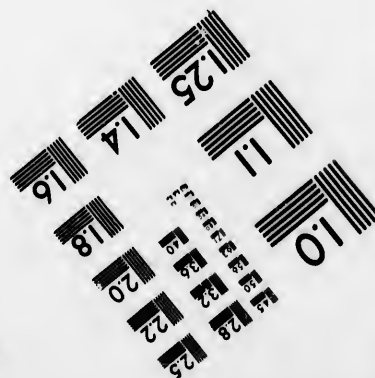
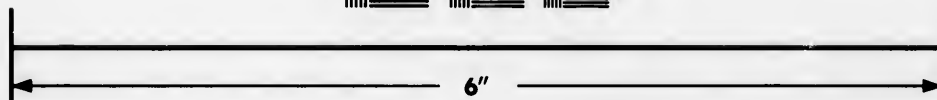
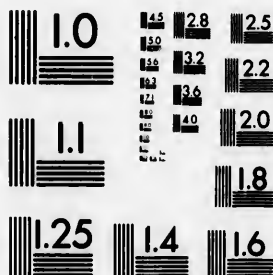


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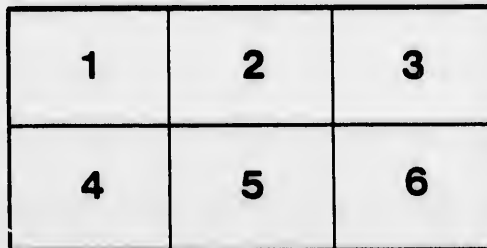
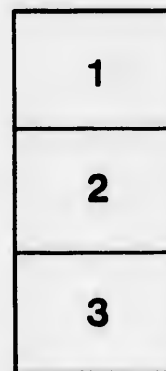
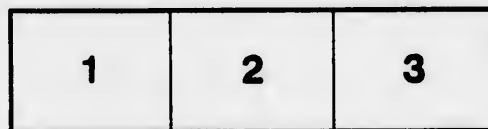
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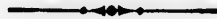
INCLUDING

ORAL, SLATE, AND WRITTEN EXERCISES.

BY

REV. D. H. MACVICAR, LL.D.,

PRINCIPAL PRESBYTERIAN COLLEGE, MONTREAL.



TORONTO :

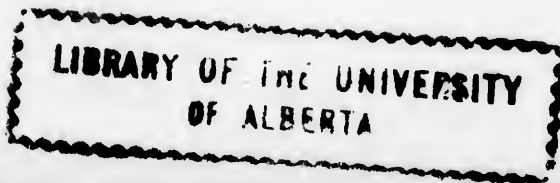
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1880.

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PREFACE.

THE objects specially aimed at in this work are to train the pupil to accuracy and rapidity in the operations of the four elementary rules of Arithmetic, to accustom him to habits of careful observation on the methods of solving practical problems, and to render him so familiar with fundamental principles and processes as to make advanced work natural and easy.

The following points indicate the plan of the book:

1. In every subject the first steps are presented objectively, followed by sufficient slate and written exercises to define and fix firmly in the mind of the pupil the truths illustrated.

2. The work from the beginning is so arranged that each step forms a natural and complete preparation for the step following. Hence the pupil is led to understand clearly the principles on which each operation depends before he is required to perform it.

3. By the use of *Arithmetical Tables* an unlimited number of examples in abstract numbers is given, affording the teacher the best means for *class drill*, and for keeping pupils employed at their seats, while giving them sufficient practice in writing numbers neatly and accurately.

4. The oral and written exercises are carefully graded, and are of the most practical nature. The use of Canadian money is introduced in *Addition* and continued throughout the book. Simple examples in denominate numbers are also given as applications in Multiplication and Division, thus making the pupil familiar, at an early stage of his work, with what is practical.

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5. The nature of fractions is presented objectively, and the pupil taught clearly how to represent various fractional units, how to change a fraction from one fractional unit to another, how to change wholes into any given fractional units, and given fractional units into wholes. After this, exercises are given requiring, in the simplest form, the use of addition, subtraction, multiplication and division of fractions.

These pages, while purely elementary, are so complete as to give the child such a knowledge of fractions as will fit him to perform the operations ordinarily occurring in practical life.

6. The book closes with denominate numbers, giving all the tables the pupil requires to know, with carefully graded exercises illustrating each table.

Hints and directions to teachers are not introduced throughout the work, because they would prove injurious to the pupil, for whom it is exclusively intended. Full instructions and a complete method of presentation will be found in the **TEACHER'S EDITION** of the **ELEMENTARY** and **COMPLETE ARITHMETICS**, by **M. MACVICAR, Ph.D., LL.D.**, Principal of the State Normal School, Potsdam, N. Y., published by Taintor Brothers, Merrill & Co., New York. The present work is specially adapted for use in Canadian Schools, while based upon the **ELEMENTARY ARITHMETIC** just named, which was prepared by **Dr. M. MACVICAR** and the undersigned.

D. H. MACVICAR.

MONTREAL, January, 1879.

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ARITHMETIC.

NUMBERS FROM 1 TO 10.

ONE.

1. The following illustrates the method of presenting numbers from *one* to *ten*. The teacher should vary the illustrations by the use of different objects and of the Numeral Frame and blackboard.

1. Show me one book. One boy. One pencil. One desk. One window. One slate.

2. Show me one hand. One door. One finger. One knife. One head. One ear. One eye.

3. What is a single thing called? Name a single thing.

4. *One* means a single thing. The figure *1* stands for *one*.

TWO.

2. 1. Show me two fingers. Two thumbs. Two girls. Two boys. Two ink bottles. Two slates. Two books.

2. How many eyes have you? How many ears? How many hands? How many feet?

3. One dog and one dog are how many? One and one are how many? Two dogs less one dog are how many?

4. Two desks less one desk are how many? Two slates less one slate? Two less one are how many?

5. *Two* means one and one. The figure *2* stands for *two*.

THREE.

3. 1. Show me three boys. Three windows. Three fingers.
2. Three dogs less one dog are how many? Three books less one book? Three less one are how many?
3. How many are two and one? How many ones in two? In three? How many twos in three, and what left?
4. Count three. Name three boys. Three girls. 2 and 1 are how many? 1 and 1 and 1 are how many?
5. Two and one make *three*. The figure 3 stands for *three*.

FOUR.

4. 1. Show me four balls on the Numeral Frame. Three balls. Two balls and two balls.
2. Two hats and one hat are how many? Three hats and one hat? Two hats and two hats?
3. How many hats taken from four will leave one? Will leave two? Will leave three? Will leave four?
4. How many two boys in four boys? How many three boys, and how many left?
5. Three and one make *four*. The figure 4 stands for *four*.

FIVE.

5. 1. Show me five balls on the Numeral Frame. Four balls. Three balls and two balls.
2. How many are two desks and one desk? Two desks and two desks? Four desks and one desk?
3. Five fishes less one fish are how many? Less two fishes? Less three fishes? Less four fishes?
4. How many are 2 and 1? 2 and 2? 4 and 1? 3 and 2? 3 and 1? 2 and 2 and 1?
5. Four and one make *five*. The figure 5 stands for *five*.

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SIX.

6. 1. Show me six balls on the Numeral Frame. Three balls and two balls. Five balls and one ball.

2. Six trees less one tree are how many? Six trees less two trees? Six trees less three trees?

3. Two books and one book are how many? Two books and three books? Two books and four books?

4. 3 and 1 are how many? 3 and 2? 3 and 3? 6 less 1 are how many? 6 less 2? 6 less 3? 6 less 4? 6 less 5?

5. Five and one make *six*. The figure 6 stands for *six*.

SEVEN.

7. 1. Show me seven balls on the Numeral Frame. Five balls and two balls? Six balls and one ball?

2. Six plums less one plum are how many? Less two plums? Less three plums? Less five plums?

3. How many 3 plums in 7 plums, and how many left? How many two plums, and how many left?

4. 3 and 1 are how many? 4 and 2? 4 and 3? 5 and 1? 5 and 2? 3 and 3?

5. Six and one make *seven*. The figure 7 stands for *seven*.

EIGHT.

8. 1. Show me eight balls on the Numeral Frame. Four balls and three balls. Two balls and six balls.

2. Eight peaches less one peach are how many? Less two? Less three? Less four? Less five? Less six?

3. How many fours in eight? How many twos? How many threes, and how many left? How many ones?

4. 6 and 1 are how many? 3 and 2? 3 and 3? 7 and 1? 6 and 2? 5 and 3? 4 and 4?

5. Seven and one make *eight*. The figure 8 stands for *eight*.

NINE.

9. 1. Show me nine balls on the Numeral Frame. Six balls and three balls. Four balls and three balls.

2. Five leaves and one leaf are how many? Five leaves and three leaves? Eight leaves and one leaf?

3. 6 and 1 are how many? 4 and 2? 4 and 3? 4 and 4? 4 and 5? 3 and 6? 2 and 7?

4. How many are 5 less than 9? 3 less than 9?

5. How many 3's in 6? How many in 9? How many in 8, and what left? How many 2's in 4? How many in 8?

6. 2 and 2 and 2 are how many? 4 and 1 and 3? 2 and 3 and 4? 4 and 2 and 2? 5 and 1 and 2?

7. Eight and one make *nine*. The figure 9 stands for *nine*.

TEN.

10. 1. Show me ten balls on the Numeral Frame. Six balls and four balls. Three balls and five balls.

2. How many are 9 cherries and 1 cherry? 8 cherries and 2 cherries? 7 cherries and 3 cherries? 6 cherries and 4 cherries? 5 cherries and 5 cherries?

3. How many 5 cherries in 10 cherries? How many 2 cherries? How many 4 cherries, and how many left?

4. In how many ways can you make 10 cherries into two groups of cherries?

5. 10 cherries less 3 cherries are how many? Less 1? Less 4? Less 2? Less 9? Less 5?

6. 7 and 2 are how many? 7 and 3? 7 and 1? 5 and 2? 5 and 4? 5 and 3? 5 and 5? 8 and 1? 8 and 2? 4 and 2?

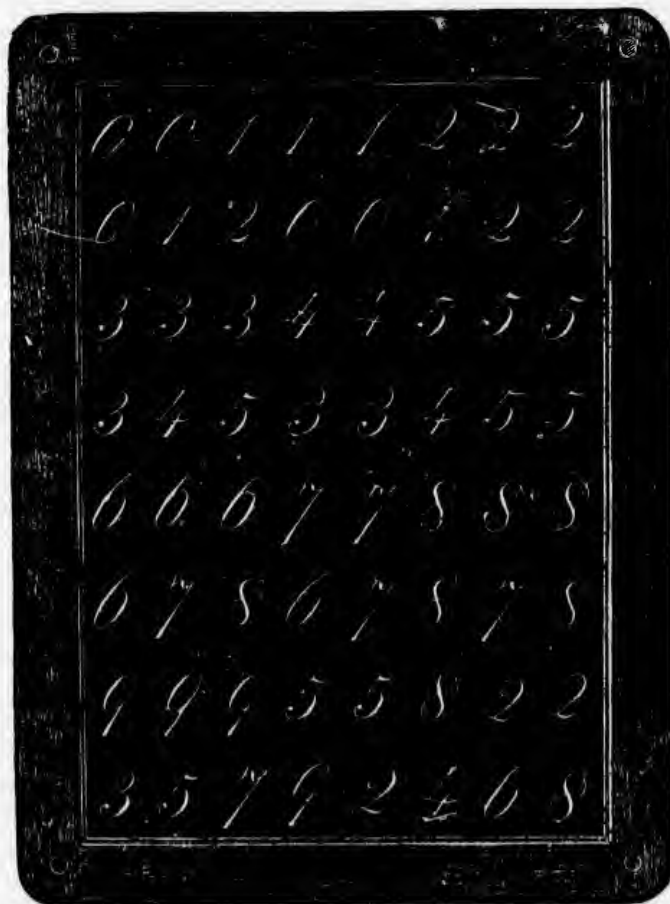
7. Nine and one make *ten*. The figures 10 stand for *ten*. The figure 0, which is called *cipher* or *zero*, has no value in itself.

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EXERCISE IN MAKING FIGURES.

11. Copy neatly from this picture of a slate all the figures in the order in which they are given.



Continue to copy these figures until you can make them on your slate as well as they are made here.

EXERCISE ON USE OF SIGNS.

12. 1. The sign + stands for *and*. Thus, $3+4$ is read, **3 and 4**.

2. The sign = stands for *make* or *equal*. Thus, $5+2=7$ is read, **5 and 2 make 7, or 5 and 2 equal 7**.

3. The mark (?) placed after the sign = means that the *answer* is to be found.

Thus, $6+3=?$ means that 9, the number that 6 and 3 are together equal to, is to be found.

Copy the following on your slate; find the answers and write them in place of the question marks:

— 1 —

$$3+2=? \quad 5+2=? \quad 7+2=? \quad 2+2=?$$

$$4+2=? \quad 6+2=? \quad 8+2=? \quad 9+1=?$$

— 2 —

$$4+3=? \quad 7+3=? \quad 2+3=? \quad 5+3=?$$

$$3+3=? \quad 6+3=? \quad 4+3=? \quad 8+2=?$$

— 3 —

$$5+4=? \quad 2+4=? \quad 6+4=? \quad 3+4=?$$

$$4+4=? \quad 7+2=? \quad 9+1=? \quad 6+4=?$$

— 4 —

$$4+5=? \quad 2+5=? \quad 5+5=? \quad 3+5=?$$

$$5+3=? \quad 6+4=? \quad 8+2=? \quad 7+3=?$$

NUMBERS FROM 10 TO 100.

EXERCISE IN GROUPING.

13. 1. Make on your slate a group of 5 marks ; of 7 marks ; of 9 marks ; thus :

2. Make in the same manner on your slate a group of 4 marks ; of 6 ; of 8 ; of 3 ; of 9 ; of 5 ; of 10.

3. Put on your slate two groups of *ten* marks each, thus :

4. Make each of these groups into two equal groups. How many groups do they now make ? How many in each group ?

5. Make on your slate a group of *ten* marks and 1 mark ; a group of *ten* marks and of 2 marks ; thus :

1 ten and 1.

Eleven.

1 ten and 2.

Twelve.

6. What does *Eleven* mean ? What does *Twelve* mean ?

7. Make in the same manner on your slate a group of ten and three ; ten and four ; and so on, thus :

1 ten and 3.

Thirteen.

1 ten and 4.

Fourteen.

8. What does *Thirteen* mean ? *Fourteen* ? *Fifteen* ? *Sixteen* ? *Seventeen* ? *Eighteen* ? *Nineteen* ? *Twenty* ?

9. Eleven objects are how many more than ten ? Twelve than eleven ? Thirteen than twelve ? Seventeen than sixteen ?

10. Give the names of the numbers from *one* to *twenty*, thus : One, Two, Three, Four, etc.

NUMBERS FROM 10 TO 20.

14. 1. Write the figure that stands for *one*. **1.**

2. Write the figures that stand for *ten*. **10.**

1 ten and **1** are *Eleven*. Written, **11.**

3. Write the figures that stand for *ten*. For *two*.

1 ten and **2** are *Twelve*. Written, **12.**

4. When two figures are written side by side, what does the one on the *right* denote? The one on the *left*?

5. Write the figures for 1 ten and 3. For 1 ten and 4. For 1 ten and 5. For 1 ten and 7.

6. What figures stand for 1 ten and 2? For 1 ten and 9? For 1 ten and 4? For 1 ten and 8?

7. Repeat this table :

1 ten and **1** are *Eleven*.

1 ten and **2** are *Twelve*.

1 ten and **3** are *Thirteen*.

1 ten and **4** are *Fourteen*.

1 ten and **5** are *Fifteen*.

1 ten and **6** are *Sixteen*.

1 ten and **7** are *Seventeen*.

1 ten and **8** are *Eighteen*.

1 ten and **9** are *Nineteen*.

8. Ten and one are how many? Twelve and one? Fourteen and one? Seventeen and one?

9. Seventeen less one are how many? Thirteen less one? Nineteen less one? Fifteen less one?

10. $11+1$ are how many? $17+1$? $15+1$? $13+1$? $18+1$? $12+1$? $14+1$? $16+1$? $19+1$?

11. Write the figures that stand for eleven. For twelve. For seventeen. For thirteen. For nineteen.

EXERCISES IN GROUPING.

15. 1. Make on your slate 2 groups of *ten* marks, and 3 groups of *ten* marks, thus:

$$\begin{array}{l} \text{2 tens.} \\ \text{-----} \\ \text{-----} \end{array} \} = \text{Twenty.} \quad \begin{array}{l} \text{3 tens.} \\ \text{-----} \\ \text{-----} \\ \text{-----} \end{array} \} = \text{Thirty.}$$

2. What does *Twenty* mean? *Thirty*? *Forty*?

3. Make in the same manner 4 groups of *ten* marks; 8 groups of *ten* marks; 6 groups of *ten* marks.

4. What does *Fifty* mean? *Sixty*? *Seventy*? *Eighty*? *Ninety*?

5. How many is sixty more than fifty? Fifty than forty?

6. Four tens are how many? Seven tens? Five tens? Three tens? Nine tens?

7. Make on your slate 10 groups of *ten* marks each.

$$\begin{array}{l} \text{Ten groups of} \\ \text{ten marks each,} \end{array} \left\{ \begin{array}{l} \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \\ \text{-----} \end{array} \right\} = \left\{ \begin{array}{l} \text{1 Hundred} \\ \text{marks.} \end{array} \right.$$

8. What is meant by *1 hundred* marks? 1 hundred books? 1 hundred boys? 1 hundred men?

9. How many does 9 groups of *ten* marks lack of being 1 hundred marks? 6 groups of *ten* marks?

10. A group of 8 boys, one of 9 boys, and one of 3 boys, will together make how many groups of *ten* boys?

11. 8 apples, 3 apples, 5 apples, and 9 apples, will make how many groups of *ten* apples

WRITING AND READING TENS.

16. 1. Write the figures that stand for *ten*.

9 and *1* are *ten*. Written *10*.

2. What two figures stand for *ten*? How are they written? Which is on the left hand? Which is on the right hand?

3. Make *ten* marks on your slate two times :

Thus, *////////// //////////*

4. Write the figures that stand for *two tens*.

2 tens are *twenty*. Written *20*.

5. Make *ten* marks on your slate 3 times ; 4 times ; 5 times ; 6 times ; 7 times ; 8 times ; 9 times ; 10 times.

6. How would you write the figures that stand for *three* tens, *four* tens, *five* tens, *six* tens, *seven* tens, *eight* tens, *nine* tens?

7. Repeat this table :

2 tens are *twenty*.

6 tens are *sixty*.

3 tens are *thirty*.

7 tens are *seventy*.

4 tens are *forty*.

8 tens are *eighty*.

5 tens are *fifty*.

9 tens are *ninety*.

10 tens are *1 hundred*.

8. What two figures together stand for *eight* tens? Which is on the left hand? Which is on the right hand?

9. How many are 3 tens? 6 tens? 9 tens? 4 tens?

Express in figures :

10. Two tens.

13. Three tens.

16. Eight tens.

11. Four tens.

14. Five tens.

17. Four tens.

12. Six tens.

15. Nine tens.

18. Seven tens.

19. Read the following :

60. 30. 70. 20. 50. 90. 60. 40. 70. 90.

NUMBERS FROM 20 TO 100.

17. 1. Write the figures that stand for *two tens* and *one*.

2 tens and 1 are *Twenty-one*. Written *21*.

2. Write the figures that stand for *three tens* and *one*.

3 tens and 1 are *Thirty-one*. Written *31*.

3. Write the figures that stand for *four tens* and *one*. For *six tens* and *one*. For *nine tens* and *one*.

4. How many are 2 tens and 1? 3 tens and 1? 7 tens and 1? 5 tens and 1? 8 tens and 1? 9 tens and 1?

5. Write the figures that stand for *two tens* and *two*.

2 tens and 2 are *Twenty-two*. Written *22*.

6. Write the figures that stand for 4 tens and 2. For 6 tens and 2. For 8 tens and 2. For 9 tens and 2.

7. How many *tens* in *Twenty-two*, and how many over? In *Thirty-two*? In *Seventy-two*?

8. How many are 2 tens and 6? 3 tens and 8? 6 tens and 5? 8 tens and 4?

9. How many are $30+7$? $40+9$? $80+5$? $70+6$? $60+3$? $90+2$?

10. How many are $20+1$? $25+1$? $27+1$? $32+1$? $36+1$? $56+1$? $89+1$?

11. How many are 37 less 1? 56 less 1? 74 less 1? 80 less 1? 93 less 1?

12. Name the numbers in order from *one* to *one hundred*; thus, one, two, three, etc.

13. Read the following numbers :

20	15	17	70	11	32	56	18	29	80
57	79	68	94	57	86	79	99	41	45

ARITHMETICAL TABLE No. 1.

18. 1. Copy on your slate columns A and B of this table.
Read each number on your slate.

	A.	B.	C.	D.	E.	F.	G.	H.
1.	3	7	2	4	7	5	9	6
2.	5	3	6	6	5	8	2	4
3.	2	8	4	3	9	6	5	7
4.	4	5	9	7	3	2	8	6
5.	6	2	7	5	6	4	3	8
6.	3	6	4	8	5	7	9	2
7.	4	8	3	6	2	6	5	7
8.	5	6	7	2	3	8	6	9
9.	8	7	5	9	8	3	7	5
10.	9	4	8	0	2	9	8	4

2. Copy on another part of your slate columns B and C, then C and D, and so on. Read the numbers as before.

1.
this table.

H.

NUMBERS FROM 100 TO 1000.

19. 1. Write the figures that express *ten tens*.

10 tens are one hundred. Written 100.

2. How many ciphers used to express *one hundred*? Where are they written? Where is the 1 written?

3. Express by figures two hundred; four hundred; six hundred; seven hundred; five hundred; nine hundred

4. Express by figures *eleven tens*.

11 tens are one hundred and ten. Written 110.

5. How many ciphers used to express *one hundred ten*?

6. Write by figures 13 tens; 15 tens; 17 tens; 19 tens; 21 tens; 23 tens; 25 tens; 29 tens.

7. How many ciphers used to express 30 tens? 50 tens? 60 tens? 40 tens? 90 tens?

8. Write by figures one hundred forty; five hundred eighty; eight hundred seventy; four hundred twenty.

9. Express by figures *ten tens* and *one*.

10 tens and 1 are one hundred and one. Written 101.

10. How many ciphers used to express *one hundred one*? Where written?

Express by figures the following numbers:

11. Three hundred one; five hundred one; nine hundred one; seven hundred one.

12. Three hundred four; six hundred two; eight hundred five; two hundred nine; nine hundred nine.

13. Two hundred sixty-one; five hundred seventy-nine.

14. Nine hundred nine; nine hundred ninety-nine.

SLATE EXERCISES.**20.** Copy on your slate and read the following:

(1.)	(2.)	(3.)	(4.)	(5.)
209	406	506	905	906
107	308	805	902	805
402	405	608	607	909
301	402	302	806	606
205	209	604	804	907
(6.)	(7.)	(8.)	(9.)	(10.)
120	140	131	289	454
360	670	523	973	897
420	380	474	884	898
560	760	382	579	555
820	680	796	845	999

Express in figures the following:

- | | |
|-----------------------------|-------------------------------|
| 11. Two hundred five. | 20. Eight hundred fifteen. |
| 12. Five hundred seven. | 21. Nine hundred nine. |
| 13. Seven hundred two. | 22. Two hundred sixty. |
| 14. Eight hundred twenty. | 23. Six hundred eighty-one. |
| 15. Six hundred ninety. | 24. Five hundred thirty-five. |
| 16. Four hundred sixty. | 25. Eight hundred fifteen. |
| 17. Three hundred seven. | 26. Two hundred seventy-four. |
| 18. Two hundred eighty. | 27. Six hundred sixty-nine. |
| 19. One hundred twenty-one. | 28. Two hundred eighty-one. |

NUMBERS ABOVE 1000.

SLATE EXERCISES.

21. 1. Express in figures *ten hundred*.

10 hundred are *one thousand*. Written **1,000**.

2. How many ciphers used to express *one thousand*? Where are they written? What place from the right of the number does the 1 occupy?

3. Write in figures three thousand; five thousand; eight thousand; nine thousand; 4 thousand; 6 thousand.

4. Express in figures *ten thousand*.

10 thousand are written **10,000**.

5. How many ciphers used to express *ten thousand*? What place from the right does the 1 occupy? What separates the 10 from the three ciphers?

6. Write in figures fifty thousand; seventy thousand; forty thousand; 50 thousand; 80 thousand.

7. How many ciphers must be placed to the right of 13 to make it denote 13 thousand?

Express in figures the following numbers:

- | | |
|--|--------------------------------|
| 8. Fifteen thousand. | 13. Twenty-four thousand. |
| 9. Thirty-five thousand. | 14. Eighty-six thousand. |
| 10. Nine thousand two. | 15. Five thousand nine. |
| 11. Seven thousand fifty-five. | 16. One thousand eighty-one. |
| 12. Forty-six thousand one | 17. Seventy-two thousand five. |
| 18. Twenty-one thousand seven hundred ninety-nine. | |
| 19. Forty-four thousand three hundred fifty. | |
| 20. Two hundred thirty-six thousand. | |

(5.)
906
805
909
606
907

(10.)
454
897
898
555
999

en.

one.

-five.

en.

y-four.

ne.

r-one.

NUMERATION TABLE.

22. 1. What place does the figure 6 occupy in 496? The figure 9? The figure 4?

2. The places in a number denote the *orders* of units.

Thus, in 946, the 6 in the *first place* from the right represents units of the *first order*, the 4 in the *second place* units of the *second order*, the 9 in the *third place* units of the *third order*.

3. The *orders* of units in a number are formed into groups of *three*. Each group is called a *Period*.

4. The figures in the *first period* on the right represent *units*, in the *second period thousands*, in the *third period millions*, as shown in the following

TABLE.

PERIODS.	3d.			2d.			1st.		
—	Millions.			Thousands.			Units.		
NAMES OF ORDERS OF UNITS.	Hundreds of Tens of Ones of			Hundreds of Tens of Ones of			Hundreds of Tens of Ones of		
—	2	4	3	6	9	8	0	8	5
Numbers to be read.	6	7	0	7	0	2	6	0	1
	4	8	0	3	3	0	7	7	0
	9	8	6	8	0	8	4	0	7
	4	0	3	0	0	2	0	0	8

5. Read the foregoing numbers.

6. How do the names of the *orders* of units in the first period compare with those of the second and third periods?

7. What is the general name for the three orders in the first period? In the second period? In the third period?

SLATE EXERCISES.

23. Read and copy the following on your slate:

(1.)	(2.)	(3.)
809009	6347074	850609
4802500	815019	6480074
606002	3709406	460668
9700000	2602300	2680308
(4.)	(5.)	(6.)
78036	83252	952436
4002	5004	87330
609636	825684	309462
50903	87303	235984
240089	593820	480002

24. Read and analyze the following, thus:

Ex. 1. 346 cents = 3 *hundreds* 4 *tens* and 6 *ones*.

ANALYSIS. 346 cents means 3 groups of *one hundred* cents, 4 groups of *ten* cents, and 6 *single* cents, or it may mean 34 groups of *ten* cents and 6 *single* cents.

2. 95 birds.	10. 1480 tables.	18. 586.
3. 436 men.	11. 5706 spikes.	19. 1907.
4. 242 sheep.	12. 4097 books.	20. 5081.
5. 76 inkstands.	13. 48079 nails.	21. 93040.
6. 654 windows.	14. 496 beds.	22. 60473.
7. 899 houses.	15. 2609 lamps.	23. 102490.
8. 94 canary birds.	16. 3075 oxen.	24. 70840.
9. 593 robins.	17. 1936 boots.	25. 430603.

SLATE EXERCISES.

25. Copy the following numbers, placing them in columns, units under units, tens under tens, etc. Read each number, pointing it off into *periods*.

1. 48864; 89463; 568; 82040.
2. 8043; 2060; 20904; 74001.
3. 40004; 100661; 3080; 8004.

26. Copy and analyze on your slate the following:

Thus, $9846 = 9000 + 800 + 40 + 6.$

$$3070 = 3000 + 70.$$

(1.)	(2.)	(3.)
63595	93940	60904
49583	86900	593006
36826	525708	606409
37043	40238	8500954

4. How many tens in 674, and how many remaining? In 809? In 868? In 4849? In 1040?

5. How many hundreds in 9584, and how many remaining? In 6362? In 5905? In 93609?

6. Read as one number $800 + 90 + 9$; $5300 + 50 + 7$.

7. If a cipher is annexed to 8, how many will it then represent? If 2 ciphers? If 4 ciphers?

8. Change 5 to five thousand; to five hundred thousand.

REVIEW AND TEST EXERCISE.

27. 1. How many tens in 50? In 80? In 70? In 90?
2. How many tens in 35 and how many left? In 48? In 63? In 69? In 97? In 84? In 72?
3. How many tens in 100? In 300? In 500? In 800?
4. How many tens in 140? In 250? In 870? In 560?
5. How many tens in 396 and how many left? In 674? In 594? In 360? In 983? In 999?
6. How many hundreds in 600? In 400? In 900? In 1200? In 2400? In 5500? In 9900?
7. How many hundreds in 436 and how many left? In 815? In 586? In 1607? In 5406? In 8852?
8. Commence at the right and read each order in 683640992.
9. Analyze into separate orders (26) 73986.
10. How many thousands in 85000? In 93000? In 50000?
11. How many thousands in 46825 and how many left? In 93462? In 289704? In 100602?

Express in figures the following :

12. One thousand. One thousand one. Two thousand nine. Eight thousand sixty. Four thousand twenty.
13. Eleven hundred. Twenty-five hundred. Twelve hundred five. Eighty-six hundred sixteen.
14. Ten tens. One hundred tens. Ten tens three. Five hundred tens fifteen. Eight hundred two tens.
15. Ten thousand. Ten thousand seven. Eighty thousand. Twenty thousand fifty-three.
16. Eighty-three thousand sixty. Seventy thousand four hundred seven. Ninety-seven thousand fifty.
17. Six million three thousand seventy-one. Seven hundred eight million fifty thousand nine.
18. Five hundred million 5 thousand eighty-nine.
19. 260 million 19 thousand 5 hundred 6.
20. Seventy million 70 thousand 4 hundred sixty-three.
21. Four hundred six million 50 thousand five.

24 NOTATION AND NUMERATION.

Read the following numbers :

22. 6007030.

24. 830000604.

26. 70050050.

23. 20600040.

25. 40060010.

27. 400008008.

DEFINITIONS.

28. A *Unit* is a single thing, or group of single things regarded as one ; as, *one desk, one foot, one ten, one hundred.*

29. A *Number* is a unit, or collection of units ; as, *one boy, three tables, two, five hundred.*

30. The *Unit of a Number* is one of the things numbered ; thus, the unit of seven yards is *one yard*, of three men is *one man*, of eight is *one*.

31. *Figures* are characters used to represent numbers.

32. *Notation* is the method of writing numbers by figures or other characters.

33. *Numeration* is the method of reading numbers which are expressed by figures or other characters.

RULES.

34. Numeration.—*I. Begin at the right and separate the number, by inserting commas, into periods of three figures each.*

II. Begin at the left and read the hundreds, tens, and ones of each period, giving the name of each period, except the last.

35. Notation.—*Begin at the left and write the figures expressing the hundreds, tens, and ones of each period in their proper order, filling with ciphers all periods or places where no significant figures are given.*

The *Arabic Notation*, presented in the preceding pages, was introduced into Europe by the Arabs, who had obtained it from the Hindoos. The following is the method which was used by the Romans.

36.
seven

Lette

Valu

Any
and a

1.

Th

tens,

2.

value,

Th

XL d

3.

value

Th

sum

4.

expr

Th

L fif

Ex

1.

2.

3.

4.

5.

ROMAN NOTATION.

36. The Roman Notation employs, in expressing numbers, seven letters and a dash.

Letters, I, V, X, L, C, D, M.

Values, One, Five, Ten, Fifty, ^{One} hundred, ^{Five} hundred, ^{One} thousand.

Laws of Roman Notation.

Any number can be written by using the above seven letters and a dash, in accordance with the following laws :

1.* *Repeating a letter repeats its value.*

Thus, I denotes one ; II, two ; III, three ; X, ten ; XX, two tens, or twenty.

2. *When a letter is placed next to the left of one of greater value, the difference of their values is the number expressed.*

Thus, IV denotes 5 less 1, or 4 ; IX denotes 10 less 1, or 9 ; XL denotes 50 less 10, or 40.

3. *When a letter is placed next to the right of one of greater value, the sum of their values is the number expressed.*

Thus, VI denotes the sum of 5 and 1, or 6 ; XI denotes the sum of 10 and 1, or 11 ; LX denotes the sum of 50 and 10, or 60.

4. *A dash placed over a letter, or letters, multiplies the value expressed by one thousand.*

Thus, \overline{X} denotes ten thousand, \overline{IV} denotes four thousand, \overline{L} fifty thousand, \overline{XVIII} eighteen thousand.

Express in Roman Notation the following :

- | | | |
|------------|---------------|-------------------|
| 1. Three. | 6. Seventeen. | 11. Thirty-three. |
| 2. Seven. | 7. Nineteen. | 12. Forty. |
| 3. Four. | 8. Fifteen. | 13. Forty-four. |
| 4. Nine. | 9. Twenty. | 14. Sixty. |
| 5. Twelve. | 10. Fourteen. | 15. Fifty-nine. |

EXERCISES IN ROMAN NOTATION.

37. Read each of the following numbers :

1. X.	8. L.	15. CIL.	22. DC.
2. XI.	9. VL.	16. CX.	23. CD.
3. IV.	10. XL.	17. XC.	24. DIC.
4. XIX.	11. LX.	18. CXX.	25. DCV.
5. XIV.	12. LIX.	19. CL.	26. DCCXV.
6. IX.	13. LVIII.	20. CIL.	27. M.
7. XXIV.	14. LXXXIV.	21. CIC.	28. CM.

Write in Roman Notation the following numbers :

1. Twenty-four.	7. One hundred nine.	13. 10001.
2. Seventy-nine.	8. Five hundred four.	14. 3005.
3. Eighty-three.	9. Three hundred seventy.	15. 5009.
4. Ninety-four.	10. Seven hundred six.	16. 2084.
5. Fifty-seven.	11. Two hundred eighty.	17. 1877.
6. Thirty-nine.	12. Four hundred two.	18. 1854.

Read each of the following numbers :

1. \overline{X} .	6. \overline{L} .	11. MDCCCLXXVII.	16. \overline{D} .
2. \overline{V} .	7. \overline{XX} .	12. MMDCLXIX.	17. \overline{XV} .
3. \overline{XI} .	8. \overline{LX} .	13. MCCLIX.	18. \overline{XXX} .
4. \overline{VI} .	9. \overline{C} .	14. MMMDLVIII.	19. \overline{XXV} .
5. \overline{IV} .	10. \overline{CX} .	15. MCDXVII.	20. \overline{XD} .

Express in Roman Notation the following :

1. Ten thousand.	6. Eight thousand five hundred.
2. Four thousand.	7. Five thousand two hundred.
3. Six thousand.	8. Three thousand six hundred.
4. Two thousand.	9. Ten thousand one hundred.
5. Nine thousand.	10. One thousand fifty-nine.

ADDITION.

ORAL AND SLATE EXERCISES.

38. 1. Add 3 pears and 5 pears.



Three pears and five pears are added thus :



Things are added by putting them together.

2. Three pears and five pears are how many? 3 and 5 are how many?

3. Add 7 blocks and 3 blocks, thus :

$$\begin{array}{ccccccc} 7 \text{ blocks} & + & 3 \text{ blocks} & = & 10 \text{ blocks.} \\ \text{-----} & & \text{and} & \text{---} & = & \text{-----} \end{array}$$

4. Seven blocks and 3 blocks are how many? 7 and 3 are how many?

5. Finding how many two or more groups of objects will make when put together is called *Addition*, and the number found is called the *Sum*.

Find the sum :

- | | |
|--------------------------------|-------------------------------|
| 6. Of 4 caps and 3 caps. | 11. Of 3 tables and 6 tables. |
| 7. Of 3 pencils and 3 pencils. | 12. Of 5 books and 4 books. |
| 8. Of 2 desks and 4 desks. | 13. Of 2 boys and 6 boys. |
| 9. Of 5 pens and 2 pens. | 14. Of 6 girls and 4 girls. |
| 10. Of 4 chairs and 5 chairs. | 15. Of 7 blocks and 3 blocks. |

SLATE EXERCISES.

39. 1. Find, by making marks on your slate, the sum of 7 marks and 6 marks; thus,

$$\begin{array}{rcccl}
 7 \text{ marks} & + & 6 \text{ marks} & = & 10 \text{ marks and 3 marks.} \\
 \text{-----} & + & \text{-----} & = & \text{-----} \\
 \underbrace{\hspace{2cm}} & & \underbrace{\hspace{2cm}} & & \underbrace{\hspace{2cm}} \\
 1 \text{ ten} & \text{and} & 3 & = & \text{Thirteen.}
 \end{array}$$

Find in this way the sum :

- | | |
|----------------------------|----------------------------|
| 2. Of 6 marks and 5 marks. | 5. Of 9 marks and 3 marks. |
| 3. Of 8 marks and 9 marks. | 6. Of 4 marks and 9 marks. |
| 4. Of 7 marks and 4 marks. | 7. Of 9 marks and 9 marks. |

Copy on your slate and find, by using objects, the sum for each example in the following exercises :

— 1 —

$$2+1=? \quad 3+1=? \quad 5+1=? \quad 9+1=?$$

$$7+1=? \quad 9+1=? \quad 6+1=? \quad 4+1=?$$

— 2 —

$$6+2=? \quad 8+2=? \quad 5+2=? \quad 7+2=?$$

$$2+2=? \quad 3+2=? \quad 9+2=? \quad 6+2=?$$

— 3 —

$$2+3=? \quad 5+3=? \quad 7+3=? \quad 6+3=?$$

$$5+3=? \quad 9+3=? \quad 4+3=? \quad 8+3=?$$

— 4 —

$$2+4=? \quad 3+4=? \quad 7+4=? \quad 5+4=?$$

$$8+4=? \quad 6+4=? \quad 9+4=? \quad 4+4=?$$

40.

how many

SOLUTION
which is 8

2. A man
cows has

3. In a
many trees

4. I bought
much dirt

5. In a
pupils are

6. A boy
how many

7. The
more than

8. Six
many boys

9. Ed
and three

10. A
pounds

11. If
another

12. F
hung up

13. A
lar by

how many

14. A
stripes

15. I
how many

ORAL EXERCISES.

40. 1. Mary had 5 apples and her brother gave her 3 more ;
how many apples had she then ?

SOLUTION.—She had as many apples as the sum of 5 apples and 3 apples,
which is 8 apples.

2. A man has 6 white cows and 3 black ones ; how many
cows has he in all ?

3. In a garden there are 7 peach trees and 3 apple trees ; how
many trees are there of both kinds ?

4. I bought a coat for 8 dollars and a hat for 5 dollars ; how
much did I give for both ?

5. In a certain class there are 4 boys and 5 girls ; how many
pupils are there in the class ?

6. A boy rode 6 miles in the cars and 2 miles in a carriage ;
how many miles did he travel ?

7. There were 7 mugs upon a shelf and Ada placed three
more there ; how many mugs were then on the shelf ?

8. Six birds were upon a tree, and four more alighted ; how
many birds on the tree ?

9. Edward caught four trout in one brook, two in another,
and three in another ; how many trout had he in all ?

10. A turkey weighed 6 pounds, but afterwards gained two
pounds ; what did the turkey then weigh ?

11. If a house has 7 windows on one side, and four on
another, how many windows has it in all ?

12. Five caps are hanging in a row, and soon four more are
hung up ; how many caps in all ?

13. A poor man earned five dollars by sawing wood, one dol-
lar by carrying coal, and four dollars by planting a garden ;
how many dollars did he earn in all ?

14. A flag has 4 red stripes and 5 white stripes ; how many
stripes has it in all ?

15. Frank had 9 cents and his sister Jessie gave him 3 more ;
how many did he then have ?

SLATE EXERCISES.

41. Copy on your slate and find, by using objects, the sum for each example in the following exercises :

— 1 —

$5+6=? \quad 2+5=? \quad 6+8=? \quad 5+5=?$

$2+4=? \quad 7+4=? \quad 4+5=? \quad 8+4=?$

— 2 —

$8+3=? \quad 6+2=? \quad 9+5=? \quad 5+6=?$

$6+3=? \quad 6+7=? \quad 4+6=? \quad 7+6=?$

— 3 —

$7+3=? \quad 5+7=? \quad 7+7=? \quad 9+7=?$

$5+6=? \quad 8+7=? \quad 7+2=? \quad 6+7=?$

— 4 —

$3+8=? \quad 5+8=? \quad 9+7=? \quad 4+8=?$

$6+8=? \quad 4+8=? \quad 9+8=? \quad 8+8=?$

— 5 —

$4+9=? \quad 3+9=? \quad 6+9=? \quad 5+9=?$

$7+9=? \quad 4+9=? \quad 8+9=? \quad 9+9=?$

— 6 —

$7+7=? \quad 8+9=? \quad 6+9=? \quad 5+8=?$

$9+5=? \quad 5+6=? \quad 9+7=? \quad 8+7=?$

42.

Thus,
the sum
and w

5

2

9

2

5

3

1

3

3

4

7

4

6

5

7

5

ADDITION TABLES.

42. Practice on each of the following tables separately. Thus, copy the numbers on your slate in the order given, find the sums and write them under the numbers, then erase them and write them again and again from memory.

+5=?

+4=?

+6=?

+6=?

+7=?

+7=?

+8=?

+8=?

+9=?

+9=?

+8=?

+7=?

Table of Twos.

5	3	4	8	1
<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>
9	6	2	7	9
<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>

Table of Threes.

5	6	2	3	4
<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>
1	7	6	8	9
<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>

Table of Fours.

3	8	2	6	2
<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
7	9	3	9	1
<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>

Table of Fives.

6	2	1	8	5
<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>
7	4	3	8	9
<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>

Table of Sixes.

5	1	8	3	6
<u>6</u>	<u>6</u>	<u>6</u>	<u>6</u>	<u>6</u>
2	4	8	9	4
<u>6</u>	<u>6</u>	<u>6</u>	<u>6</u>	<u>6</u>

Table of Sevens.

3	4	7	9	1
<u>7</u>	<u>7</u>	<u>7</u>	<u>7</u>	<u>7</u>
5	9	8	2	6
<u>7</u>	<u>7</u>	<u>7</u>	<u>7</u>	<u>7</u>

Table of Eights.

8	5	2	4	7
<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>
9	3	1	6	9
<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>

Table of Nines.

4	6	5	8	3
<u>9</u>	<u>9</u>	<u>9</u>	<u>9</u>	<u>9</u>
1	7	6	5	9
<u>9</u>	<u>9</u>	<u>9</u>	<u>9</u>	<u>9</u>

ORAL EXERCISES.

43. 1. John had one cluster of four grapes, another of seven, and another of three ; how many grapes had he ?

SOLUTION.—He had as many grapes as the sum of 4 grapes, 7 grapes, and 3 grapes, which is 14 grapes.

2. Norman had four red tops, two blue tops, and five white tops ; how many tops had he ?

3. My house contains 2 parlors, 1 sitting room, 1 dining room, 1 kitchen, 4 chambers, 5 bedrooms, and an attic ; how many rooms in all does it contain ?

4. A man takes two daily papers, four weekly papers, and three monthly papers ; how many papers does he take in all ?

5. My garden has six rows of beans, four rows of peas, and three rows of turnips ; how many rows does it contain ?

6. A farmer has a spade worth three dollars, a mallet worth one dollar, a hatchet worth one dollar, and a gun worth five dollars ; how many dollars are they all worth ?

7. I have four gold rings, eight brass rings, and two silver rings ; how many rings have I ?

8. Oliver has 4 slate pencils, and Kate has 6 lead pencils and 5 slate pencils ; how many pencils have both ?

9. A farmer has 9 cows and 8 oxen ; how many cattle has he in all ?

10. Harvey paid 10 cents for a slate, 2 cents for a pencil, and 6 cents for a sponge ; how much did they all cost ?

11. A man bought a saddle for 9 dollars, a bridle for 3 dollars, and a whip for 1 dollar ; how much did they all cost ?

12. What is the sum of $5 + 8 + 4 + 3$?

13. There are 3 pears on one plate, 5 on another, and 9 on another ; how many pears on the three plates ?

14. Warren's mother gave him 15 cents, he earned 9 cents, and found 7 cents ; how many cents did he then have ?

15. A lady has 7 iron spoons and 3 more silver spoons than iron ones ; how many spoons has she in all ?

44

in 10

2. 1

and 7

3. 1

66 and

4. 1

105 and

5. 1

465 and

6. 1

79 and

7. 1

69 and

8. 1

A

9. 1

10. 1

11. 1

12. 1

17. 1

18. 1

of 2 and

19. 1

addition

20. 1

600 + 3

21. 1

70 + 40

ORAL EXERCISES.

44. 1. How many ones are there in 11 and 4? in 7 and 8? in 10 and 5? in 13 and 7?

2. How many ones are there in 27 and 6? in 36 and 8? in 55 and 7? in 66 and 7? in 92 and 8?

3. How many are 2 and 1? 11 and 3? 24 and 5? 32 and 3? 66 and 2? 81 and 5?

4. How many are 3 and 7? 13 and 5? 23 and 6? 74 and 3? 105 and 4? 643 and 4? 553 and 4?

5. How many are 8 and 7? 16 and 7? 35 and 7? 75 and 7? 465 and 7? 18 and 8? 36 and 8? 246 and 8?

6. How many are 9 and 3? 49 and 3? 59 and 3? 9 and 6? 79 and 6? 229 and 6? 469 and 6?

7. How many are 8 and 7? 28 and 7? 36 and 7? 9 and 8? 69 and 8? 359 and 8?

8. Add by 2's from 1 to 33; thus, 1, 3, 5, 7, 9, 11.

Add

9. By 2's from 2 to 50.

13. By 5's from 6 to 96.

10. By 3's from 4 to 74.

14. By 7's from 3 to 87.

11. By 3's from 2 to 78.

15. By 6's from 5 to 95.

12. By 5's from 2 to 84.

16. By 7's from 4 to 89.

17. Add by 9's from 2 to 105; from 5 to 87; from 7 to 119.

18. Add from 1 to 76 by repeating the successive additions of 2 and 3; thus, 1, 3, 6, 8, 11, 13, etc.

19. Begin with 4 and add to 105 by repeating the successive additions of 2, 3, and 4.

20. How many are $20+5?$ $60+7?$ $300+40+6?$ $700+90+3?$ $800+30+4?$ $600+50+7?$

21. How many are $30+40?$ $50+60?$ $70+40+6?$ $80+20?$ $70+40?$ $90+80?$ $80+60+8?$

SLATE EXERCISES.

45. Copy on your slate and find the sum for each example in the following exercises :

— 1 —

$300 + 50 + 6 = ? \quad 700 + 60 + 4 = ?$

$600 + 40 + 9 = ? \quad 900 + 50 + 6 = ?$

$500 + 80 + 1 = ? \quad 900 + 70 + 5 = ?$

— 2 —

$503 + 50 = ? \quad 308 + 50 = ? \quad 504 + 60 = ?$

$66 + 400 = ? \quad 88 + 600 = ? \quad 13 + 800 = ?$

$80 + 504 = ? \quad 30 + 509 = ? \quad 80 + 209 = ?$

— 3 —

$33 + 5 = ? \quad 47 + 8 = ? \quad 55 + 9 = ?$

$63 + 5 = ? \quad 57 + 8 = ? \quad 75 + 9 = ?$

$83 + 5 = ? \quad 67 + 8 = ? \quad 85 + 9 = ?$

$73 + 5 = ? \quad 77 + 8 = ? \quad 65 + 9 = ?$

— 4 —

$37 + 6 + 6 + 6 = ? \quad 42 + 5 + 5 + 5 = ?$

$59 + 4 + 4 + 4 = ? \quad 26 + 8 + 8 + 8 = ?$

$25 + 9 + 9 + 9 = ? \quad 34 + 7 + 7 + 7 = ?$

$57 + 5 + 5 + 5 = ? \quad 65 + 3 + 3 + 3 = ?$

46.
shown
table.
copy a

ARITHMETICAL TABLE No. 2.

	A.	B.	C.	D.	E.	F.	G.	H.
1.	3	7	2	4	7	5	9	6
2.	5	3	6	9	5	8	2	4
3.	2	8	4	3	9	6	5	7
4.	4	5	9	7	3	2	8	6
5.	6	2	7	5	6	4	3	8
6.	3	6	4	8	5	7	9	2
7.	4	8	3	6	2	9	5	7
8.	5	3	7	2	4	8	0	9
9.	8	7	5	9	8	3	7	5
10.	9	4	8	6	2	9	8	4

46. Copy neatly on your slate examples from this table, as shown on next page. Make the figures as they are in the table. Find the sum of each example, then erase them, and copy and find the sum again and again.

SLATE EXERCISE TABLE NO. 2.*Columns of Three Figures.*

47. 1. Commence with column *A*; opposite *1*, and copy three figures for the *first example*; then opposite *2*, and copy three more for the *second example*; then opposite *3*, and copy three more for the *third example*. Continue in this way to the bottom of the column and you will have on your slate:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>3</i>	<i>5</i>	<i>2</i>	<i>4</i>	<i>6</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>5</i>	<i>2</i>	<i>4</i>	<i>6</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>8</i>
<u><i>2</i></u>	<u><i>4</i></u>	<u><i>6</i></u>	<u><i>3</i></u>	<u><i>4</i></u>	<u><i>5</i></u>	<u><i>8</i></u>	<u><i>9</i></u>

2. Copy examples from each of the other columns in the same manner and find the sum for each example.

Columns of Four or More Figures.

48. 1. Commence with column *A*, opposite *1*, and copy the required number of figures for the first example. Copy the second, third, etc., examples in the same manner as those with three figures.

2. Copy in this way from each column in the table, examples with four figures in a column; then five figures; six figures; seven figures; eight figures.

NOTE.—The teacher should illustrate on the blackboard, to young pupils, the method of copying examples from this and following tables.

The pupil should be required to practice on examples with three and four numbers until he can give the sums almost at sight of the figures; longer columns can then be given.

Definite work from this and subsequent tables should be assigned to the pupil to prepare, on his slate or on paper, at his seat and at home.

SLATE AND BOARD EXERCISES.

49. Find the sum of

(1)	(2)	(3)
8	80	800
9	90	900
7	70	700
24	240	2400

EXPLANATION.—1. The sum of 7, 9, and 8 is found by forming *groups of ten*. Thus, the 7 and 9 make 1 *ten* and 6, and this 6 and 8 make 1 *ten* and 4. Hence, 7, 9, and 8 make 2 *tens* and 4.

2. The sum of 7, 9, and 8 is the same whether these figures represent *units*, *tens*, or *hundreds*, etc. Hence, when their sum is found, if they represent *units*, as in the

first example, the sum is units; if they represent *tens*, as in the second example, the sum is tens; if *hundreds*, hundreds, etc.

50. Analyze on your slate each of the following sets of numbers, thus :

$$8539 = 8000 + 500 + 30 + 9.$$

$$3080 = 3000 + 80.$$

$$7402 = 7000 + 400 + 2.$$

(1)	(2)	(3)	(4)	(5)	(6)
6746	5578	3063	68953	70406	37506
8042	6909	6704	70507	40069	93540
4305	7025	5380	38005	80340	60320

51. Find the sum in each of the following examples :

- | | | |
|------------------|-------------------|-----------------|
| 1. 70 + 5. | 4. 7200 + 80 + 4. | 7. 90 + 60. |
| 2. 800 + 60 + 3. | 5. 6003 + 400. | 8. 700 + 600. |
| 3. 600 + 80 + 9. | 6. 70 + 50. | 9. 5000 + 9000. |

(10)	(11)	(12)	(13)	(14)	(15)
30	400	9000	40000	9000	4005
60	700	5000	80000	5000	7003
20	800	7000	30000	8000	2006
50	600	3000	90000	6000	8009

SLATE AND BOARD EXERCISES.

52. 1. Find the sum of 245, 568, 795, and 259.

245
568
795
259
1867

EXPLANATION.—1. We write the numbers so that figures representing the same order of units stand in the same column.

2. We add the units' column, as in (49), naming only the successive sums, thus, 9, 14, 22, 27. We write the 7 *units* under the units' column.

3. We add the 2 *tens* of the units' column to the tens' column, adding the tens' column by naming as before the successive sums; thus, 2, 7, 16, 22, 26 *tens*, or 2 *hundred* and 6 *tens*. We write the 6 *tens* under the tens' column.

4. We add the 2 *hundred* to the hundred's column, and proceed as with the units and tens. We write the 18 *hundred* under the hundred's column.

53. Copy on your slate and add and explain, as above, each of the following examples:

(2)	(3)	(4)	(5)	(6)	(7)
503	99	370	2075	48060	52708
66	560	8086	59683	3504	976
759	63	6708	762	983	5839
93	695	635	7523	76839	96786
58	457	78	3789	5969	638
<u>543</u>	<u>422</u>	<u>6497</u>	<u>25394</u>	<u>36348</u>	<u>45576</u>
(8)	(9)	(10)	(11)	(12)	(13)
304	209	8437	5674	865	85060
3976	9560	589	8009	93	3905
8698	8877	62	73060	7458	40638
57	634	437	7950	83966	96077
633	3735	6895	36509	506	4940
5998	476	763	4877	2398	82596
755	65	4325	727	7433	8579
<u>979</u>	<u>420</u>	<u>512</u>	<u>44553</u>	<u>746</u>	<u>31164</u>

ARITHMETICAL TABLE No. 3.

	A.	B.	C.	D.	E.	F.	G.	H.
1.	6	5	8	9	4	8	5	8
2.	5	3	7	0	8	0	7	9
3.	2	0	5	7	5	9	0	6
4.	6	7	3	5	9	7	9	8
5.	4	2	8	0	1	5	8	4
6.	5	6	0	9	0	8	5	7
7.	6	5	7	4	8	5	0	7
8.	3	0	4	7	5	4	9	5
9.	5	4	0	0	9	7	8	0
10.	2	0	5	8	0	9	3	8

54. Copy examples as shown on next page from this table and from Table No. 2, on page 35. Continue this practice until you can add rapidly and accurately.

Answers to examples from the *Tables* are given at the end of the book.

EXAMPLES FROM TABLES NO. 2 AND 3.*Exercises with Numbers of Two Figures.*

55. 1. Copy examples with two numbers from Table No. 2, page 35, then from Table No. 3, page 39.

Use columns *A* and *B*. Commence opposite *1*, and take two numbers for the first example, then opposite *2*, and take two more numbers for another example, and so on to the bottom of the table. The examples taken in this way from columns *A* and *B*, Table No. 3, are as follows:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
65	53	20	67	42	36	65	30	54
<u>53</u>	<u>20</u>	<u>67</u>	<u>42</u>	<u>36</u>	<u>65</u>	<u>30</u>	<u>54</u>	<u>26</u>

2. Copy in this manner examples from columns *B* and *C*; *C* and *D*; *D* and *E*; *E* and *F*; *F* and *G*; *G* and *H*.

3. Copy in the same way examples of three numbers; four numbers; five numbers, etc. Find the sum for each example.

Exercises with Numbers of Three or More Figures.

56. 1. For numbers of three figures use any three columns that follow each other, as *ABC*, *DEF*.

2. For numbers of four places use any four columns that follow each other, as *BCDE*, *EFGH*.

3. Commence with examples of three numbers, then take four, five, and so on up to eight numbers.

4. Copy the numbers from the table in the same manner as those of two figures. Thus, the examples with three numbers from columns *ABC*, Table No. 3, are as follows:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
658	537	205	673	428	360	657	304
537	205	673	428	360	657	304	540
<u>205</u>	<u>673</u>	<u>428</u>	<u>360</u>	<u>657</u>	<u>304</u>	<u>540</u>	<u>265</u>

AND 3.

ures.

Table No. 2,

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54
26

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example.

Figures.

columns

as that fol-

then take

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the numbers

(8)
304
540
265

WRITTEN EXERCISES.

57. 1. How many pounds in three loads of hay, each weighing 2325 pounds? In five loads, each weighing 1983 pounds?

2. How many acres in four farms, each containing 198 acres?

3. A farmer sold 293 bushels of wheat to one man, 185 to another, and 86 to another. How many bushels did he sell?

4. Henry Scott sold a span of horses for \$275, a carriage for \$395, and harness for \$65. How much did he receive?

5. A farmer has 95 sheep in one field, 187 in another, and 264 in another. How many sheep has he in all?

6. A merchant sold 175 yards of cotton on Monday, 386 yards on Tuesday, 139 yards on Wednesday, 98 yards on Thursday, 216 on Friday, and 397 on Saturday. How many yards did he sell in all?

7. A man sold a house for \$3894, a horse and carriage for \$586, and seven tons of hay for \$95. How much did he receive for the whole?

8. Peter Eaton paid for a tub of butter \$24, for eight cords of wood \$49, and four barrels of flour \$36. How much did he pay in all?

9. How many pounds of butter in five tubs, each weighing 85 pounds? In three tubs, each weighing 78 pounds?

10. What is the sum of \$472, \$843, \$366, and \$95? Of \$397, \$283, \$94, \$569, and \$85? Of \$836, \$1372, \$995, and \$48?

11. How many bushels in three loads of wheat, each containing 83 bushels? In seven loads, each containing 69 bushels?

12. A grocer bought three cheeses, each weighing 54 pounds, and four, each weighing 69 pounds. How many pounds did he buy in all?

13. Find the sum of \$356, \$257, \$423, and \$87. Of \$936, \$504, \$240, \$50, and \$203. Of \$504, \$641, \$237, \$2140, and \$731.

CANADIAN MONEY.

58. 1. The *Sign* \$ stands for the word *dollars*. Thus, \$9 is read *nine dollars*.

2. The letters *ct.* stand for *cents*. Thus, 24 *ct.* is read *twenty-four cents*.

3. When dollars and cents are both given, the cents are expressed by writing them after the dollars with a period between them. Thus, \$5 and 37 *ct.* are written \$5.37.

4. When the number of cents is less than 10, a cipher must occupy the first place at the right of the period. Thus, \$15 and 9 *ct.* are written \$15.09.

5. In arranging numbers for addition, dollars must be placed under dollars and cents under cents, in such order that the periods in the numbers stand in the *same column*; thus,

(1)	(2)	(3)
\$42.69	\$840.36	\$900.05
8.25	93.08	60.32
<u>346.54</u>	<u>207.03</u>	<u>300.04</u>

Add as if there were no periods in the numbers, and in the sum place a period between the second and third figure from the right. The figures on the left of the period express dollars, those on the right cents.

59. Read, arrange and add the following:

1. \$6.36 + \$99.43 + \$5.07 + \$70.50.
2. \$364.02 + \$30.52 + \$709.80.
3. \$3.06 + \$805.30 + \$34.09 + \$600.04.
4. \$490.08 + \$5.25 + \$46 + \$208.07.

Express the following in figures and with the proper signs.

5. Thirteen dollars and forty-eight cents.
6. Two hundred three dollars and seventy cents.
7. Four dollars and seven cents.
8. Eight hundred dollars and forty cents.

SLATE EXERCISES.

60. Copy and find the sum of each of the following :

(1)	(2)	(3)	(4)	(5)
\$307.02	\$800.60	\$583.	\$37.06	\$573.
84.69	905.07	609.06	802.40	65.32
500.00	32.06	28.	75.	802.05
400.75	708.39	436.90	90.03	850.73
<u>239.08</u>	<u>400.05</u>	<u>800.07</u>	<u>342.79</u>	<u>90.50</u>
(6)	(7)	(8)	(9)	(10)
\$900.05	\$26.80	\$854.05	\$389.	\$101.01
57.	13.14	60.22	57.65	79.
406.13	590.	100.10	105.10	253.39
73.00	268.39	530.05	780.23	893.
5.59	85.	85.70	96.05	500.
<u>260.</u>	<u>703.04</u>	<u>705.04</u>	<u>405.</u>	<u>46.90</u>

Read, arrange on your slate in columns, and find the sum :

11. Of \$8.25, \$27.48, \$13.06, \$407.39, and \$80.05.
12. Of \$273.06, \$75, \$306.02, \$500, and \$330.73.
13. Of \$506, \$39, \$602.15, \$290.87, and \$730.42.

Express the following in figures and with the proper signs :

14. Seven dollars and nine cents. Eighty-four dollars and six cents.
15. Two hundred ten dollars and three cents.
16. One dollar and nine cents. Five dollars and ninety cents.
17. Six hundred thirty dollars and eight cents.
18. Use the sign \$ and express 45 cents ; 79 cents ; 95 cents ; 8 cents ; 4 cents ; 1 cent.
19. 79 cents ; 50 cents ; 7 cents ; 6 cents ; 10 cents ; 9 cents.
20. One hundred one dollars and one cent.
21. One thousand one dollars and one cent.

WRITTEN EXERCISES.

61. 1. Bought twelve pounds of sugar for \$1.68, two pounds of tea for \$1.90, and eight pounds of butter for \$2.40. What did the whole cost?

2. Paid \$1.15 for cheese, \$4.93 for coffee, \$3.85 for flour, and \$7.09 for potatoes. How much did I pay in all?

3. Sold three barrels of apples for \$12.75, fifteen bushels turnips for \$3.75, and four cabbages for 60 cents. How much did I get for the whole?

4. Paid one man \$38.02, another \$307.45. How much did I pay in all?

5. Henry bought a gun for \$17.70, a pair of skates for \$3.45, and a hunter's knife for \$2.45. How much did the whole cost?

6. Bought a coat for \$22.85, and a hat for \$5.54. How much did I pay for both?

7. A lady paid for goods in one store \$14.36, in another \$37.79, and in another \$6.05. How much did she pay in all?

8. A grocer sold to one man \$34.63 of groceries, to another \$16.20, and to another \$9.07. How much did he sell in all?

9. Bought three books for \$5.73, six quires of paper for 90 cents and a gold pen for \$6.85. How much did they all cost?

10. Ada paid for a dress \$23.34, a hat \$5.87, a shawl \$17.64, and a pair of gloves \$1.95. How much did she pay in all?

11. James sold 2 barrels of apples for \$6.95, a bushel of pears for \$3.45, and 4 baskets of peaches for \$4.25. How much did he get for the whole?

12. George bought 10 cords of wood for \$42.50, a tub of butter for \$20.75, and 17 bushels of potatoes for \$8.50. What was the cost of the whole?

13. A farmer received in one year \$806.95 for wheat, \$256.38 for corn, and \$95.86 for oats. How much did he receive in all?

14. Paid for wheat \$736.25, for oats \$121.10. How much did I pay for all?

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WRITTEN EXERCISES.

62. 1. Thomas Austin bought 3 horses for \$527, 6 cows for \$181, and 12 sheep for \$63.85; what did he pay for all?

2. A man gave to his wife \$1145, to his daughter Jane \$205.60, to his daughter Agnes the same amount, and to his son \$305.58; how much money did he give to all?

3. In a certain city there are 5 schools; in the first are 789 pupils, in the second and third, each 935, in the fourth 1100, and in the fifth 886; how many pupils in the five schools?

4. Elmer earned \$80.29, his father gave him \$47.13, then he earned \$62.08 more; how much money had he?

5. If I deposit \$207.18 in a bank on Monday, \$466.97 on Tuesday, \$136.08 on Wednesday, \$37.20 on Thursday, \$200.28 on Friday, and \$1060 on Saturday, how many dollars do I deposit in the six days?

6. A man buys a village lot for \$2652, upon which he builds a house which cost him \$1907.75, he pays \$20.32 for fencing, \$49.09 for having his lot graded, and \$35.48 for laying a sidewalk; how much money will pay for all?

7. James Thompson owes one man 26 dollars and 4 cents, he owes another man 475 dollars and 90 cents, another \$1406 and 8 cents; what is the amount of his indebtedness?

8. John Bedford went to the grocery and bought the following items: 2 barrels of flour for \$13.75, 12 pounds of butter for 3 dollars and 8 cents, 4 gallons of syrup for \$4.60, 25 pounds of meal for \$2 and 7 cents, and 13 gallons of vinegar for 6 dollars and 30 cents; what did he pay for all?

9. A nurseryman sold 185 peach trees, 3146 apple trees, 230 plum trees, 2024 cherry trees, 876 pear trees, 256 quince trees, and has still remaining 4892 trees; how many trees did he have before he sold any?

10. William Henderson paid for groceries for the week \$7.89, for meat \$2.37, for other articles \$2.05, and for a suit of clothes \$23.75; how much did he pay in all?

DEFINITIONS.

63. *Addition* is the process of uniting two or more numbers into one number.

64. *Addends* are the numbers added.

65. The *Sum* or *Amount* is the number found by addition.

66. The *Process of Addition*, when the sum is greater than ten, consists in forming units of the same order into groups of ten, so as to express their amount in terms of a higher order.

67. The *Sign of Addition* is +, and is read *plus*. When placed between numbers, thus, $8+3+6+2+9$, it means that they are to be added.

68. The *Sign of Equality* is =, and is read *equal*; thus, $9+4=13$ is read *nine plus four equal thirteen*.

RULE.

69. *I. Write the numbers to be added in such a manner that figures representing the same order of units stand in the same column.*

II. Add each column separately, commencing with the units.

III. When the sum of any column is expressed by two or more figures, place the right-hand figure under the column, and add the number expressed by the remaining figures to the next column.

IV. Write under the last column its entire sum.

PROOF.—Add the numbers by commencing at the top of the columns. If the results agree, the work is probably correct.

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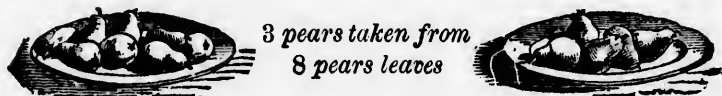
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SUBTRACTION.

ORAL EXERCISES.

70. 1. If 3 pears be taken from 8 pears, how many will be left?



2. Things are *Subtracted* by taking them away.

3. 9 books less 5 books are how many? Less 2 books?

4. Henry has 8 pears and James has 5; how many more pears has Henry than James?



5. How many are 8 pears greater than 5 pears?

6. Comparing two numbers, to find how many the one number is greater than the other, is called *Subtraction*.

The *greater* of the two numbers compared is called the *Minuend*, the *lesser* the *Subtrahend*.

7. The number which indicates *how many* the *minuend* is greater than the *subtrahend* is called the *Difference*.

8. The *Sign* ($-$) stands for the word *less*; thus, $7-3=4$ is read, seven *less* three equal four.

SLATE EXERCISES.

71. Copy the following exercises and practice on each separately. Thus, find the differences and write them under the numbers, then erase them and write them again and again from memory.

$$\begin{array}{r} \text{--- } 1 \text{ ---} \\ \begin{array}{cccccccc} 3 & 2 & 5 & 6 & 8 & 4 & 7 & 9 \\ \hline 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{array} \end{array}$$

$$\begin{array}{r} \text{--- } 2 \text{ ---} \\ \begin{array}{cccccccc} 3 & 5 & 6 & 7 & 9 & 10 & 4 & 8 \\ \hline 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 \end{array} \end{array}$$

$$\begin{array}{r} \text{--- } 3 \text{ ---} \\ \begin{array}{cccccccc} 5 & 4 & 7 & 9 & 10 & 8 & 11 & 6 \\ \hline 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 \end{array} \end{array}$$

$$\begin{array}{r} \text{--- } 4 \text{ ---} \\ \begin{array}{cccccccc} 5 & 7 & 9 & 11 & 10 & 6 & 8 & 13 \\ \hline 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 \end{array} \end{array}$$

$$\begin{array}{r} \text{--- } 5 \text{ ---} \\ \begin{array}{cccccccc} 6 & 9 & 11 & 8 & 13 & 10 & 7 & 14 \\ \hline 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 \end{array} \end{array}$$

$$\begin{array}{r} \text{--- } 6 \text{ ---} \\ \begin{array}{cccccccc} 12 & 10 & 8 & 13 & 15 & 11 & 14 & 7 \\ \hline 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 \end{array} \end{array}$$

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ORAL EXERCISES.

72. 1. James had six doves and sold two of them to George; how many doves had he then left?

SOLUTION.—He has as many doves as the difference between 6 doves and 2 doves, which is 4 doves.

2. John had a knife with four blades, but he broke three of them; how many blades did the knife then have?

3. Nine girls were playing together, but five of them were called home by their mothers; how many remained?

4. A wheel had twelve spokes, but three of them were afterwards broken out; how many spokes were left?

5. Robert is 11 years old and Mary is 7; what is the difference in their ages?

6. One cat caught eleven mice and another caught three; how many more mice did one catch than the other?

7. Ivan has eight rabbits and Hubert has five; how many more rabbits has Ivan than Hubert?

8. Laura has 6 dolls and Mabel has only two; how many more dolls has Laura than Mabel?

9. A long ladder has 17 steps and a short one has 8; how many more steps has the long ladder than the short one?

10. A jeweler has 19 gold rings and 5 silver ones; how many more gold rings has he than silver ones?

11. There were 18 apples on a tree, but the wind blew off 9; how many apples were then left?

12. A farmer set thirteen fence-posts; six of them were oak and the rest cedar; how many were cedar?

13. Samuel caught seventeen fish; three were perch, three pike, and the rest trout; how many trout did he catch?

14. A boy had nine cents and gave five of them for an orange; how many cents had he left?

15. William had 15 dollars and gave away 6; how many dollars has he left?

SLATE EXERCISES.

73. Copy the following exercises and practice on each separately, as directed in (71). Continue the practice until you can give the differences at sight of the numbers.

$$\begin{array}{r} \text{--- } 1 \text{ ---} \\ 12 \quad 9 \quad 8 \quad 11 \quad 10 \quad 15 \quad 14 \quad 16 \\ \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \end{array}$$

$$\begin{array}{r} \text{--- } 2 \text{ ---} \\ 13 \quad 15 \quad 11 \quad 9 \quad 10 \quad 16 \quad 14 \quad 17 \\ \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \end{array}$$

$$\begin{array}{r} \text{--- } 3 \text{ ---} \\ 10 \quad 13 \quad 11 \quad 15 \quad 17 \quad 14 \quad 16 \quad 12 \\ \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \end{array}$$

$$\begin{array}{r} \text{--- } 4 \text{ ---} \\ 8 \quad 12 \quad 6 \quad 17 \quad 13 \quad 12 \quad 18 \quad 11 \\ \underline{3} \quad \underline{4} \quad \underline{6} \quad \underline{8} \quad \underline{2} \quad \underline{5} \quad \underline{3} \quad \underline{9} \end{array}$$

$$\begin{array}{r} \text{--- } 5 \text{ ---} \\ 9 \quad 16 \quad 7 \quad 12 \quad 13 \quad 15 \quad 18 \quad 12 \\ \underline{7} \quad \underline{6} \quad \underline{5} \quad \underline{8} \quad \underline{7} \quad \underline{9} \quad \underline{9} \quad \underline{4} \end{array}$$

$$\begin{array}{r} \text{--- } 6 \text{ ---} \\ 18 \quad 19 \quad 27 \quad 35 \quad 49 \quad 28 \quad 25 \quad 59 \\ \underline{9} \quad \underline{3} \quad \underline{4} \quad \underline{2} \quad \underline{5} \quad \underline{3} \quad \underline{2} \quad \underline{6} \end{array}$$

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ORAL EXERCISES.

74. 1. How many are 8 less 6? 11 less 6? 14 less 6?

2. How many are 16 less 7? 13 less 7? 9 less 7? 15 less 7?
16 less 7? 14 less 7? 29 less 7?

3. How many will remain if 8 be taken from 8? From 10?
From 14? From 17? From 12? From 16? From 29?

4. How many are 11 less 9? 17 less 9? 13 less 9? 19 less 9?
12 less 9? 18 less 9?

5. How many are 13 - 8? 17 - 9? 26 - 5? 13 - 5?
15 - 7? 24 - 3? 39 - 4? 86 - 3? 99 - 9?

6. If 7 *tens* be taken from 9 *tens*, how many *tens* will remain?
8 *tens* less 3 *tens* are how many? $80 - 20 =$ how many?

7. Express in figures 5 *tens*; 8 *tens*; 6 *tens*; 12 *tens*;
15 *tens*; 9 *tens*; 18 *tens*; 25 *tens*; 57 *tens*; 16 *tens*.

8. Express 9 *tens* and 5 *tens* each in figures. 9 *tens* less 5 *tens*
are how many? 90 less 60 are how many?

9. Eighty trees less 50 trees are how many trees?

10. Express in figures 7 *hundred*; 4 *hundred*; 12 *hundred*;
16 *hundred*; 19 *hundred*; 28 *hundred*; 74 *hundred*; 150 *hundred*.

11. Express 9 *hundred* and 3 *hundred* each in figures.
8 *hundred* less 3 *hundred* are how many?

12. Nine hundred less one hundred are how many?

13. Thirteen *tens* less seven *tens* are how many? 130 less 80
are how many? 120 less 90 are how many?

14. Fifteen *hundred* less eight *hundred* are how many?
1500 less 800 are how many? $1400 - 600 =$ how many?

15. A farmer had 9 *hundred* bushels of wheat and sold
6 *hundred*; how many bushels had he left? $900 - 600 =$
how many?

16. Express in figures 6 *thousand*; 8 *thousand*; 19 *thousand*.

17. Seven *thousand* less five *thousand* are how many? 7000
less 5000 are how many? $6000 - 2000 =$ how many?

each sep-
until you

$$\begin{array}{r} 4 \\ 7 \\ \hline 16 \\ 7 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ 8 \\ \hline 17 \\ 8 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ 9 \\ \hline 12 \\ 9 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ 3 \\ \hline 11 \\ 9 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ 9 \\ \hline 12 \\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ 2 \\ \hline 59 \\ 6 \\ \hline \end{array}$$

SLATE EXERCISES.

75. Copy on your slate and perform the subtraction in each of the following exercises, thus:

— 1 —					
7	70	700	7000	500	5000
<u>4</u>	<u>40</u>	<u>400</u>	<u>4000</u>	<u>300</u>	<u>3000</u>
3	30	300	3000	200	2000

Observe, that when 4 is taken from 7, the remainder is 3; hence 4 *units* taken from 7 *units* the remainder must be 3 *units*, 4 *tens* or 40 taken from 7 *tens* or 70 the remainder must be 3 *tens* or 30, and so on with *hundreds*, *thousands*, and so forth.

— 2 —					
80	800	8000	60	600	6000
<u>30</u>	<u>300</u>	<u>3000</u>	<u>20</u>	<u>200</u>	<u>2000</u>

— 3 —					
900	9000	120	110	130	150
<u>500</u>	<u>5000</u>	<u>60</u>	<u>70</u>	<u>50</u>	<u>80</u>

— 4 —					
7000	5000	9000	1400	1200	1600
<u>4000</u>	<u>3000</u>	<u>7000</u>	<u>800</u>	<u>300</u>	<u>900</u>

— 5 —					
70	9	79	600	80	7
<u>30</u>	<u>4</u>	<u>34</u>	<u>400</u>	<u>50</u>	<u>2</u>
					<u>687</u>
					<u>452</u>

— 6 —					
907	7008	5804	8976	6598	9786
<u>502</u>	<u>2004</u>	<u>2301</u>	<u>3242</u>	<u>2173</u>	<u>2514</u>

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SLATE EXERCISES.

76. Separate each of the following numbers into two parts, so that one part will consist of 1 *ten*, or of 1 *ten* and the *units* of the number, thus :

$$30 = 20 + 10.$$

$$78 = 60 + 18.$$

$$359 = 340 + 19.$$

Continue to separate in this manner, on your slate, the following numbers, until you can give the parts at sight of each number.

— 1 —

20	60	31	71	62	33	73	24
40	30	61	32	92	63	23	64
70	90	91	52	72	93	54	94
50	21	41	82	22	43	74	44
80	51	81	42	53	83	34	84

— 2 —

35	65	26	56	77	43	98	29
85	25	96	97	57	78	28	69
45	55	36	37	27	38	39	99
75	76	66	87	67	68	59	49
95	46	86	47	38	58	89	79

77. Write on your slate in irregular order the *tens* from 10 to 90 and subtract 2 from each, thus :

40	20	60	30	70	50	80	10	90
<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>
38	18	58	28	68	48	78	8	88

Observe, that in each example we simply subtract 2 from 10; thus, in taking 2 from 40 the 40 is regarded as 30 + 10, and the 2 taken from the 10, leaving 8, this 8 added to the 30 gives the remainder 38.

Subtract in this manner successively 1, 2, 3, 4, and so on up to 9. When the remainders are found, erase them and write them again and again from memory, until you can write them at sight of the two numbers.

SLATE EXERCISES.

78. Write on your slate in irregular order the *tens* and 1 unit from 21 to 91 inclusive, and subtract 2 from each number, thus:

			<u> </u> 1 <u> </u>				
31	51	81	21	91	61	41	71
<u> 2 </u>	<u> 2 </u>	<u> 2 </u>	<u> 2 </u>	<u> 2 </u>	<u> 2 </u>	<u> 2 </u>	<u> 2 </u>
29	49	79	19	89	59	39	69

Observe, that in each example the number from which the 2 is subtracted is separated into two parts, as in (76). Thus, in subtracting 2 from 31, the 31 is regarded as 20 + 11, and the 2 is taken from 11, leaving 9; adding this 9 to the 20 gives the remainder 29.

Subtract in this manner successively 3, 4, 5, 6, 7, 8, and 9 from each of these numbers. In each case, when the subtraction is performed, erase the remainders and write them again and again from memory.

Practice in this way upon each of the following exercises:

			<u> </u> 2 <u> </u>				
42	72	32	52	82	22	62	92
<u> 3 </u>	<u> 3 </u>	<u> 3 </u>	<u> 3 </u>	<u> 3 </u>	<u> 3 </u>	<u> 3 </u>	<u> 3 </u>

Practice as directed, upon subtracting 3, then erase it and practice in the same manner upon 4, then 5, then 6, 7, 8, and 9.

			<u> </u> 3 <u> </u>				
53	83	33	63	93	43	23	73
<u> 4 </u>	<u> 4 </u>	<u> 4 </u>	<u> 4 </u>	<u> 4 </u>	<u> 4 </u>	<u> 4 </u>	<u> 4 </u>

Practice upon 4 as directed, then 5, then 6, 7, 8, and 9.

			<u> </u> 4 <u> </u>				
84	34	64	24	74	44	94	54
<u> 5 </u>	<u> 5 </u>	<u> 5 </u>	<u> 5 </u>	<u> 5 </u>	<u> 5 </u>	<u> 5 </u>	<u> 5 </u>

Practice upon 5 as before, then upon 6, 7, 8, and 9.

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SLATE EXERCISES.

79. Practice as directed in (78) on the following exercises :

$$\begin{array}{r} \text{--- 1 ---} \\ 76 \quad 46 \quad 86 \quad 86 \quad 66 \quad 26 \quad 56 \quad 96 \\ \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \quad \underline{7} \end{array}$$

After practicing upon 7, erase it and use 8, then 9.

$$\begin{array}{r} \text{--- 2 ---} \\ 47 \quad 67 \quad 57 \quad 97 \quad 37 \quad 87 \quad 27 \quad 77 \\ \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \quad \underline{8} \end{array}$$

Subtract 9 from each number in the same manner.

$$\begin{array}{r} \text{--- 3 ---} \\ 38 \quad 58 \quad 98 \quad 48 \quad 78 \quad 28 \quad 68 \quad 88 \\ \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \quad \underline{9} \end{array}$$

80. Analyze the numbers and perform the subtraction in each of the following examples, thus :

Find the difference between 85 and 47.

$$\begin{array}{l} \text{Minuend,} \quad 85 = 70 + 15 \\ \text{Subtrahend,} \quad 47 = 40 + 7 \\ \text{Difference,} \quad 38 = 30 + 8 \end{array}$$

Observe, that the 7 units in the subtrahend cannot be taken from the 5 units in the minuend. Hence we separate the minuend into 70 + 15 and take the 7 units from the 15

units, and the 4 tens, or 40, from the 7 tens, or 70, leaving 38, the difference between 85 and 47.

Perform in this way the following subtractions :

- | | | |
|-------------|--------------|---------------|
| 1. 53 - 26. | 6. 85 - 37. | 11. 361 - 34. |
| 2. 82 - 55. | 7. 63 - 44. | 12. 284 - 58. |
| 3. 61 - 27. | 8. 52 - 25. | 13. 757 - 29. |
| 4. 95 - 79. | 9. 31 - 13. | 14. 363 - 35. |
| 5. 64 - 35. | 10. 82 - 46. | 15. 471 - 43. |

ORAL EXERCISES.

81. 1. How many will remain if 6 be taken from 11? 6 from 21? 6 from 41? 6 from 91? 6 from 141?

2. How many will remain if 5 be taken from 13? 5 from 23? 5 from 53? 5 from 73? 5 from 253?

3. What number must be added to 7 to make 14? To make 34? To make 44? To make 84? To make 134?

4. There are 24 hours in a day; if you sleep 7 hours, how many hours are you awake?

5. I sold a cow for 38 dollars, which was 9 dollars more than it cost; how many dollars did it cost?

6. A man paid 49 dollars for some hay and 7 dollars for some straw; how much did the hay cost more than the straw?

7. A tree had 73 apples on it, but the wind blew off 8 of them; how many remained on the tree?

8. There were 82 houses in a certain town, but 6 of them were destroyed by fire; how many houses remained?

9. There were 55 persons on a train of cars, and at a certain station 5 got off and 13 got on; how many were then on the train?

10. Amy has 27 lines to read in her primer and she has read 6; how many more lines has she to read?

11. Judson caught 39 trout, but the 7 largest fell back into the water; how many did he have to carry home?

12. Farmer Esty had 132 sheep; five of them were black and the rest white; how many were white?

13. A school contains 9 more boys than girls, and there are 86 boys; how many girls are there?

14. There were 236 houses in a village, but a fire burned 8 of them; how many remained?

15. 283 minus 5 are how many? 357 minus 9? 574 minus 8? 613 - 7? 115 - 9? 845 - 6? 88 - 9? 976 - 7? 89 - 3? 37 - 8? 217 - 4?

16. An orchard has 7 more apple trees than cherry trees, and there are 73 apple trees; how many cherry trees are there?

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SLATE AND BOARD EXERCISES.

82. Find the difference between 437 and 179.

Minuend, 437

Subtrahend, 179

Difference, 258

EXPLANATION. — 1. We write the lesser number under the greater, so that units of the same order are in the same column.

2. Since 9 *units* cannot be taken from 7 *units*, we regard the minuend 437 as 420 + 17, and take

the 9 *units* from 17 *units*, leaving 8 *units*.

3. Since 7 *tens* cannot be taken from the 2 *tens* that are left in the minuend, we regard the 420 of the minuend as 300 + 120, and take 7 *tens* or 70 from the 12 *tens* or 120, leaving 5 *tens* or 50.

4. We take the 1 *hundred* from the 3 *hundred* left in the minuend, leaving 200; hence the difference between 437 and 179 is 258.

PROOF, $179 + 258 = 437$.

83. Perform the subtraction in each of the following examples, and explain and prove as above.

- | | |
|------------------------|------------------|
| 1. Take 248 from 524. | 18. 3759 — 1985. |
| 2. Take 385 from 732. | 19. 8352 — 4765. |
| 3. Take 596 from 963. | 20. 6425 — 3847. |
| 4. Take 478 from 654. | 21. 4221 — 1777. |
| 5. Take 289 from 467. | 22. 9443 — 5888. |
| 6. Take 653 from 821. | 23. 7332 — 3555. |
| 7. Take 364 from 533. | 24. 5555 — 2666. |
| 8. Take 487 from 762. | 25. 8232 — 6444. |
| 9. Take 555 from 743. | 26. 6524 — 2879. |
| 10. Take 296 from 854. | 27. 9365 — 4987. |
| 11. Take 359 from 532. | 28. 3694 — 2867. |
| 12. Take 89 from 2341. | 29. 6325 — 4838. |
| 13. Take 425 from 613. | 30. 4263 — 1795. |
| 14. Take 96 from 3624. | 31. 9564 — 8208. |
| 15. Take 587 from 936. | 32. 5348 — 3769. |
| 16. Take 293 from 462. | 33. 2436 — 857. |
| 17. Take 69 from 4325. | 34. 8253 — 976. |

SLATE EXERCISES.

84. Find the difference between 500 and 7.

$$\begin{array}{r} 500 \\ 7 \\ \hline 493 \end{array}$$

EXPLANATION.—There are no *units* from which to take the 7 *units*, hence we regard the 500 as $400 + 90 + 10$, and take the 7 *units* from the 10 *units*, leaving 3 *units*. Hence we have remaining $400 + 90 + 3 = 493$, the difference between 500 and 7.

PROOF, $493 + 7 = 500$.

85. Perform the subtraction in each of the following examples, and explain and prove as above.

(1) $\begin{array}{r} 30 \\ 4 \\ \hline \end{array}$	(2) $\begin{array}{r} 800 \\ 2 \\ \hline \end{array}$	(3) $\begin{array}{r} 500 \\ 5 \\ \hline \end{array}$	(4) $\begin{array}{r} 600 \\ 6 \\ \hline \end{array}$	(5) $\begin{array}{r} 900 \\ 3 \\ \hline \end{array}$	(6) $\begin{array}{r} 400 \\ 7 \\ \hline \end{array}$
(7) $\begin{array}{r} 7000 \\ 8 \\ \hline \end{array}$	(8) $\begin{array}{r} 9000 \\ 4 \\ \hline \end{array}$	(9) $\begin{array}{r} 3000 \\ 5 \\ \hline \end{array}$	(10) $\begin{array}{r} 8000 \\ 3 \\ \hline \end{array}$	(11) $\begin{array}{r} 6000 \\ 6 \\ \hline \end{array}$	(12) $\begin{array}{r} 4000 \\ 9 \\ \hline \end{array}$
(13) $\begin{array}{r} 4000 \\ 37 \\ \hline \end{array}$	(14) $\begin{array}{r} 6000 \\ 25 \\ \hline \end{array}$	(15) $\begin{array}{r} 8000 \\ 63 \\ \hline \end{array}$	(16) $\begin{array}{r} 3000 \\ 57 \\ \hline \end{array}$	(17) $\begin{array}{r} 9000 \\ 74 \\ \hline \end{array}$	(18) $\begin{array}{r} 5000 \\ 46 \\ \hline \end{array}$
(19) $\begin{array}{r} 150 \\ 4 \\ \hline \end{array}$	(20) $\begin{array}{r} 1200 \\ 7 \\ \hline \end{array}$	(21) $\begin{array}{r} 1800 \\ 5 \\ \hline \end{array}$	(22) $\begin{array}{r} 210 \\ 3 \\ \hline \end{array}$	(23) $\begin{array}{r} 510 \\ 2 \\ \hline \end{array}$	(24) $\begin{array}{r} 710 \\ 8 \\ \hline \end{array}$
(25) $\begin{array}{r} 1900 \\ 53 \\ \hline \end{array}$	(26) $\begin{array}{r} 8100 \\ 69 \\ \hline \end{array}$	(27) $\begin{array}{r} 8000 \\ 37 \\ \hline \end{array}$	(28) $\begin{array}{r} 5100 \\ 62 \\ \hline \end{array}$	(29) $\begin{array}{r} 3100 \\ 74 \\ \hline \end{array}$	(30) $\begin{array}{r} 61000 \\ 41 \\ \hline \end{array}$
(31) $\begin{array}{r} 7004 \\ 307 \\ \hline \end{array}$	(32) $\begin{array}{r} 13000 \\ 6008 \\ \hline \end{array}$	(33) $\begin{array}{r} 4000 \\ 502 \\ \hline \end{array}$	(34) $\begin{array}{r} 61000 \\ 7004 \\ \hline \end{array}$	(35) $\begin{array}{r} 11000 \\ 8006 \\ \hline \end{array}$	(36) $\begin{array}{r} 10000 \\ 3003 \\ \hline \end{array}$

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ARITHMETICAL TABLE No. 4.

	A.	B.	C.	D.	E.	F.	G.	H.
1.	6	5	8	9	4	8	5	8
2.	5	3	7	0	8	0	7	9
3.	2	0	5	7	5	6	0	0
4.	0	7	3	5	9	7	9	8
5.	4	2	8	0	0	5	8	4
6.	3	0	0	4	6	3	5	7
7.	0	5	7	4	3	5	0	7
8.	5	0	4	7	5	4	9	5
9.	5	4	0	0	9	7	8	0
10.	2	0	5	8	0	9	3	8

86. Copy examples as shown on next page from this table and from Table No. 2, on page 35. Continue this practice until you can find accurately, almost at sight of the figures, the difference between any two numbers.

EXAMPLES FROM TABLE NO. 3.

Exercises with Numbers of Two Figures.

87. 1. Use columns *A* and *B*. Take for the first example the figures opposite **1** and **2**, for the second example the figures opposite **2** and **3**, etc. Write the lesser number under the greater. The examples from columns *A* and *B* are the following :

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
65	53	67	67	42	65	65	54	54
<u>53</u>	<u>20</u>	<u>20</u>	<u>42</u>	<u>36</u>	<u>36</u>	<u>30</u>	<u>30</u>	<u>26</u>

2. Copy examples in the same manner from *B* and *C*; *C* and *D*; *D* and *E*; *E* and *F*; *F* and *G*; *G* and *H*.

3. Copy new examples, taking one number from columns *A* and *B* and the other from columns *B* and *C*, thus:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
65	53	20	73	42	60	65	30	59	65
<u>58</u>	<u>37</u>	<u>5</u>	<u>67</u>	<u>28</u>	<u>36</u>	<u>57</u>	<u>4</u>	<u>40</u>	<u>26</u>

4. Copy examples in this way, taking the numbers from columns *B* and *C*, and *C* and *D*; *C* and *D*, and *D* and *E*; *D* and *E*, and *E* and *F*; *E* and *F*, and *F* and *G*; *F* and *G*, and *G* and *H*.

Exercises with Numbers of Three or more Figures.

88. 1. Copy examples with numbers of three figures from columns *ABC* in the same manner as the first set with two figures, then from columns *BCD*, *CDE*, *DEF*, *EFG*, *FGH*.

Examples with numbers of four or more figures may be copied in the same way by using the required number of columns.

2. Use for one number columns *ABC* and for the other number columns *BCD*; then *BCD* and *CDE*; and so on.

89. 1. dollars has

2. What \$1824 and \$

3. A man many dollar

4. A groc pounds of i

5. I had man \$49, to

6. A man acres, to an

7. A boy 49 of them.

8. A groc pounds, the out of the in all?

9. A gra 584 bushel what he bo

10. A fa tons, and i stacks 99

11. A n he sold t another 62 left?

12. A m \$472, and much has

13. A many ton

WRITTEN EXERCISES.

89. 1. Henry has \$74 and James has \$29. How many dollars has Henry more than James?

2. What is the difference between \$436 and \$279? Between \$1824 and \$968? Between \$1035 and \$632?

3. A man had \$935 in the bank, and took out \$369. How many dollars had he then left in the bank?

4. A grocer bought 482 pounds of maple sugar, and sold 295 pounds of it. How much has he still left?

5. I had \$145 in my pocket-book and paid out of it to one man \$49, to another \$48. How much had I then left?

6. A man owning 934 acres of land, sold to one man 283 acres, to another 215. How many acres has he still left?

7. A boy had 41 marbles and bought 62 more; he then lost 49 of them. How many had he left?

8. A grocer bought two tubs of butter, the first containing 63 pounds, the second 85 pounds; he sold out of the first 29 pounds, out of the second 48 pounds. How many pounds has he left in all?

9. A grain merchant bought three lots of wheat as follows: 584 bushels, 239 bushels, and 463 bushels; he then sold out of what he bought 1098 bushels. How many bushels has he left?

10. A farmer has in one stack of hay 28 tons, in another 53 tons, and in another 47 tons; he has sold in all out of the three stacks 99 tons. How many tons has he left?

11. A merchant had a piece of cloth containing 469 yards; he sold to one man 132 yards, to another 184 yards, and to another 62 yards. How many yards of the piece had he then left?

12. A man deposited in the bank at one time \$238, at another \$472, and at another \$684; he drew out in all \$1097. How much has he still left in the bank?

13. A farmer had 143 tons of hay and sold 19 tons; how many tons has he left?

CANADIAN MONEY.

90. 1. Take \$18.67 from \$43.25.

\$43.25
18.67
 \$24.58

EXPLANATION.—1. Write the lesser number under the greater, so that the periods are in the same column. When there are no cents, place two ciphers on the right of the period.

2. Subtract as if there were no periods, the 1867 from the 4325, and place in the remainder a period between the second and third figure from the right.

3. The figures to the right of the period express the number of cents, and those to the left the number of dollars; hence the remainder is read, twenty-four dollars and fifty-eight cents.

Perform the subtraction in the following :

(2)	(3)	(4)	(5)	(6)
\$49.76	\$97.35	\$83.52	\$58.93	\$387.26
<u>23.51</u>	<u>43.14</u>	<u>31.27</u>	<u>29.65</u>	<u>159.84</u>

(7)	(8)	(9)	(10)	(11)
\$835.21	\$362.04	\$730.42	\$2034.07	\$4309.05
<u>586.59</u>	<u>128.17</u>	<u>583.90</u>	<u>1293.69</u>	<u>2083.97</u>

12. I was to pay a man \$3.19 and gave him a 5 dollar bill. How much change did I receive?

13. Sold a load of wheat for \$87.52 and received in pay only \$43.95. How much am I yet to receive?

14. Bought a book for \$2.35 and gave the bookseller \$10. How much change did he return?

15. A man owed me \$37.43; he has paid \$12.97. How much is still due me?

16. A boy went into a grocery with \$12, and paid for sugar \$2.13, for tea \$1.85, for butter \$3.47, and for flour \$4. How much of the \$12 had he left?

17. A man earns \$18 a week and his family expenses are \$13.42. How much does he save each week?

91. 1. \$85.68.

2. Bought both \$23.25.

3. Will he has received?

4. A father \$19.07, and money received.

5. Henry and a bug much is yet?

6. Out of I left?

7. Sold oxen at \$1.35. How much did he receive?

8. Alexander's wards drew.

9. A man 7 yards of \$1.35. How much did he leave unpaid?

10. A man and a spouse. How much did he receive?

11. Out of \$8.05.

12. A man paid \$7 for flour and had she left?

WRITTEN EXERCISES.

91. 1. A man had in his purse \$413.52, and paid a debt of \$85.68. How much had he left in his purse?

2. Bought a coat for \$29.75, a vest for \$4.83, and paid on both \$23.27. How much is yet to be paid?

3. William Robertson lent his neighbor \$405.45, on which he has received \$239.87. How much has he yet to receive?

4. A farmer sold a firkin of butter for \$52.35, a cheese for \$19.07, and a load of wheat for \$83.25. He paid out of the money received \$67.93. How much had he then left?

5. Henry Mills bought a horse for \$253, a harness for \$37.45 and a buggy for \$207. He paid on the whole \$283.87. How much is yet to be paid?

6. Out of \$792.32 I paid a debt of \$409.72. How much have I left?

7. Sold a horse for \$247, and took in exchange a yoke of oxen at \$97 and a lot of sheep at \$68.75. How much is still due me?

8. Alexander Smith deposited in the bank \$630.43, and afterwards drew out \$375.87. How much has he in the bank?

9. A merchant sold a lady 12 yards of cloth for \$17.39, 7 yards of ribbon for \$2.95, a shawl for \$29.17, and gloves for \$1.35. She paid on the whole bill \$36.83. How much did she leave unpaid?

10. A farmer bought a cow for \$87, a lot of sheep for \$203.85, and a span of horses for \$264. He paid on the whole \$352.97. How much has he yet to pay?

11. Out of a 60 dollar bill I paid \$2.35, \$7.84, \$23.27 and \$8.05. How much of the bill have I left?

12. A lady had \$99.50 when she went into a grocery. She paid \$7 for sugar, \$20.39 for butter, \$2.13 for spices, \$9 for flour and \$39.67 on an old account. How much of her money had she left?

DEFINITIONS.

92. *Subtraction* is the process of finding the difference between two numbers.

93. The *Minuend* is the greater of two numbers whose difference is to be found.

94. The *Subtrahend* is the lesser of two numbers whose difference is to be found.

95. The *Difference* or *Remainder* is the result obtained by subtraction.

The *Process* of *Subtraction* consists in comparing two numbers and resolving the greater into two parts, one of which is equal to the difference of the two numbers.

96. The *Sign* of *Subtraction* is $-$, and is read *minus*. It indicates that the number written after it is to be taken from the number written before it; thus, $12 - 5 = 7$.

RULE.

97. *I. Write the subtrahend under the minuend, placing units of the same order in the same column.*

II. Begin at the right, and find the difference between the units of each order of the subtrahend and the corresponding order of the minuend, and write the result beneath.

III. If the number of units of any order of the subtrahend is greater than the number of units of the corresponding order of the minuend, increase the latter by 10 and subtract; then diminish by 1 the units of the next higher order of the minuend, and proceed as before.

PROOF.—Add the remainder to the subtrahend; if the sum is equal to the minuend, the work is probably correct.

98.

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MULTIPLICATION.

ORAL EXERCISES.

98. 1. 3 lines + 3 lines + 3 lines are how many lines?

$$\equiv + \equiv + \equiv \text{ are 9 lines.}$$

Three *times* 3 lines are 9 lines.

2. 2 times 3 lines are how many? 5 times 3 lines?

3. 6 times 3 pears are how many pears? 7 times 3 pears?

4. The *Sign* \times stands for the word *times*. Thus, 5×3 is read 3 times 5, and means $5 + 5 + 5$.

5. Express each of the following by using both the sign \times and the sign $+$. Thus, 3 times 4 = $4 \times 3 = 4 + 4 + 4$.

3 times 4.

2 times 8.

4 times 7.

4 times 6.

5 times 4.

6 times 5.

6. Find by adding how many 2 times 6 are; 4 times 7.

7. When we memorize these results and can tell without adding how many 2 times 6, 4 times 7, and so on are, we are said to *multiply*.

8. Taking one number, by using memorized results, as many times as there are ones or units in another, is called *Multiplication*.

9. The number taken or multiplied is called the *Multiplicand*. Thus, in 5 times 9, the 9 is the multiplicand.

10. The number that shows *how many times* the multiplicand is to be taken is called the *Multiplier*.

11. The result obtained by multiplying is called the *Product*.

ORAL EXERCISES.

99. 1. Five boys went fishing ; each caught two fishes, which they put in the same basket ; how many fishes were in the basket ? $2+2+2+2+2=?$ How many are five 2's ?

2. A man planted two rows of trees in his garden ; if there were three trees in each row, how many were there in all ? $3+3=?$ How many are two 3's ?

3. Simon picked two clusters of grapes, each cluster containing 4 grapes ; how many grapes did he pick ? $4+4=?$ How many are two 4's ?

4. Edith's mother gave her 4 books, and each book had three pictures ; how many pictures in all ? $3+3+3+3=?$ How many are four 3's ?

5. There are three clover-leaves on a stem ; how many leaves shall I have if I pick five stems ? $3+3+3+3+3=?$ How many are five 3's ?

6. Ralph's father gave him six dollars a month for three months ; how many dollars did he get in all ? $6+6+6=?$ How many are three 6's ?

7. If a class learn four pages at one lesson, how many pages will they learn at four lessons ? $4+4+4+4=?$ How many are four 4's ?

8. A man sold five hats, getting four dollars for each hat ; how many dollars did he get in all ? $4+4+4+4+4=?$ How many are five 4's ?

9. If five leaves are on one twig, how many leaves will be on six such twigs ? $5+5+5+5+5+5=?$ How many are six 5's ?

10. If one chest has five drawers, how many drawers will four chests have ? $5+5+5+5=?$ How many are four 5's ?

11. If there are four eggs in each nest, how many eggs will there be in seven nests ? $4+4+4+4+4+4+4=?$ How many are seven 4's ?

100.

Find t
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Tab

2×2

2×5

2×3

2×8

Tab

4×5

4×3

4×7

4×4

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SLATE EXERCISES.

100. Copy separately each of the following tables :

Find the *product* for each example by addition and write it on your slate thus :

$$5 \times 3 = 5 + 5 + 5 = 15.$$

$$5 \times 5 = 5 + 5 + 5 + 5 + 5 = 25.$$

Table of Twos.

2×2	2×6
2×5	2×4
2×3	2×7
2×8	2×9

Table of Threes.

3×4	3×8
3×2	3×5
3×6	3×7
3×3	3×9

Table of Fours.

4×5	4×6
4×3	4×8
4×7	4×2
4×4	4×9

Table of Fives.

5×2	5×3
5×6	5×5
5×4	5×7
5×8	5×9

101. Write each of the foregoing tables on your slate without the sign \times . The table of twos, for example, should be written thus :

<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>
<u>2</u>	<u>5</u>	<u>3</u>	<u>8</u>	<u>6</u>	<u>4</u>	<u>7</u>	<u>9</u>

Find the product of each pair of numbers as before and write it under the numbers. Then erase all these products and continue to rewrite them from memory, until you can write them at sight of the numbers.

SLATE EXERCISES.

102. Find the product for the following examples and explain each example thus:

(1) 4×3 . Four multiplied by 3 are 12.

(2) 40×3 . Four *tens* multiplied by 3 are 12 *tens*, or 120.

(3) 400×3 . Four *hundred* multiplied by 3 are 12 *hundred*, or 1200.

Table of Twos applied.

2×2	20×5	200×3	2000×6
2×8	20×3	200×6	2000×2
2×4	20×7	200×9	2000×8
2×6	20×4	200×5	2000×5
2×9	20×8	200×7	2000×7

Table of Threes applied.

30×4	300×8	3000×6	30000×9
30×7	300×3	3000×8	30000×7
30×5	300×9	3000×5	30000×5
30×9	300×7	3000×9	30000×8
30×6	300×2	3000×4	30000×6

Table of Fours applied.

40×2	400×7	4000×5	40000×9
40×5	400×4	4000×9	40000×5
40×8	400×8	4000×6	40000×8
40×6	400×3	4000×8	40000×3
40×9	400×9	4000×4	40000×7

Table of Fives applied.

50×7	500×6	5000×4	50000×8
50×9	500×8	5000×9	50000×3
50×5	500×4	5000×5	50000×6
50×8	500×9	5000×7	50000×2

103.
the produ
Thus, 6

Table of

6×2
 6×4
 6×8
 6×5

Table of

9×3
 9×6
 9×4
 9×8

12×2
 12×5

104
out the

6

2

Find
under
them f

60×8
 60×3
 60×6
 60×2

SLATE EXERCISES.

103. Copy separately each of the following tables and find the product for each example by addition.

Thus, $6 \times 4 = 6 + 6 + 6 + 6 = 24$.

120.

hundred,

Table of Sixes.

6×2	6×6
6×4	6×3
6×8	6×7
6×5	6×9

Table of Sevens.

7×3	7×8
7×5	7×2
7×7	7×6
7×4	7×9

Table of Eights.

8×4	8×7
8×2	8×3
8×6	8×5
8×8	8×9

2000 \times 62000 \times 22000 \times 82000 \times 52000 \times 7*Table of Nines.*

9×3	9×7
9×6	9×2
9×4	9×9
9×8	9×5

Table of Tens.

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

Table of Elevens.

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

Table of Twelves.

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

104. Write each of the foregoing tables on your slate without the sign \times thus:

6	6	6	6	6	6	6	6
<u>2</u>	<u>4</u>	<u>8</u>	<u>5</u>	<u>6</u>	<u>3</u>	<u>7</u>	<u>9</u>

40000 \times 940000 \times 540000 \times 840000 \times 340000 \times 7

Find as before the product of each example and write it under the numbers. Then erase all these products and rewrite them from memory as in (101).

*Table of Sixes applied.*50000 \times 850000 \times 350000 \times 650000 \times 2

60×3	600×2	6000×5	60000×7
60×5	600×8	6000×8	60000×9
60×7	600×6	6000×6	60000×4
60×4	600×9	6000×9	60000×8

SLATE EXERCISES.

105. Copy each of the following examples and find the products.

Thus, $4007 \times 6 = 24042$. *Observe*, when you multiply the 7 *units* by 6, you have 4 *tens* and 2 *units*, which you write in the *tens* and *units* place; when you multiply the 4 *thousands* by 6, you have 24 *thousands*.

Table of Sevens applied.

707×2	7007×6	70707×7	700707×8
707×5	7007×9	70707×5	700707×6
707×3	7007×4	70707×8	700707×9

Table of Eights applied.

808×3	8008×6	80808×2	80808×6
808×7	8008×5	80808×8	80808×9
808×4	8008×9	80808×4	80808×7

Table of Nines applied.

9009×5	90909×2	90909×9	99909×6
9009×8	90909×6	90909×5	90909×9
9009×3	90909×4	90909×8	90909×7

106. Find the product for each of the following examples and name the tables you apply in each case.

Thus, $90705 \times 3 = 272115$. In multiplying the 5 *units* by the 3 the table of *fives* is applied, in multiplying the 7 *hundreds* by the 3 the table of *sevens* is applied, in multiplying the 9 *ten-thousands* by the 3 the table of *nines* is applied.

- | | | |
|-----------------------|-----------------------|-----------------------|
| 1. 30906×7 . | 4. 20705×8 . | 7. 90305×7 . |
| 2. 80405×3 . | 5. 50908×4 . | 8. 30806×9 . |
| 3. 20603×8 . | 6. 80306×7 . | 9. 70409×5 . |

Multiply and explain the following :

- | | | | |
|---------------------|----------------------|-----------------------|---------------------|
| 10. 10×4 . | 11. 100×7 . | 12. 1000×8 . | 13. 4×10 . |
|---------------------|----------------------|-----------------------|---------------------|

107

483

6

2898

to add to

3. Six

49 *tens* of

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4. Six

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29.

SLATE EXERCISES.

107. 1. Multiply 483 by 6.

$$\begin{array}{r} 483 \\ 6 \\ \hline 2898 \end{array}$$

EXPLANATION.—1. The number to be multiplied contains 4 *hundred 8 tens* and 3 *units*, and each of these parts are to be taken 6 times.

2. Six times 3 *units* make 18 units, or 1 *ten* and 8 *units*. We write the 8 *units* in the *units*' place and reserve the 1 *ten*

to add to the *tens*.

3. Six times 8 *tens* make 48 *tens*, which, with the 1 *ten* reserved, make 49 *tens* or 4 *hundred* and 9 *tens*. We write the 9 *tens* in the *tens*' place, and reserve the 4 *hundred* to add to the *hundreds*.

4. Six times 4 *hundred* make 24 *hundred*, which, with the 4 *hundred* reserved, make 28 *hundred* or 2 *thousand 8 hundred*.

Multiply and explain in this manner each of the following examples :

- | | | |
|--------------|---------------|----------------|
| 2. 385 by 3. | 7. 5934 × 8. | 12. 80360 × 3. |
| 3. 692 by 7. | 8. 2306 × 4. | 13. 59007 × 6. |
| 4. 864 by 6. | 9. 8509 × 5. | 14. 30835 × 4. |
| 5. 497 by 4. | 10. 6083 × 7. | 15. 79068 × 5. |
| 6. 853 by 9. | 11. 3095 × 9. | 16. 99999 × 7. |

17. Multiply 83604 by 7 ; by 9 ; by 3 ; by 8 ; by 5.
18. Multiply 509307 by 3 ; by 5 ; by 7 ; by 8 ; by 2 ; by 9.
19. Multiply 83 *hundred* by 10 ; by 6 ; by 9.
20. Multiply 903 *thousand* by 7 ; by 5 ; by 3 ; by 8.

- | | | |
|----------------|----------------|----------------|
| 21. 70707 × 5. | 30. 33333 × 7. | 39. 80808 × 9. |
| 22. 30303 × 8. | 31. 88888 × 9. | 40. 79065 × 7. |
| 23. 90909 × 6. | 32. 55555 × 3. | 41. 38409 × 5. |
| 24. 50508 × 9. | 33. 44444 × 8. | 42. 62537 × 3. |
| 25. 90009 × 7. | 34. 77777 × 4. | 43. 99906 × 6. |
| 26. 99999 × 4. | 35. 22222 × 5. | 44. 43925 × 8. |
| 27. 66666 × 5. | 36. 80907 × 6. | 45. 89374 × 9. |
| 28. 50505 × 6. | 37. 39564 × 9. | 46. 59648 × 5. |
| 29. 83092 × 3. | 38. 80700 × 2. | 47. 83095 × 7. |

ORAL AND WRITTEN EXERCISES.

108. 1. A mason earned 12 dollars a week and spent 4 dollars; how much did he save in 6 weeks?

SOLUTION.—He saved 6 times the difference between \$12 and \$4, which is \$48.

2. How many are 2 times 7, plus 5? 3 times 8, plus 7? 6 times 8, plus 3? 7 times 12, plus 9?

3. How many are 5 times 6, minus 4? 4 times 9, minus 6? 4 times 11, minus 9? 8 times 7, minus 8?

4. At 40 cents a yard, what would 7 yards of cambric cost? 11 yards? 12 yards? 8 yards? 10 yards?

5. How many cents will 12 doves cost, at 9 cents apiece? At 11 cents apiece? At 12 cents apiece?

6. Bought 15 barrels of apples, at \$3 a barrel, and a barrel of crackers for \$5; how much did the whole cost?

7. A merchant sold 7 coats at \$12 apiece, 8 vests at \$4 each, and 10 yards of broadcloth at \$7 a yard; how much did he receive for the whole?

8. Bought 136 chairs at \$3 each, 8 sofas at \$25 each, and 9 tables at \$9 each; how much did the whole cost?

9. Gave \$39 each to 6 men, paid for 29 yards of cloth at \$4 a yard, and for a coat \$26; how much money have I spent?

10. At 5 dollars a cord, what will 39 cords of wood cost? 87 cords? 384 cords? 79 cords?

11. In a week there are 7 days; how many days in 4 weeks? In 3 weeks? In 6 weeks? In 32 weeks?

12. Bought 12 boxes of soap, each containing 39 bars; how many bars in all?

13. What is the cost of 12 acres of land at \$39 an acre? At \$59? At \$84? At \$185? At \$507? At \$953?

14. Jacob McIntyre can earn 100 dollars a month, and it costs him 62 dollars a month to support his family; how much can he save in one year?

109.

257

10

2570

3. Placing
to the left;

In the
number by 10

Multiplication

1. Multiplication

2. Multiplication

3. Multiplication

4. Multiplication

110.

(1) { A
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EXPLANATION
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2. In (3)
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SLATE EXERCISES.

109. Multiply 257 by 10.

257

10

2570

EXPLANATION.—1. In 257 the figure 7 expresses 7 *units*, the figure 5 expresses 5 *tens*, and the figure 2 expresses 2 *hundred*.

2. Each of these figures will express 10 *times* what they now do if moved *one place* farther to the *left*.

3. Placing a cipher at the right of 257 moves each figure *one place* farther to the *left*; hence multiplies each order in 257 by 10.

In the same manner annexing *two* ciphers multiplies a number by 100; three ciphers by 1000, and so on.

Multiply and explain in this manner each of the following:

1. Multiply 93 by 10; by 100; by 1000; by 10000.
2. Multiply 709 by 100; by 10000.
3. Multiply 490 by 10; by 100; by 1000; by 10000.
4. Multiply 9736 by 1000; by 10000.

110. Multiply 59 by 30.

$$(1) \begin{cases} \text{First step, } 59 \times 10 = 590. \\ \text{Second step, } 590 \times 3 = 1770. \end{cases}$$

$$(2) \begin{cases} \text{Both steps in } 59 \\ \text{one operation, } 30 \\ \hline 1770 \end{cases}$$

EXPLANATION.—1. In the *First Step* in (1) 59 is taken 10 times by annexing a cipher; hence 590 is 10 times 59. Now, by taking 590 *three* times, as in the *Second Step*, we have 30 times 59; hence 1770 is 30 times 59.

2. In (2) we unite the *two steps* in one operation by regarding the 59 as multiplied by 10, or as 59 *tens*, and multiplying by 3; hence we write a cipher in the units place in the product, and write 3 times the 59 to the left of the cipher.

Observe, that to multiply by *hundreds* we regard the multiplicand as expressing hundreds, and hence write ciphers in the *units* and *tens* place in the product. We proceed in the same manner in multiplying by thousands, and so on.

SLATE EXERCISES.

111. Multiply and explain each of the following examples :

1. 85×50	37×4000	5007×60000
2. 73×80	95×7000	8045×30000
3. 92×60	463×9000	3906×70000
4. 54×90	627×5000	4509×50000
5. 367×30	890×3000	7000×90000
6. 509×70	70×40	8009×40000
7. 76×200	90×60	9300×20000
8. 39×400	800×700	5090×80000

112. Multiply 783 by 45.

(1)		(2)
783	<i>Multiplicand.</i>	783
45	<i>Multiplier.</i>	45
$783 \times 5 = 3915$	<i>1st partial product.</i>	3915
$783 \times 40 = 31320$	<i>2d partial product.</i>	3132
35235	<i>Whole product.</i>	35235

EXPLANATION.—The multiplier $45 = 40 + 5$; hence we multiply the 783 first by 5, then by 40, and add these two products as shown in (1), giving 35235, which is $40 + 5$ or 45 times 783.

Observe, that when multiplying by the 40 the cipher at the right of the product need not be written, as shown in (2). The position of each figure in 3132 under 3915 indicates what order it represents. Thus, the 2 is placed under the *tens* in 3915; hence we know that it expresses 2 *tens*.

Multiply and explain each of the following :

1. $476 \times 53.$	5. $795 \times 69.$	9. $837 \times 635.$
2. $839 \times 78.$	6. $389 \times 84.$	10. $954 \times 827.$
3. $587 \times 95.$	7. $936 \times 78.$	11. $386 \times 349.$
4. $296 \times 37.$	8. $598 \times 42.$	12. $749 \times 594.$

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ARITHMETICAL TABLE No. 5.

	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
1.	1	6	9	2	5	8	4	6	3	9
2.	4	3	6	8	3	6	9	2	8	5
3.	2	7	5	9	6	3	2	5	4	8
4.	5	9	3	7	4	8	5	9	7	2
5.	8	4	6	3	9	2	7	3	5	9
6.	3	1	9	5	7	9	3	8	2	6
7.	6	5	7	9	2	4	8	4	9	3
8.	9	2	4	6	8	5	9	7	6	8
9.	5	1	8	4	6	7	5	9	3	7
10.	7	4	2	7	9	4	8	5	9	4
11.	4	8	9	5	4	8	6	8	5	9
12.	9	7	5	8	7	3	9	4	8	6

113. Copy examples from this table as follows :

Multiplicand three figures ; Multiplier one.

1. Commence opposite **1** and take multiplicands in order, as in addition (**47**), from columns ABC, then from BCD, CDE, DEF, EFG, FGH, GHI, and HIJ.

For each example take as the multiplier the figure immediately under the right-hand figure of the multiplicand.

Multiplicand five figures ; Multiplier one.

Take multiplicands in order from columns ABCDE, then from BCDEF, CDEFG, DEFGH, EFGHI, FGHIJ.

Take for multipliers, as before, the figure immediately under the right-hand figure of the multiplicand.

SLATE EXERCISES.

Multiplicand four figures ; Multiplier two.

114. 1. Take the multiplicands from Table No. 5, as before directed. Use first columns ABCD, then BCDE, CDEF, DEFG, EFGH, FGHI, and GHIJ.

Take as multipliers the two figures immediately under the two right-hand orders of the multiplicands. The first five examples taken in this way from columns ABCD are :

1692	4368	2759	5937	8463
<u>68</u>	<u>59</u>	<u>37</u>	<u>68</u>	<u>95</u>

Multiplicand six figures ; Multiplier four.

2. Take the multiplicands first from columns ABCDEF, then BCDEFG, CDEFGH, DEFGHI, and EFGHIJ.

Use as multipliers the *four* figures immediately under the four right-hand orders of the multiplicands. The first four examples from columns ABCDEF are :

169258	436833	275963	593748
<u>6836</u>	<u>5963</u>	<u>3748</u>	<u>6392</u>

3. James Wood sold 64 acres of land at 58 dollars per acre ; how much money did he receive ? *Ans.* \$3712.

4. If a railroad car goes 26 miles an hour, how far will it run in 43 hours at the same rate ? *Ans.* 1243 miles.

5. A tailor has a piece of cloth containing 126 yards ; how much will he have left after cutting from it 9 suits, with 4 yards in each suit ? *Ans.* 90 yards.

6. If one acre of land cost \$285, what will 27 acres cost at the same rate ? *Ans.* \$7695.

7. There are 5280 feet in one mile ; how many feet in 345 miles ? *Ans.* 1821600 feet.

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DEFINITIONS.

115. *Multiplication* is the process of taking one number as many times as there are units in another.

116. The *Multiplicand* is the number taken, or multiplied.

117. The *Multiplier* is the number which denotes how many times the multiplicand is taken.

118. The *Product* is the result obtained by multiplication.

RULES.

119. *I. Write the multiplier under the multiplicand, so that units of the same order stand in the same column.*

To multiply by numbers less than 10.

II. Begin at the right hand, and multiply each order of the multiplicand by the multiplier. Write in the product, in each case, the units of the result, and add the tens to the next higher result.

To multiply by 10, 100, 1000, etc.

III. Annex as many ciphers to the multiplicand as there are ciphers in the multiplier.

To multiply by numbers greater than 10.

IV. Multiply the multiplicand by each significant figure in the multiplier successively, beginning at the right, and place the right-hand figure of each partial product under the order of the multiplier used. Add the partial products, which will give the product required.

PROOF.—1. Repeat the work. 2. Use the multiplicand as multiplier; if the results are the same, the work is probably correct.

WRITTEN EXERCISES.

120. 1. A drover bought 56 cows at 38 dollars each, and 49 oxen at \$59 each; what did he pay for all?

2. There are 86400 seconds in one day; how many seconds are there in 297 days? *Ans.* 25660800.

3. A grocer has 48 boxes of raisins, each box containing 36 pounds; how many pounds in all the boxes?

4. A flour merchant sold 286 barrels of flour, each barrel containing 196 pounds; how many pounds did he sell?

5. In a certain orchard are 15 rows of apple trees; there are 12 trees in a row and 4500 apples on each tree; how many apples on all the trees? *Ans.* 810000 apples.

6. One man owes another \$118. He gives in part payment 6 sheep at \$4 per head, and 3 cows at \$27 apiece; how much does he still owe him? *Ans.* \$13.

7. A farmer bought 7 cows at \$35 each, a span of horses for \$225, 4 calves at \$5 each, and a colt for \$45; what did he pay for all? *Ans.* \$535.

8. How many lemons in 350 boxes, if each box contains 274 lemons? *Ans.* 95900 lemons.

9. How much would a man earn in 19 years, if he received a salary of 975 dollars a year? *Ans.* \$18525.

10. A man bought at one time 14 tons of hay at 16 dollars a ton, at another time 24 tons at 18 dollars a ton; what did he pay for all? *Ans.* \$656.

11. How much more must be given for 96 head of cattle at 47 dollars per head, than for 28 horses at 155 dollars each?

12. If 65 bushels of oats can be raised on one acre of ground, how many bushels can be raised on 96 acres?

13. If a cotton mill manufactures 789 yards of cloth in one day, how many yards can it make in 365 days?

14. The profits of a bank amount to \$3500 per month; how much will they amount to in 15 months?

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APPLICATIONS.

CANADIAN MONEY.

121. Canadian Money is the legal currency of the Dominion of Canada. It is composed of *dollars, cents, and mills*. The *dollar* is the unit.

The silver coins of the Dominion are the fifty-cent piece, the twenty-five-cent piece, the ten-cent piece, and the five-cent piece. The only copper coin is the one-cent piece. The *mill* is not coined; it is used only in computation.

TABLE OF UNITS.

10 mills (m.) make	1 cent	. . .	ct.
100 cents	"	1 dollar.	. . . \$.
$\$1 = 100 \text{ ct.} = 1000 \text{ m.}$			

1. How many cents in \$7?

SOLUTION.—Since in \$1 there are 100 ct., in \$7 there must be 7 times 100 ct., which are 700 ct.

Observe, that since \$1 = 100 ct. = 1000 m., any number of dollars are expressed in cents by annexing *two ciphers*, in mills by annexing *three ciphers* (109).

2. In \$9 how many cents? How many mills? How many mills in \$5?

3. Express \$12 in cents; \$6 in mills; \$263 in cents; \$84 in mills; \$24 in cents.

4. James has \$9 all in 5-cent pieces; how many 5-cent pieces has he? How many cents? How many mills?

Observe, mills are written after cents; thus, \$7.495, read 7 dollars 49 cents 5 mills.

5. Read, \$72.439; \$37.936; \$803.072; \$300.009; \$.576; \$3.069; \$.093; \$40.306; \$83.007.

6. How many mills in 8 cents? In 25 ct.? In \$1? In \$7? In \$3.42?

7. Express \$1 in mills; \$3; \$1.36; \$4.32; \$84.

WRITTEN EXERCISES.

- 122.** 1. Find the cost of 8 yards of cloth at \$2.45 for each yard.

$$\begin{array}{r} \$2.45 \\ \times 8 \\ \hline \$19.60 \end{array}$$

EXPLANATION.—1. Since 1 yard cost \$2.45, 8 yards must cost 8 times \$2.45, which are \$19.60.

2. We find 8 times \$2.45 by multiplying as if there were no period between the 2 and 45.

3. We put a period in the product *two* places from the *right*, and prefix the sign (\$) to the whole.

Multiply and explain in this manner the following :

(2)	(3)	(4)	(5)	(6)
\$4.87	\$9.37	\$32.82	\$25.49	\$8.57
<u>5</u>	<u>9</u>	<u>14</u>	<u>37</u>	<u>28</u>

7. Sold a horse for \$195.80, and 45 bushels of wheat at \$1.39 a bushel ; how much did I receive for both ?

8. Bought 59 sheep at \$3.27 each ; how much did I pay for the whole ?

9. Find the cost of 45 yards of cloth at \$2.85 a yard.

10. At \$.435 a pound, what are 73 pounds of coffee worth ?

11. A farmer sold 753 bushels of wheat at \$1.83 a bushel, and paid out of what he received \$893.57. How much had he left ?

12. A lady bought 7 yards of ribbon at \$.45 a yard, 18 yards of silk at \$2.25 a yard, 2 pairs of gloves at \$1.50 each, and 64 yards of cotton at \$.14 a yard. How much did she pay for the whole ?

13. A merchant sold in one day 532 yards of cotton at 15 ct. a yard, 89 yards black cloth at \$2.45 a yard, 150 yards of ribbon at 25 ct. a yard, 3 shawls at \$19.75 each, and 47 yards of silk at \$1.85 a yard. What was the amount of all that he sold during the day ?

14. What is the cost of 15 cords of wood at \$5.50 a cord ?

MEASURES OF WEIGHT.

123. Troy Weight is used in weighing gold, silver, and precious stones, and in philosophical experiments.

TABLE OF UNITS.

24 grains (gr.)	make	1 pennyweight	. pwt.
20 pennyweights	"	1 ounce	. . . . oz.
12 ounces	"	1 pound	. . . . lb.

124. Avoirdupois Weight is used in weighing groceries and all heavy and coarse articles.

TABLE OF UNITS.

16 ounces (oz.)	make	1 pound	. . . . lb.
100 pounds	"	1 hundredweight	. cwt.
20 cwt. or 2000 lbs.	"	1 ton	. . . . T.
1 pound contains 7000 grains <i>Troy</i> .			

Observe, the old ton of 2240 lb. is still in use.

The following denominations are also used :

100 pounds of grain or flour	make	1 cental.
100 pounds of dry fish	"	1 quintal.
100 pounds of nails	"	1 cask or keg.
196 pounds of flour	"	1 barrel.
200 pounds of pork	"	1 barrel.

125. 1. How many ounces in 4 lb. 9 oz. Troy ?

SOLUTION.—Since in 1 lb. Troy there are 12 oz., in 4 lb. there must be 4 times 12 oz., which is 48 oz.; 48 oz. plus 9 oz. equal 57 oz.

2. How many ounces in 7 lb. Troy ? In 8 lb. ? In 12 lb. ?

3. How many pennyweights in 3 oz. ? In 6 oz. ? In 10 oz. ? In 7 oz. ? In 3 oz. 5 pwt. ?

4. In 4 lb. 3 oz. Avoirdupois, how many ounces ?

5. How many pounds in 3 T. 170 lb. ? In 5 T. 84 lb. ? In 14 T. 230 lb. ?

WRITTEN EXERCISES.

126. 1. How many pennyweights in 8 lb. 5 oz. 7 pwt.?

8 lb. 5 oz. 7 pwt.

12
 101 oz.
 20
 2027 pwt.

SOLUTION.—1. Since 12 oz. make 1 lb., in any number of pounds there are 12 times as many ounces as there are pounds. Hence we multiply the 8 lb. by 12, giving 96 oz., to which we add the 5 oz., giving 101 oz.

2. Again, since 20 pwt. make 1 oz., in any number of ounces there are 20 times as many pennyweights as there are ounces.

Hence we multiply the 101 oz. by 20 and add in the 7 pwt., giving 2027 pwt.

2. How many grains in 11 oz. 6 pwt. 18 gr.?

3. What will be the cost of 6 lb. 15 pwt. of gold-dust at \$1 a pennyweight?

4. In 5 cwt. 14 lb. 8 oz., how many ounces?

5. How many pounds in 8 T. 12 cwt.?

6. What will 2 lb. 5 oz. of candy cost at 2 cents an ounce?

7. What will be the cost of 1 T. 3 cwt. 75 lb. of hay at one cent a pound?

8. How many pounds in 9 barrels of flour?

9. Express 3 lb. 8 oz. 17 pwt. in grains.

10. What will be the cost of 5 kegs and 14 lb. of raisins at 4 cents a pound?

11. Express 8 cwt. 29 lb. 14 oz. in ounces.

12. In 6 T. 15 oz., how many ounces?

13. What must I pay for 28 barrels of pork at 12 cents a pound?

14. Find the cost of 4 cwt. 56 lb. of sugar at 11 cents a pound, and 2 quintals of fish at 7 cents a pound.

15. If it takes 2 oz. 4 pwt. of metal to make one tablespoon, how many pennyweights will make 18 tablespoons?

16. How many pounds in 16 cwt.? How many ounces?

DIVISION.

ORAL EXERCISES.

127. 1. In 12 marks how many groups of 4 marks?

$$\begin{array}{rcl} 12 \text{ marks} & = & 3 \text{ groups of 4 marks.} \\ \text{-----} & = & \text{-----} \end{array}$$

2. How many *fours* in *twelve*?

3. How many times 3 marks in 15 marks.

$$\begin{array}{rcl} 15 \text{ marks} & = & 5 \text{ times 3 marks.} \\ \text{-----} & = & \text{-----} \end{array}$$

4. How many *threes* in fifteen?

5. How many times can 6 pears be taken from 18 pears?

6. How many times are 5 pears contained in 15 pears?

7. The sign \div stands for the words "*How many times.*"

Thus, $15 \div 5$ is read, *how many times 5 in 15.*

8. Express by the sign \div the following:

How many times 8 in 24?

How many 6's in 30?

How many times 7 in 35?

How many 9's in 45?

9. Find by subtraction how many 8's in 24.

$$\text{Thus, } 24 - 8 = 16, \quad 16 - 8 = 8, \quad 8 - 8 = 0.$$

10. Find in the same way how many 9's in 54; 7's in 56.

11. How could you find how many 9's in 54 without subtracting?

12. Finding, by using memorized results, how many times one number is contained in another, is called *Division*.

13. The number divided is called the *Dividend*.

14. The number used to divide is called the *Divisor*.

15. The result found by division is called the *Quotient*.

ORAL EXERCISES.

128. 1. At 2 cents apiece, how many pencils can I buy for 8 cents.

SOLUTION.—As many pencils as 2 cents are contained times in 8 cents, which are 4.

2. How many times 2 cents are 16 cents? 18 cents?

3. At 5 cents per pound, how many pounds of rice can I buy for 25 cents? For 40 cents? For 35 cents?

4. How many times 3 pounds are 18 pounds? 27 pounds?

5. At 4 dollars a pair, how many pairs of boots can be bought for 36 dollars? For 28 dollars?

6. If one top cost 3 cents, how many can I buy for 18 cents? For 24 cents? For 30 cents?

7. At 4 cents a quart, how many quarts of milk can I buy for 16 cents? For 24 cents? For 36 cents?

8. How many times 3 pears are 9 pears? 27 pears? 12 pears? 16 pears?

9. At 4 dollars a yard, how many yards of broadcloth can be bought for 20 dollars? For 36 dollars?

10. 28 apples are how many times 4 apples?

11. How many times can 4 apples be taken from 20 apples? From 24 apples? From 36 apples?

12. If a man travel 4 miles in one hour, how long will it take him to travel 45 miles?

13. How many times 5 miles are 15 miles? 25 miles? 35 miles? 55 miles?

14. How many times 3 dollars in 21 dollars? In 27 dollars? In 18 dollars?

15. If a yard of ribbon cost 4 cents, how many yards can be bought for 24 cents? For 33 cents?

16. How many times 5 bushels are 30 bushels? 40 bushels? 20 bushels? 60 bushels? 45 bushels?

SLATE EXERCISES.

129. Copy and practice on each of the following exercises, thus:

$$\begin{array}{r} 2 \overline{) 8} \quad 2 \overline{) 12} \quad 2 \overline{) 4} \quad 2 \overline{) 10} \quad 2 \overline{) 16} \quad 2 \overline{) 6} \end{array}$$

1. *Observe*, the number before the curved line is the *divisor* and the one after the *dividend*. Thus, $2 \overline{) 18}$ means the same as $18 \div 2$, and is read 18 divided by 2, or How many 2's in 18?

Observe, also, the quotients are found by using the multiplication table.

2. Write the quotients under the dividends thus:

$$\begin{array}{r} 2 \overline{) 8} \quad 2 \overline{) 12} \quad 2 \overline{) 4} \quad 2 \overline{) 10} \quad 2 \overline{) 16} \quad 2 \overline{) 6} \\ 4 \quad 6 \quad 2 \quad 5 \quad 8 \quad 3 \end{array}$$

Having found and written the quotients in this way, erase them and write them again and again from memory.

Practice in this manner on each of the following exercises.

$$\begin{array}{r} \text{--- } 1 \text{ ---} \\ 2 \overline{) 6} \quad 2 \overline{) 12} \quad 2 \overline{) 2} \quad 2 \overline{) 8} \quad 2 \overline{) 16} \quad 2 \overline{) 10} \\ 2 \overline{) 8} \quad 2 \overline{) 20} \quad 2 \overline{) 14} \quad 2 \overline{) 22} \quad 2 \overline{) 18} \quad 2 \overline{) 24} \end{array}$$

$$\begin{array}{r} \text{--- } 2 \text{ ---} \\ 3 \overline{) 3} \quad 3 \overline{) 24} \quad 3 \overline{) 18} \quad 3 \overline{) 6} \quad 3 \overline{) 12} \quad 3 \overline{) 27} \\ 3 \overline{) 9} \quad 3 \overline{) 30} \quad 3 \overline{) 15} \quad 3 \overline{) 24} \quad 3 \overline{) 21} \quad 3 \overline{) 33} \end{array}$$

$$\begin{array}{r} \text{--- } 3 \text{ ---} \\ 4 \overline{) 12} \quad 4 \overline{) 30} \quad 4 \overline{) 4} \quad 4 \overline{) 28} \quad 4 \overline{) 44} \quad 4 \overline{) 24} \\ 4 \overline{) 32} \quad 4 \overline{) 8} \quad 4 \overline{) 36} \quad 4 \overline{) 40} \quad 4 \overline{) 16} \quad 4 \overline{) 48} \end{array}$$

$$\begin{array}{r} \text{--- } 4 \text{ ---} \\ 5 \overline{) 10} \quad 5 \overline{) 25} \quad 5 \overline{) 15} \quad 5 \overline{) 5} \quad 5 \overline{) 35} \quad 5 \overline{) 20} \\ 5 \overline{) 45} \quad 5 \overline{) 60} \quad 5 \overline{) 40} \quad 5 \overline{) 55} \quad 5 \overline{) 30} \quad 5 \overline{) 50} \end{array}$$

ORAL AND SLATE EXERCISES.

130. Find how many 2's in 60, or divide 60 by 2.

First step, $60 = 10$ sixes.

Second step, $6 \div 2 = 3$.

Hence $60 \div 2 = 10$ times 3, or 30.

EXPLANATION.—1. We know, as shown in the *First step*, that in 60 there are 10 *sixes*. We know also, as shown in the *Second step*, that there are 3 *twos* in

6; consequently in 60 there are 10 *times* 3 *twos* or 30 *twos*. Hence $60 \div 2 = 30$.

Divide and explain in this way each of the following examples:

1. How many 2's in 14? In 40? In 400? In 4000? In 40000?

2. How many 2's in 12? In 130? In 170? In 1400? In 16000? In 18000?

3. Divide 800 by 2; 9000 by 3; 36 by 4; 24000 by 4.

4. How many 5's in 25? In 1500? In 10? In 1000? In 250? In 4500? In 35000?

5. How many 3's in 18? In 180? In 18000? In 2100?

6. Divide 240 by 3; 8000 by 4; 16000 by 2; 28000 by 4.

7. Divide 450 by 5; 35000 by 5; 36000 by 4; 25000 by 5.

8. How many 3's in 969?

Observe, that $969 = 900 + 60 + 9$, and that you can find at once the number of 3's in each of these parts, and then add the results, which will give the 3's in 969 thus:

$$969 \div 3 = \left\{ \begin{array}{l} 900 \div 3 = 300 \\ 60 \div 3 = 20 \\ 9 \div 3 = 9 \end{array} \right\} = 323.$$

9. How many 2's in 286? In 644? In 868? In 686?

10. Divide 888 by 4; 699 by 3; 484 by 4; 24864 by 2.

11. How many 3's in 969? In 639? In 396936? In 93600? In 360000? In 693000?

12. How many 5's in 635? In 985? In 775? In 8495? In 6235? In 445?

SLATE EXERCISES.

131. Copy each of the following exercises on your slate, and practice in writing the quotients at sight of the divisor and dividend, as directed in (129).

$$\begin{array}{r} \text{--- } 1 \text{ ---} \\ 6 \overline{) 18} \quad 6 \overline{) 30} \quad 6 \overline{) 42} \quad 6 \overline{) 6} \quad 6 \overline{) 36} \quad 6 \overline{) 12} \\ 6 \overline{) 24} \quad 6 \overline{) 60} \quad 6 \overline{) 54} \quad 6 \overline{) 72} \quad 6 \overline{) 48} \quad 6 \overline{) 66} \end{array}$$

$$\begin{array}{r} \text{--- } 2 \text{ ---} \\ 7 \overline{) 28} \quad 7 \overline{) 35} \quad 7 \overline{) 56} \quad 7 \overline{) 14} \quad 7 \overline{) 77} \quad 7 \overline{) 7} \\ 7 \overline{) 70} \quad 7 \overline{) 31} \quad 7 \overline{) 63} \quad 7 \overline{) 42} \quad 7 \overline{) 84} \quad 7 \overline{) 49} \end{array}$$

$$\begin{array}{r} \text{--- } 3 \text{ ---} \\ 8 \overline{) 32} \quad 8 \overline{) 8} \quad 8 \overline{) 40} \quad 8 \overline{) 56} \quad 8 \overline{) 72} \quad 8 \overline{) 88} \\ 8 \overline{) 16} \quad 8 \overline{) 64} \quad 8 \overline{) 96} \quad 8 \overline{) 48} \quad 8 \overline{) 24} \quad 8 \overline{) 80} \end{array}$$

$$\begin{array}{r} \text{--- } 4 \text{ ---} \\ 9 \overline{) 27} \quad 9 \overline{) 45} \quad 9 \overline{) 9} \quad 9 \overline{) 72} \quad 9 \overline{) 99} \quad 9 \overline{) 54} \\ 9 \overline{) 18} \quad 9 \overline{) 63} \quad 9 \overline{) 90} \quad 9 \overline{) 36} \quad 9 \overline{) 81} \quad 9 \overline{) 108} \end{array}$$

132. Divide and explain each of the following examples as directed in (130).

1. How many 6's in 30? In 246? In 2400? In 24000?
2. How many 8's in 56? In 5600? In 3200? In 72000?
3. Divide 45 by 9; 4500 by 9; 35 by 7; 35000 by 7; 6400 by 8.
4. Divide 490 by 7; 40 by 8; 4000 by 8; 6300 by 9.
5. How many 9's in 450? In 7200? In 54000? In 81000?
6. How many 7's in 280? In 4200? In 6300? In 35000?

WRITTEN EXERCISES.

- 133.** 1. At 4 dollars per barrel, how many barrels of flour can be bought for \$3600 ?
2. How many barrels of apples at \$3 per barrel can be bought for \$690 ? For \$936 ?
3. If a ton of coal cost \$7, how many tons can be bought for \$147 ? For \$3507 ? For \$6300 ?
4. If a man can earn two dollars a day, how many days will it take him to earn \$862 ?
5. At \$5 a cord, how many cords of wood can be bought for \$3500 ? For \$1550 ? For \$4500 ?
6. If a steamboat run 9 miles an hour, how long will it take her to go 7200 miles ?
7. If 6 yards of cloth make a suit of clothes, how many suits can be made from 3600 yards ? From 4800 yd. ?
8. How many sheep at \$4 apiece can be bought for \$160 ? For \$230 ? For \$3608 ? For \$2408 ?
9. If Charles can earn \$8 in one week, in how many weeks can he earn \$240 ? \$480 ?
10. At \$5 a week, how many weeks' board can be had for \$100 ? For \$150 ? For \$350 ?
11. If a stage-coach travel 7 miles an hour, how many hours will it take her to travel 4200 miles ?
12. A farmer put two bushels of grain in a bag ; how many bags will it take to hold 4682 bushels ?
13. How many times 3 is 9630 ? Is 3690 ? Is 9369 ?
14. How many calves at \$4 apiece can be bought for \$2484 ? For \$2800 ? For \$3608 ?
15. How many times 6 cents are 5460 cents ? 1260 cents ? 4806 cents ? 3606 cents ?
16. At 4 dollars a barrel, how many barrels of apples can be bought for 2480 dollars ? For \$2840 ? For \$3680 ?
17. Divide 284840 by 4 ; by 2.

ORAL AND SLATE EXERCISES.

134. 1. How many 4's in 14 and how many remaining?

Observe, that you know from the multiplication table that 3 fours are 12, and hence you can tell at once that 14 contains 3 fours and 2 remaining.

Find in this manner orally the quotient and remainder for each of the following examples. Then practice upon your slate in writing the quotients and remainders under each example, separating them by a dash, thus :

$$\begin{array}{r} 2 \overline{) 7} \\ 3-1 \end{array} \quad \begin{array}{r} 5 \overline{) 28} \\ 5-3 \end{array} \quad \begin{array}{r} 4 \overline{) 26} \\ 6-2 \end{array} \quad \begin{array}{r} 8 \overline{) 39} \\ 4-7 \end{array} \quad \begin{array}{r} 3 \overline{) 17} \\ 5-2 \end{array}$$

— 1 —

$$\begin{array}{r} 3 \overline{) 8} \\ 3 \overline{) 16} \\ 3 \overline{) 17} \\ 3 \overline{) 22} \\ 3 \overline{) 19} \\ 3 \overline{) 25} \\ 3 \overline{) 23} \\ 3 \overline{) 10} \end{array} \quad \begin{array}{r} 4 \overline{) 11} \\ 4 \overline{) 22} \\ 4 \overline{) 33} \\ 4 \overline{) 29} \\ 4 \overline{) 30} \\ 4 \overline{) 13} \\ 4 \overline{) 35} \\ 4 \overline{) 14} \end{array} \quad \begin{array}{r} 5 \overline{) 19} \\ 5 \overline{) 24} \\ 5 \overline{) 33} \\ 5 \overline{) 42} \\ 5 \overline{) 29} \\ 5 \overline{) 43} \\ 5 \overline{) 32} \\ 5 \overline{) 23} \end{array}$$

— 2 —

$$\begin{array}{r} 6 \overline{) 22} \\ 6 \overline{) 38} \\ 6 \overline{) 52} \\ 6 \overline{) 28} \\ 6 \overline{) 44} \\ 6 \overline{) 59} \\ 6 \overline{) 22} \\ 6 \overline{) 51} \end{array} \quad \begin{array}{r} 6 \overline{) 58} \\ 6 \overline{) 52} \\ 6 \overline{) 28} \\ 6 \overline{) 55} \\ 6 \overline{) 40} \\ 6 \overline{) 26} \\ 6 \overline{) 38} \\ 6 \overline{) 58} \end{array} \quad \begin{array}{r} 7 \overline{) 19} \\ 7 \overline{) 22} \\ 7 \overline{) 45} \\ 7 \overline{) 37} \\ 7 \overline{) 25} \\ 7 \overline{) 61} \\ 7 \overline{) 30} \\ 7 \overline{) 60} \end{array} \quad \begin{array}{r} 7 \overline{) 26} \\ 7 \overline{) 38} \\ 7 \overline{) 53} \\ 7 \overline{) 69} \\ 7 \overline{) 41} \\ 7 \overline{) 52} \\ 7 \overline{) 66} \\ 7 \overline{) 40} \end{array}$$

— 3 —

$$\begin{array}{r} 8 \overline{) 19} \\ 8 \overline{) 26} \\ 8 \overline{) 39} \\ 8 \overline{) 22} \\ 8 \overline{) 23} \\ 8 \overline{) 47} \\ 8 \overline{) 20} \\ 8 \overline{) 36} \end{array} \quad \begin{array}{r} 8 \overline{) 38} \\ 8 \overline{) 44} \\ 8 \overline{) 21} \\ 8 \overline{) 33} \\ 8 \overline{) 49} \\ 8 \overline{) 51} \\ 8 \overline{) 38} \\ 8 \overline{) 52} \end{array} \quad \begin{array}{r} 9 \overline{) 24} \\ 9 \overline{) 43} \\ 9 \overline{) 66} \\ 9 \overline{) 79} \\ 9 \overline{) 50} \\ 9 \overline{) 39} \\ 9 \overline{) 90} \\ 9 \overline{) 80} \end{array} \quad \begin{array}{r} 9 \overline{) 30} \\ 9 \overline{) 52} \\ 9 \overline{) 39} \\ 9 \overline{) 87} \\ 9 \overline{) 60} \\ 9 \overline{) 40} \\ 9 \overline{) 29} \\ 9 \overline{) 70} \end{array}$$



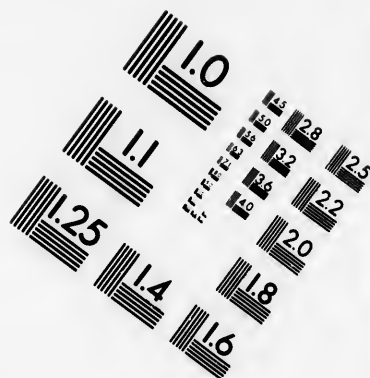
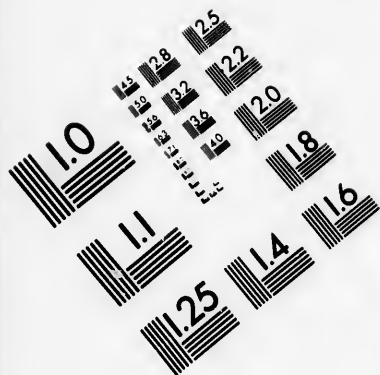
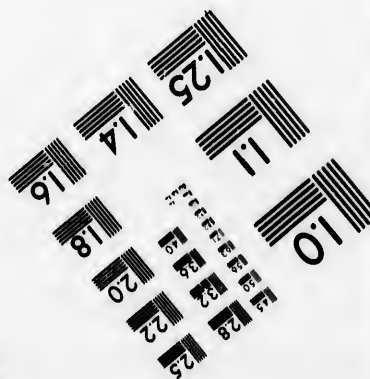
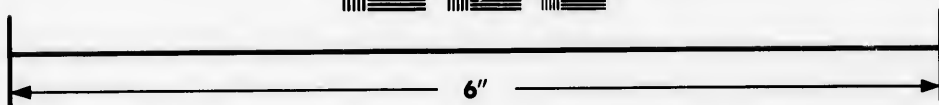
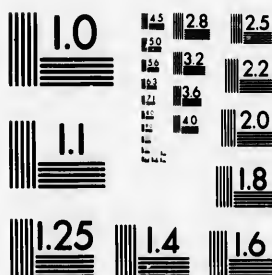
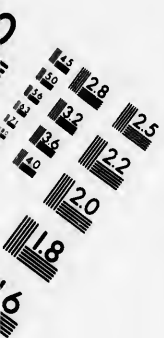


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ORAL AND WRITTEN EXERCISES.

135. 1. If one marble cost 4 ct., how many marbles can I buy for 38 ct., and how many cents remaining?

SOLUTION.—I can buy as many marbles as 4 ct. are contained times in 38 ct., which are 9 and 2 cents remaining.

2. At 6 cents apiece, how many oranges can be purchased for 60 cents? For 68 cents? For 79 cents?

3. If one pound of sugar cost 9 cents, how many pounds can be bought for 79 cents? For 84 cents?

4. At \$8 per ton, how many tons of hay can be bought for \$499? For \$579? For \$7509?

5. If 3 yards of cloth make one coat, how many coats can be made from 378 yards? From 467 yards?

6. How many times can 5 yards be cut from 359 yards? From 3058 yards? From 5556 yards?

7. In one week there are 7 days; how many weeks in 489 days? In 3509 days?

8. How many times 4 days are 49 days? 246 days? 15487 days? 60480 days?

9. If 5 bushels of wheat make a barrel of flour, how many barrels can be made from 5059 bushels?

10. There are 7057 apples in a bin; how many times can I take out 2 apples? 6 apples?

11. If a boy save \$3 a week, how many weeks will it take him to save \$3290? \$2734?

12. At \$6 a cord, how many cords of wood can be bought for \$549? For \$529? For \$388?

13. How many times 8 cherries in 65 cherries? In 76? In 50? In 73? In 79? In 56?

14. If a man build 4 rods of fence in one week, how many weeks will it take him to build 29 rods? 37 rods? 50 rods? 408 rods?

15. Divide 357 by 4; by 6; by 8; by 9.

SLATE AND WRITTEN EXERCISES.

136. 1. Find how many 4's in 1496.

$$\begin{array}{r}
 4 \overline{) 1496} \quad (300 \\
 \underline{1200} \\
 296 \\
 \underline{280} \quad 70 \\
 16 \\
 \underline{16} \quad 4 \\
 4
 \end{array}$$

Hence the quotient is 374

EXPLANATION.—1. We divide 1400 by 4 (130), and find that it contains, as shown in (1), 300 *fours*, equal 1200. Subtracting 1200 from 1496, we have 296 yet to be divided.

2. We now divide 290 by 4 (130) and find that it contains, as shown in (2), 70 *fours*, equal 280. Subtracting the 280 from the 296, we have 16 yet to be divided.

3. The 16 remaining contains 4 *fours*, as shown in (3); hence the 1496 contains $300 + 70 + 4 = 374$ fours.

Perform the division and explain in this manner each of the following examples:

- | | | |
|-------------------|-------------------|--------------------|
| 2. $1572 \div 2.$ | 6. $4365 \div 9.$ | 10. $5992 \div 7.$ |
| 3. $1041 \div 3.$ | 7. $1935 \div 5.$ | 11. $3888 \div 6.$ |
| 4. $1166 \div 2.$ | 8. $2478 \div 7.$ | 12. $6273 \div 9.$ |
| 5. $3348 \div 4.$ | 9. $5872 \div 8.$ | 13. $6872 \div 8.$ |

14. If one cord of wood can be bought for \$4, how many cords can be bought for \$348?

SOLUTION.—As many cords can be bought as \$4 are contained times in \$348. Hence, $\$348 \div \$4 = 87$, the number of cords that can be bought.

15. At \$7 a barrel, how many barrels of flour can be bought for \$413? For \$581? For \$2625?

16. A lady received \$9 a week for teaching and was paid in all \$351; how many weeks did she teach?

17. A farmer sold a piece of land at \$8 an acre, and received in all \$1432; how many acres did he sell?

18. At \$6 a ton, how many tons of coal can be bought for \$348? For \$558? For \$2178?

19. At \$5 a yard, how many yards of cloth can be bought for \$285? For \$875? For \$325?

EXERCISES ON CONTRACTED FORM.

137. Find how many 7's there are in 2695.

$$\begin{array}{r}
 \text{(1)} \\
 7 \overline{) 2695} \text{ (300)} \\
 \underline{7 \times 300 = 2100} \\
 595 \\
 \underline{7 \times 80 = 560} 80 \\
 35 \\
 \underline{7 \times 5 = 35} 5
 \end{array}$$

$$\begin{array}{r}
 \text{(2)} \\
 7 \overline{) 2695} \text{ (385)} \\
 \underline{21} \\
 59 \\
 \underline{56} \\
 35 \\
 \underline{35}
 \end{array}$$

EXPLANATION.—*Observe*, first, that the form in (1) is the same as that on which practice was given in the last exercise. *Observe*, second, that in the form in (2) the work is shortened thus:

1. The multiplication of the divisor 7 by each of the partial quotients is not written, as in (1).

2. The ciphers are omitted from the products 2100 and 560, the significant figures 21 and 56 being in each case placed so that the order of the dividend they are under indicates the order they represent.

3. Only one figure of the dividend is taken down at a time, this being all that is necessary to give another quotient figure.

Perform the division in each of the following examples, and write the work on your slate, as shown in (2).

- | | | |
|---------------------|---------------------|---------------------|
| 1. $874 \div 2$. | 12. $2915 \div 5$. | 23. $4865 \div 7$. |
| 2. $1678 \div 2$. | 13. $4434 \div 6$. | 24. $6642 \div 9$. |
| 3. $1578 \div 2$. | 14. $5022 \div 6$. | 25. $5373 \div 9$. |
| 4. $1035 \div 3$. | 15. $2910 \div 6$. | 26. $7524 \div 9$. |
| 5. $2214 \div 3$. | 16. $3759 \div 7$. | 27. $5688 \div 6$. |
| 6. $1752 \div 3$. | 17. $6041 \div 7$. | 28. $1395 \div 5$. |
| 7. $2572 \div 4$. | 18. $5243 \div 7$. | 29. $8613 \div 9$. |
| 8. $3356 \div 4$. | 19. $6696 \div 8$. | 30. $1971 \div 3$. |
| 9. $1556 \div 4$. | 20. $4632 \div 8$. | 31. $4784 \div 8$. |
| 10. $3690 \div 5$. | 21. $6064 \div 8$. | 32. $5751 \div 9$. |
| 11. $2335 \div 5$. | 22. $3968 \div 8$. | 33. $8613 \div 9$. |

SLATE AND WRITTEN EXERCISES.

Short Division.

138. 1. Find how many 7's there are in 2695, thus:

$$\begin{array}{r} 7 \overline{) 2695} \\ 385 \end{array}$$

EXPLANATION.—The work is shortened still more by writing only the quotient figures, and holding all the numbers in the memory while performing the required operations, thus:

1. We observe, as in the former plan of working, that 7 is contained 3 *hundred* times in 26 *hundred*. Writing the 3 under the *hundreds* of the dividend to show that it represents *hundreds*, we subtract mentally 3 *hundred* times 7, or 21 *hundred*, from the 26 *hundred*, leaving 5 *hundred*, or 50 *tens*, to which we add the 9 *tens* of the dividend, making 59 *tens*.

We proceed in the same manner with the *tens* and *units*.

Division by numbers not greater than 12 should always be performed in this manner. Nothing should ever be written but the quotient.

This form of division is called *Short Division*.

Divide and explain in this manner the following:

- | | | |
|--------------|---------------|----------------|
| 2. 4018 ÷ 7. | 6. 29432 ÷ 4. | 10. 68901 ÷ 7. |
| 3. 1985 ÷ 5. | 7. 34188 ÷ 6. | 11. 38742 ÷ 6. |
| 4. 5912 ÷ 8. | 8. 14511 ÷ 3. | 12. 30976 ÷ 8. |
| 5. 3924 ÷ 9. | 9. 12820 ÷ 5. | 13. 32661 ÷ 9. |

14. If a boy earn \$~ in one week, how many weeks will it take him to earn \$2569?

15. If a canal-boat travel at the rate of 8 miles per hour, how long will it take her to travel 4344 miles? 5376 miles? 3784 miles?

16. How many times can 9 bushels of wheat be taken from 7884 bushels? From 2457 bushels?

17. How many pieces, each 7 inches long, can be cut from a roll of paper 3045 inches long?

18. How many times are \$9 contained in \$8046? In \$8415?

ARITHMETICAL TABLE No. 5.

	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
1.	4	3	8	5	2	7	9	3	6	8
2.	1	9	4	7	8	3	5	6	9	2
3.	5	3	6	9	5	8	7	4	3	7
4.	2	8	3	6	7	4	2	9	5	8
5.	7	4	8	2	5	7	9	6	8	3
6.	3	7	5	8	3	2	6	4	9	7
7.	5	2	9	4	7	3	8	6	5	9
8.	8	5	7	3	9	6	4	9	6	8
9.	3	9	6	8	3	9	2	7	5	4
10.	6	4	8	5	9	7	6	8	4	9
11.	2	7	4	6	3	8	9	7	5	8
12.	5	8	9	4	7	3	8	5	9	7

139. Copy examples from this table as follows :

Dividend three figures ; Divisor one.

1. Commence opposite 2, and take the numbers for dividends from ABC, then from BCD, then CDE, DEF, EFG, FGH, GHI, HIJ.

2. For each example, take as the divisor the figure immediately above the right-hand figure of the dividend.

The first six examples from columns ABC are :

8) 194 4) 536 6) 283 3) 748 8) 375 5) 529

Dividend five figures ; Divisor one.

1. Commence opposite 2, and take the dividend from columns ABCDE, then from BCDEF, then CDEFG, DEFGH, EFGHI, FGHIJ.

2. Take as the divisor, in each example, the figure immediately above the right-hand figure of the dividend.

EXERCISES ON EQUAL PARTS.

140. 1. Make 12 into two equal parts.

$$12 \div 2 = 6$$

Hence $12 = 2$ sixes.

EXPLANATION.—Observe, that in $12 \div 2 = 6$ the divisor denotes how many times the quotient 6 can be taken out of 12. Conse-

quently the quotient 6 is one of the two equal parts of 12, and hence $12 = 6 + 6$.

2. Find *one* of the *two* equal parts of 12; of 16; of 18; of 20; of 10; of 16; of 14; of 24; of 22; of 56; of 68.

3. *One* of the *two* equal parts of a number is called *one-half*, and is written 1 over 2, thus $\frac{1}{2}$. $\frac{1}{2}$ of 12 is $12 \div 2 = 6$.

4. Find *one* of the *three* equal parts of 12; of 18; of 27; of 15; of 33; of 24; of 36; of 99; of 48; of 87.

5. *One* of the *three* equal parts of a number is called *one-third*, and is written 1 over 3, thus $\frac{1}{3}$. $\frac{1}{3}$ of 15 is $15 \div 3 = 5$.

6. *One* of the *four* equal parts of a number is called *one-fourth*; *one* of the *five* equal parts *one-fifth*, and so on.

7. *One* of any number of equal parts of a number is written by placing *one* over the number that denotes the number of equal parts into which the given number is made, thus :

One-fourth is written $\frac{1}{4}$. $\frac{1}{4}$ of 20 is $20 \div 4 = 5$.

One-fifth is written $\frac{1}{5}$. $\frac{1}{5}$ of 35 is $35 \div 5 = 7$.

One-sixth is written $\frac{1}{6}$. $\frac{1}{6}$ of 24 is $24 \div 6 = 4$.

One-tenth is written $\frac{1}{10}$. $\frac{1}{10}$ of 80 is $80 \div 10 = 8$.

One-twelfth is written $\frac{1}{12}$. $\frac{1}{12}$ of 84 is $84 \div 12 = 7$.

And so on with any number of equal parts.

8. Find *one-eighth* of 8; of 24; of 48; of 56; of 72; of 40; of 96; of 560; of 480.

9. If a house and lot is worth \$5056, what is *one-fourth* of it worth? *One-half* of it?

WRITTEN EXERCISES.

141. 1. If 60 cents be equally divided among 3 boys, how many cents will each have ?

2. If 9 oxen cost 486 dollars, what is the price of one ox ?

3. If 8 yards of tweed cost 792 cents, what does one yard cost ?

4. Sold 7 tons of hay for \$119 ; how much did I receive for one ton ?

5. A company of 8 persons own equal shares in a store worth \$25672 ; what is each man worth ?

6. If \$5484 be divided into 3 equal parts, what is the value of each part ?

7. There are 7 farms of equal size that contain in all 2415 acres ; how many acres in each farm ?

8. A farmer has 3864 bushels of wheat, which fill 8 bins of equal size ; how many bushels in each bin ?

9. A father left an estate of \$37865 to be divided equally among his five sons ; how much would each receive ?

10. A grocer bought 7 chests of tea of equal size ; there were 1757 pounds in all ; how many pounds in each chest ?

11. If a railroad train moves 256 miles in 8 hours, how many miles does it move per hour ?

12. Sold 9 acres of land for \$882 ; how much did I receive for one acre ?

13. Divide \$9324 equally among 6 men.

14. A railroad, owned by 9 men who paid equal sums for building it, cost \$258876 ; what did it cost each man ?

15. A grist mill is worth \$38052 ; what is one-fourth of it worth ? One-sixth ? One-twelfth ?

16. Bought 5 houses for \$40325 ; how much did I pay for each house ?

17. Sold 4 horses for \$580 ; how much did I receive for each horse ?

SLATE AND BOARD EXERCISES.

142 Divide 14800 by 37.

$$\begin{array}{r} 37 \overline{) 14800} \quad (400 \\ \underline{14800} \end{array}$$

EXPLANATION.—When the divisor contains two or more figures, we can find the quotient figures by finding how many times the left-hand figure of the divisor is contained in the fewest

left-hand figures of the dividend that will contain it.

Thus 3, the left-hand figure of the divisor, is contained 4 times in 14, the two left-hand figures of the dividend; hence we conclude that 37 is contained in 148 hundred 4 hundred times. Multiplying 37 by 400, we find that $37 \times 400 = 14800$. Hence 400 is the correct quotient.

Divide in this way the following:

- | | | |
|---------------------|-----------------------|------------------------|
| 1. $2220 \div 74$. | 7. $58500 \div 65$. | 13. $525000 \div 75$. |
| 2. $7470 \div 83$. | 8. $12600 \div 42$. | 14. $252000 \div 84$. |
| 3. $4340 \div 62$. | 9. $48500 \div 87$. | 15. $558000 \div 93$. |
| 4. $2160 \div 54$. | 10. $28800 \div 32$. | 16. $287000 \div 43$. |
| 5. $7650 \div 85$. | 11. $26500 \div 53$. | 17. $768000 \div 96$. |
| 6. $7360 \div 92$. | 12. $53600 \div 67$. | 18. $623000 \div 89$. |

19. Divide 27300 by 39.

$$\begin{array}{r} 39 \overline{) 27300} \quad (700 \\ \underline{27300} \end{array}$$

Observe, that by pursuing the same course as before, we find in this example that 3, the left-hand figure of the divisor, is contained 9 times in 27, the two left-hand figures of the dividend; but

when we multiply 39 by 900 we have 35100, a number greater than the dividend, and hence 900 is not the correct quotient. Trying 800 in the same manner, we find it is too large a quotient; hence we take 700, which we find to be the correct quotient.

The correct quotient figure in examples of this kind can be found only by trial.

Perform the division in the following:

- | | | |
|----------------------|-----------------------|-----------------------|
| 1. $1350 \div 27$. | 4. $33600 \div 43$. | 7. $358000 \div 25$. |
| 2. $2340 \div 39$. | 5. $342000 \div 38$. | 8. $273000 \div 35$. |
| 3. $11200 \div 28$. | 6. $208000 \div 26$. | 9. $415000 \div 45$. |

SLATE AND BOARD EXERCISES.

Long Division.

143. 1. Divide 9282 by 26.

$$26 \overline{) 9282} \quad (357$$

$$\begin{array}{r} 78 \\ 148 \\ 130 \\ 182 \\ 182 \end{array}$$

EXPLANATION.—1. When the divisor consists of two or more figures, the results cannot be held in the memory while we perform the operations; hence we proceed thus:

2. We find by *trial* that 26 is contained in 92 hundred 3 hundred times. Multiplying the divisor 26 by 3 hundred, we have 78 hundred, which we subtract from the 92 hundred, leaving 14 hundred, or 140 tens, to which we add the 8 tens of the dividend, giving 148 tens.

3. We now find by *trial* that 26 is contained in 148 tens 5 tens times. Multiplying the divisor 26 by 5 tens, we have 130 tens, which we subtract from the 148 tens, leaving 18 tens, or 180 units, to which we add the 2 units of the dividend, giving 182 units.

4. We find again by *trial* that 26 is contained in 182 units 7 units times. Multiplying the divisor 26 by 7 we have 182, which taken from 182 leaves nothing; hence the division is complete, and 357 is the quotient of 9282 divided by 26.

Perform and explain the division in the following :

- | | | |
|-------------------|-------------------|-------------------|
| 1. 1125 ÷ 45. | 13. 649 ÷ 36. | 25. 59653 ÷ 187. |
| 2. 5976 ÷ 83. | 14. 120597 ÷ 328. | 26. 140378 ÷ 276. |
| 3. 2623 ÷ 43. | 15. 46648 ÷ 136. | 27. 250489 ÷ 382. |
| 4. 16002 ÷ 63. | 16. 63455 ÷ 259. | 28. 480159 ÷ 699. |
| 5. 28952 ÷ 56. | 17. 92115 ÷ 345. | 29. 630121 ÷ 798. |
| 6. 57810 ÷ 94. | 18. 91693 ÷ 239. | 30. 132525 ÷ 285. |
| 7. 18430 ÷ 81. | 19. 103326 ÷ 568. | 31. 684187 ÷ 168. |
| 8. 29822 ÷ 31. | 20. 80307 ÷ 439. | 32. 89458 ÷ 137. |
| 9. 43896 ÷ 93. | 21. 100192 ÷ 351. | 33. 361246 ÷ 476. |
| 10. 127098 ÷ 614. | 22. 120058 ÷ 228. | 34. 80084 ÷ 292. |
| 11. 228984 ÷ 203. | 23. 22796 ÷ 48. | 35. 292683 ÷ 387. |
| 12. 48204 ÷ 309. | 24. 120223 ÷ 64. | 36. 77728 ÷ 145. |

SLATE AND ORAL EXERCISES.

144. Take examples for practice from Arithmetical Table No. 5, p. 94, as follows :

Dividend four figures ; Divisor two.

1. Commence opposite 2, and take the dividends from columns ABCD, then from BCDE, then CDEF, DEFG, EFGH, FGHI, GHIJ.

2. For each example take as divisor the figures immediately above the two right-hand figures of the dividend.

The first five examples from columns ABCD are :

$$85 \overline{) 1947} \quad 47 \overline{) 5369} \quad 69 \overline{) 2836} \quad 36 \overline{) 7482} \quad 82 \overline{) 2758}$$

Dividend six figures ; Divisor three.

1. Commence opposite 2, and take the dividends from columns ABCDEF, then BCDEFG, CDEFGH, DEFGHI, EFGHIJ.

2. For each example take as divisor the figures immediately above the three right-hand figures in the dividend.

1. At 12 cents a pound, how many pounds of sugar can be bought for 36 cents ? For 60 ct. ? For 96 ct. ? For 120 ct. ?

SOLUTION.—Since 1 pound cost 12 cents, as many pounds can be bought for 36 cents as 12 cents are contained times in 36 cents, which are 3.

2. At \$3 a yard, how many yards of cloth can be bought for \$6 ? For \$15 ? For \$75 ? For \$861 ?

3. How many melons at 9 cents each can be bought for 27 cents ? For 81 cents ? For 315 cents ? For 657 cents ?

4. If a man earns \$5 a day, in how many days can he earn \$15 ? \$25 ? \$40 ? \$50 ? \$500 ? \$450 ?

5. At \$4 a head how many sheep can be bought for \$24 ? For \$26 ? For \$48 ? For \$80 ? For \$280 ?

ORAL AND WRITTEN EXERCISES.

145. 1. If 24 cents are divided equally among 6 boys, how many cents will each boy receive?

SOLUTION.—To give each boy 1 cent requires 6 cents. Hence each boy will receive as many cents as 6 cents are contained times in 24 cents, which are 4.

2. What is the price of 1 yard of ribbon, when 5 yards cost 25 ct.? 35 ct.? 45 ct.? 80 ct.? 100 ct.? 400 ct.?

3. How much does a man earn each month, if he receives for 6 months work \$56? \$60? \$150? \$360?

4. What is the price of one acre of land, when 7 acres cost \$21? \$35? \$42? \$56? \$63? \$140? \$280?

5. If 3 yards of silk cost \$9, what will be the cost of 8 yards? Of 12 yards? Of 15 yards? Of 45 yards?

SOLUTION.—Since at \$9 for 3 yards the price of 1 yard is \$3, the cost of 8 yards is 8 times \$3 or \$24.

6. If 5 peaches cost 15 cents, what will be the cost of 3 peaches? Of 7 peaches? Of 12 peaches? Of 25 peaches?

7. If 9 oranges cost 36 cents, what will be the cost of 4 oranges? Of 16 oranges? Of 32 oranges? Of 27 oranges?

8. If 25 yards of cloth cost \$75, what is the cost of one yard? Of 5 yards? Of 9 yards?

9. I paid \$270 for 15 tons of hay; what did I pay for one ton? For 4 tons? For 7 tons?

10. If James can hoe 336 rows in 21 days, how many rows can he hoe in 5 days? In 16 days?

11. A drover bought cows at \$42 per head, and paid for all \$13440; how many did he buy?

12. A grocer bought 283 barrels of molasses, for which he paid \$7358; what was the price of one barrel? Of 35 barrels? Of 160 barrels?

13. How many pounds of butter at 24 cents per pound will pay for 16 yards of calico at 12 cents a yard?

WRITTEN EXERCISES.

146. 1. If a man earn \$325 a year, how long will it take him to earn \$2925? \$4225?

2. A drover paid \$8375 for 67 horses; what did he pay for each? What did he pay for 16 horses?

3. I have a farm worth \$8460; what is one-half of its value? One-third? One-fourth? One-fifth?

4. How many barrels of apples at \$4 per barrel will pay for 2 barrels of sugar at \$14 a barrel, and 4 pounds of tea at one dollar a pound?

5. If 345 bushels of wheat weigh 11040 pounds, what is the weight of one bushel? Of 28? Of 96? Of 150?

6. Divide 165164 into 314 equal parts.

7. A farmer raised 2470 bushels of oats on 65 acres of land; how much did he raise on 9 acres? On 20 acres? On 28 acres? On 46 acres?

8. How many barrels of potatoes at \$2 a barrel must be given for 7 barrels of flour at \$8 a barrel?

9. A person sells 5 cows at \$25 each, 3 horses at \$75 each, and agrees to take his pay in sheep at \$5 a head; how many sheep does he get?

10. A father dying left an estate of \$48064 to be equally divided among his wife, four sons, and three daughters; how much does each receive?

11. How many dozen of eggs at 12 cents per dozen must be given for 4 boxes of raisins, each containing 15 pounds, at 15 cents per pound?

12. In one pound there are 16 ounces; how many pounds in 15808 ounces?

13. Divide \$97128 into 213 equal parts.

14. I have \$60250, with which I buy land at \$125 an acre; how many acres can I buy?

15. Divide 38950 into 25 equal parts.

DEFINITIONS.

147. *Division* is the process of finding how many times one number is contained in another.

148. The *Dividend* is the number divided.

149. The *Divisor* is the number by which the dividend is divided.

150. The *Quotient* is the result obtained by division.

151. The *Remainder* is the part of the dividend left after the division is performed.

152. *Short Division* is that form of division in which no step of the process is written.

153. *Long Division* is that form of division in which the *subtraction* necessary in the process is written.

RULE.

154. *I. Find how many times the divisor is contained in the fewest figures at the left of the dividend that will contain it, and write the result for the first figure of the quotient.*

II. Multiply the divisor by this quotient figure, and subtract the result from the part of the dividend that was used; to the remainder annex the next lower order of the dividend for a new partial dividend and divide as before. Proceed in this manner with each order of the dividend.

III. If there be at last a remainder, place it after the quotient, with the divisor underneath.

PROOF.—*Multiply the divisor by the quotient and add the remainder, if any, to the product. This result will be equal to the dividend, when the division has been performed correctly.*

APPLICATIONS.

ORAL AND SLATE EXERCISES.

155. *Dry Measure* is used in measuring grain, fruits, etc.

TABLE OF UNITS.

2 pints (pt.) make	1 quart . . . qt.
8 quarts	" 1 peck . . . pk.
4 pecks	" 1 bushel . . bu.

1. In 1 peck how many pints? In 2 pecks? In 8 pecks? In 24 quarts? In 3 bushels? In 10 bushels?

2. In 448 pints how many pecks?

SOLUTION.—Since 2 pints make 1 quart, 448 pints must make as many quarts as 2 quarts are contained times in 448 quarts, which are 224.

Again, since 8 quarts make 1 peck, 224 quarts must make as many pecks as 8 quarts are contained times in 224 quarts, which are 28.

Hence in 448 pints there are 28 pecks.

3. How many bushels in 540 pk. ? In 2080 qt. ? In 1088 pt. ? In 22272 pt. ? In 15104 qt. ?

4. At 8 cents a quart, how many bushels of peaches can be bought for \$15.36? For \$20.48? For \$23.04?

SOLUTION.—Since \$15.36 are equal 1536 cents, as many quarts of peaches can be bought for \$15.36 as 8 cents are contained times in 1536 cents, which are 192, and 192 quarts make 6 bushels.

Observe, the dividend is changed to cents to be of the same name as the divisor.

5. At 12 cents a peck, how many pecks of potatoes can be bought for 48 ct. ? For 72 ct. ? For \$8.76 ? For \$64.56 ?

6. At 25 cents a yard, how many yards of cloth can be bought for 50 cents? For 75 ct. ? For \$1 ? For \$9 ?

7. At \$4 per chair, how many chairs can be bought for \$112? For \$248? For \$856?

ORAL AND SLATE EXERCISES.

156. Liquid Measure is used to measure all kinds of liquids.

TABLE OF UNITS.

4 gills (gi.)	make	1 pint . . .	pt.
2 pints	"	1 quart . . .	qt.
4 quarts	"	1 gallon . . .	gal.
31½ gallons	"	1 barrel . . .	ddl.
63 gallons	"	1 hogshead . .	hhd.

1. How many pints in 12 qt. ? In 25 qt. ? In 10 gal. ? In 30 gal. ?

2. How many gallons in 16 qt. ? In 28 qt. ? In 64 pt. ? In 96 pt. ? In 160 pt. ?

3. Express 48 pints in gallons ; 72 gills in quarts.

4. In a cistern there are 2835 gal. of water ; how many hogsheads does it contain ?

5. If one quart of molasses cost \$.23, what will be the cost of 4 gal. ? 7 gal. ? 18 gal. ? 2 hhd. ?

6. In 5 hhd. how many qt. ? How many gills ?

7. At 4 cents a pint, how many gallons of milk can be bought for \$4.48 ? For \$8.64 ? For \$9.60 ?

SOLUTION.—1. Since 1 gallon makes 8 pints, at 4 cents a pint 1 gallon can be bought for 32 cents.

2. Since 1 gallon can be bought for 32 cents, as many gallons can be bought for \$4.48, or 448 cents, as 32 cents are contained times in 448 cents, which are 14.

8. At 5 cents a pint for vinegar, how many gallons can be bought for \$4.40 ? For \$5.60 ? For \$7.60 ?

9. When maple syrup costs 16 cents a quart, how many gallons can be bought for \$1.28 ? For \$7.68 ? For \$47.36 ?

10. At 9 cents a quart, how many gallons of kerosene can be bought for \$1.44 ? For \$2.52 ? For \$3.24 ? For \$26.64 ?

EXERCISES ON EXACT DIVISORS.

157. 1. What numbers will divide 12 without a remainder?

A number that will divide another without a remainder is called an *Exact Divisor*.

Find all the *exact divisors* of each of the following numbers :

2. 15.	5. 20.	8. 42.	11. 40.	14. 48.
3. 21.	6. 27.	9. 36.	12. 56.	15. 32.
4. 35.	7. 30.	10. 28.	13. 63.	16. 64.

17. What number is an *exact divisor* of each of the numbers 4, 6, and 10? Of each of the numbers 9, 15, and 27?

A number which is an *exact divisor* of each of two or more numbers is called a *Common Divisor*.

18. Find the *common divisors* of each of the following sets of numbers :

12 and 16.	36 and 63.	48, 28, and 32.
15 and 25.	60 and 84.	15, 45, and 36.
18 and 30.	55 and 45.	54, 18, and 48.
42 and 28.	40 and 64.	28, 42, and 63.

19. What is the *Greatest Common Divisor* of 8 and 12? Of 18 and 30?

The *greatest* number that is an exact divisor of each of two or more numbers is called the *Greatest Common Divisor*.

20. Find the greatest common divisor of each of the following sets :

15 and 20.	32 and 72.	22, 55, and 99.
30 and 24.	45 and 54.	36, 60, and 84.
18 and 27.	42 and 35.	54, 63, and 72.

21. What is the greatest common divisor of \$10 and \$15? Of \$20 and \$50? Of \$36 and \$84? Of \$45 and \$63?

EXERCISES ON MULTIPLES.

158. 1. *Twenty-four* is how many times *eight*? How many times *six*? How many times *twelve*? How many times *twenty-four*?

A number which is one or more times another number is called a *Multiple* of that number.

2. What is a multiple of 3? Of 6? Of 4? Of 8? Of 10? Of 7? Of 11? Of 9? Of 12?

3. Name three multiples of 9; of 5; of 8; of 12.

4. Find the first three multiples of 17; of 23; of 29.

Thus, 1st multiple is 17, 2d multiple $17 \times 2 = 34$, 3d multiple $17 \times 3 = 51$.

5. Find the first 4 multiples of 25; of 37; of 63; of 95; of 84; of 235; of 347; of 836; of 793; of 965.

6. How many multiples can you find for 19? For 35? For 69? For any given number?

7. Find a number which is a multiple of 4 and of 6.

Thus, $4 \times 6 = 24$, hence 24 is a multiple of both 4 and 6.

8. Find a number which is a multiple of 7 and of 9; of 5 and of 8; of 6 and of 11; of 3 and of 9; of 9 and of 12.

A number which is a multiple of two or more numbers is called a *Common Multiple* of these numbers.

9. Of what numbers is 12 a *common multiple*? Is 21? Is 45? Is 63? Is 48? Is 72? Is 64? Is 88? Is 108?

Find a common multiple:

10. Of 5 and 8. 13. Of 7 and 19. 16. Of 13 and 29.

11. Of 9 and 6. 14. Of 4 and 23. 17. Of 32 and 28.

12. Of 12 and 7. 15. Of 5 and 37. 18. Of 43 and 15.

19. Of how many cents is 20 cents a multiple? 30 cents? 25 cents? 56 cents? 72 cents?

FRACTIONS.

ORAL EXERCISES.

159. 1. One of the *two equal parts* of a whole thing is called *one-half*, thus :



One of the two equal parts of a peach is called one-half of a peach.



2. How many *halves* are there in *one* peach? In *one* apple? In *one* dollar? In *one* cake? In *one* of anything?

3. One of the *three equal parts* of a whole thing is called *one-third*, thus :



One of the three equal parts of a pear is called one-third of a pear.



4. How many *thirds* are there in *one* pear? In *one* inch? In *one* pound of sugar? In *one* of anything?

5. One of the *four equal parts* of a whole thing is called *one-fourth*, thus :



One of the four equal parts of an orange is called one-fourth of an orange.



6. How many *fourths* are there in *one* orange? In *one* pie?
7. What is meant by *one-half* of anything? *One-third*? *One-fourth*? *Two-thirds*? *Three-fourths*? *Three-thirds*?

8. One or more of the equal parts of a unit is called a *Fraction*.

SLATE AND ORAL EXERCISES.

160. 1. Show on your slate, with lines, that a *whole* can be made into equal parts of different sizes, thus :

WHOLE.		EQUAL PARTS.	
	=		<i>Halves.</i>
	=		<i>Thirds.</i>
	=		<i>Fourths.</i>
	=		<i>Fifths.</i>

2. How can you find the one-half of an orange? The one-third? The one-fourth? The one-fifth?

3. What is meant by one-half of anything? One-third? One-fourth? One-fifth?

4. How many halves make a whole pear? How many thirds? How many fourths? How many fifths?

5. What is meant by two-thirds of a cake? Three-fourths? Two-fifths? Three-fifths?

6. Represent with lines, on your slate, *sixths*, *sevenths*, *eighths*, *ninths*, *tenths*, *elevenths*, *twelfths*, and so on, thus :

	=		<i>6 sixths.</i>
	=		<i>7 sevenths.</i>

7. How can you find the *one-sixth* of an apple? The one-seventh? The one-eighth? The one-ninth? The one-tenth, and so on?

8. What is meant by the one-half of a garden? The one-third? The one-seventh? The one-twelfth? The one-fifteenth?

9. If a whole is made into eight equal parts, how is one part named? Three parts? Five parts? Seven parts?

10. Which is the larger part, one-half or one-third, and why?

ORAL AND SLATE EXERCISES.

161. 1. A *whole* apple is equal to how many *fifths*?*equals**One whole*

is equal to

Five-fifths.

2. How many *fifths* can be made of *one* pie? Of *one* pound of sugar? Of *one* sheet of paper? Of *one* peck of peaches?

3. A pear can be made into how many halves? Thirds? Sixths? Ninths? Thirteenths? Sixteenths? Twenty-thirds?

4. What is meant by the *two-thirds* of a yard of cloth? Of a bushel of wheat? Of a garden? Of a load of hay?

5. What is meant by *three-fifths* of anything? *Five-sevenths*? *Nine-tenths*?

6. Equal parts, or *fractions*, are expressed by figures, thus :

NUMERATOR,	2	Shows the number of equal parts taken.
DIVIDING LINE,	—	Shows that 2 and 3 express a fraction.
DENOMINATOR,	3	Shows that the whole is made into 3 equal parts.

Read, *Two-thirds*.

7. Express by figures each of the following examples :

One-half.	Five-sevenths.	Eight-twelfths.
Two-fourths.	Four-ninths.	Nine-fifteenths.
Three-fifths.	Seven-tenths.	Sixteen-twenty-fifths.
Seven-eighths.	Five-elevenths.	Nineteen-fortieths.
Three-sevenths.	Ten-thirteenths.	Fourteen-thirtieths.
Six-ninths.	Six-fourteenths.	Six-fifteenths.

ORAL AND SLATE EXERCISES.

162. 1. Read $\frac{2}{3}$, $\frac{5}{7}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{15}{12}$, $\frac{7}{10}$, $\frac{12}{15}$, $\frac{16}{18}$, $\frac{11}{30}$, $\frac{4}{7}$.

2. What is the *numerator* of $\frac{5}{8}$? The denominator? What does the numerator show? The denominator?

3. Express by figures nine-tenths. Five-thirteenths. Twenty-thirty-fifths.

4. How many numbers must be used to express *seven-fifteenths* by figures? What does each number show?

5. What is meant by $\frac{3}{7}$ of an apple? $\frac{5}{6}$ of a garden? $\frac{3}{4}$ of a farm?

6. How can you find the *fifth* of a sheet of paper? The three-fifths? The one-ninth? The five-ninths?

7. How much of an apple is three-thirds of it? Five-fifths of it?

8. What does $\frac{1}{4}$ of a garden mean? $\frac{3}{8}$ of a bushel of corn?

9. In order that Henry may give $\frac{3}{4}$ of an orange to James, what must he do with the orange, and why?

10. One-fifth of 60 is how many? Of 35? Of 80?

SOLUTION. $\frac{1}{5}$ of 60 = $60 \div 5 = 12$.

11. Find $\frac{1}{4}$ of 27; $\frac{1}{5}$ of 40; $\frac{1}{6}$ of 63; $\frac{1}{12}$ of 96; $\frac{1}{24}$ of 144.

12. Find $\frac{2}{5}$ of 35; $\frac{3}{8}$ of 24; $\frac{5}{7}$ of 42.

SOLUTION. $\frac{1}{5}$ of 35 is 7. Hence $\frac{2}{5}$ of 35 must be 3 times 7, or 21.

13. Find the $\frac{2}{3}$ of 15; the $\frac{3}{4}$ of 24; the $\frac{2}{7}$ of 35; the $\frac{5}{6}$ of 45; the $\frac{3}{8}$ of 80; the $\frac{5}{6}$ of 63; the $\frac{1}{12}$ of 72.

14. What is $\frac{3}{4}$ of \$28? $\frac{5}{6}$ of \$36? $\frac{1}{2}$ of \$63?

SOLUTION. $\frac{1}{4}$ of \$28 is \$4. Hence $\frac{3}{4}$ of \$28 must be 3 times \$4, or \$12.

15. What is $\frac{1}{3}$ of 35 pounds of starch? Of 45 lb.?

16. A farmer had 84 cords of wood and sold $\frac{3}{4}$ of it at \$4 a cord. How much did he receive for what he sold?

17. Robert had \$63 and gave $\frac{5}{6}$ of it to his brother Henry. How many dollars has he left?

ORAL EXERCISES.

163. In this exercise study carefully the illustrations given.

1. A fraction may be represented by equal lines, thus :

$$\frac{2}{3} = \frac{\text{---} \quad \text{---}}{\text{---} \quad \text{---} \quad \text{---}} \quad \begin{array}{l} \text{Part taken.} \\ \text{Whole.} \end{array}$$

Observe, that in $\frac{2}{3}$, the denominator 3 represents the *whole*, or 3 *thirds*, and the numerator 2 represents 2 *thirds*, or two parts of the same size as those represented by the denominator.

Hence, 3 *equal* lines for the denominator, and 2 equal lines of the same length for the numerator represent correctly the number of parts that form the whole or unit, the number of parts taken, and the relation of the parts to each other as represented by the fraction $\frac{2}{3}$.

2. Represent by lines $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{5}$, $\frac{3}{7}$, $\frac{5}{8}$, $\frac{4}{10}$.

3. If you make *one-half* of a line into *two equal parts*, what kind of parts will you then have, and why?

$$\begin{array}{l} \frac{1}{2} = \frac{2}{4} \\ \text{Part taken, } \frac{\text{---}}{\text{---}} = \frac{\text{---} \quad \text{---}}{\text{---} \quad \text{---} \quad \text{---} \quad \text{---}} \\ \text{Whole, } \frac{\text{---}}{\text{---}} = \frac{\text{---} \quad \text{---} \quad \text{---} \quad \text{---}}{\text{---} \quad \text{---} \quad \text{---} \quad \text{---}} \end{array}$$

Examine this illustration carefully, observing what has been done to change the $\frac{1}{2}$ to $\frac{2}{4}$, then answer the question.

4. If *one-half* is made into *three equal parts*, what will be the name of the parts? If into four equal parts?

5. In $\frac{1}{3}$ how many *fourths*? How many *sixths*? How many *eighths*? How many *tenths*? How many *twelfths*, and why?

6. How many sixths can you make of *one-half* of an apple? How many fourteenths, and why?

7. *One-half* of a bushel is equal to how many *sixths* of a bushel? *Tenths* of a bushel, and why?

ORAL EXERCISES.

164. 1. How many *sixths* in *one-third* of a line, and why?

$$\frac{1}{3} = \frac{2}{6}$$

Study carefully this illustration, then answer the question.

2. In $\frac{1}{3}$ how many *ninths*, and why? How many *fifteenths*?
3. To make *thirds* of a sheet of paper into *eighteenths*, what must be done with them, and why?
4. In $\frac{2}{3}$, how many *twelfths*? How many *twenty-fourths*, and why?

5. Why is $\frac{2}{3} = \frac{2 \times 3}{3 \times 3} = \frac{2 \times 4}{3 \times 4} = \frac{2 \times 5}{3 \times 5}$? Illustrate by lines.

6. When both the numerator and denominator of a fraction are multiplied by the same number, what change is made in the fraction, and why?

7. When *one-fourth* of a line is made into *three equal parts*, what will each of these parts be called, and why?

$$\frac{1}{4} = \frac{3}{12}$$

Study carefully the illustration, then answer the question.

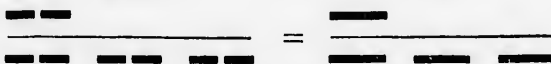
8. Why is $\frac{1}{4}$ of an apple equal to $\frac{3}{12}$ of it?
9. In $\frac{1}{4}$ of a pound of raisins, how many *twentieths* of a pound?

10. Why is $\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{3 \times 3}{4 \times 3} = \frac{3 \times 4}{4 \times 4}$? Illustrate by lines.

11. PRINCIPLE.—*Multiplying both numerator and denominator of a fraction by the same number does not change the value of the fraction.*

ORAL AND WRITTEN EXERCISES.

165. 1. How many *thirds* of a line in two-sixths of it?

$$\frac{2 \div 2}{6 \div 2} = \frac{1}{3}$$


Observe, that when every *two* of the *sixths* are put into *one*, as shown in the illustration, the whole line is made into *three equal parts*, and one part taken. Hence, *two-sixths* of a line make *one-third* of it.

2. How many *thirds* in $\frac{4}{3}$ of one apple? In $\frac{6}{3}$? In $\frac{8}{3}$?

3. Change $\frac{9}{12}$ to fourths; $\frac{12}{15}$ to fifths; $\frac{7}{14}$ to halves.

4. PRINCIPLE.—*Dividing both the numerator and denominator of a fraction by the same number does not change the value of the fraction.*

5. How many *thirds* in $\frac{4}{3}$? In $\frac{6}{3}$? In $\frac{10}{3}$? In $\frac{8}{3}$?

6. Change $\frac{4}{3}$ and $\frac{9}{12}$ each to *fourths*, and explain.

7. Express $\frac{9}{12}$, $\frac{9}{15}$, and $\frac{8}{24}$, each as *sixths*.

When two or more fractions have the same denominator, they are said to have a **Common Denominator**.

8. Change $\frac{1}{3}$ and $\frac{1}{4}$ each to the common denominator 6.

9. Change $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$, each to *twelfths*; to *thirty-sixths*.

10. Change $\frac{1}{10}$, $\frac{5}{25}$, and $\frac{12}{30}$, each to *fifths*, and explain.

11. Express $\frac{3}{8}$, $\frac{5}{8}$, and $\frac{7}{12}$, each as *twenty-fourths*.

12. Change $\frac{2}{3}$ and $\frac{4}{5}$ to a common denominator.

Observe, $\frac{2}{3}$ and $\frac{4}{5}$ can each be changed to *fifteenths* (164–11). Thus,

$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}, \quad \text{and} \quad \frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15}.$$

13. Change to a common denominator $\frac{2}{3}$ and $\frac{2}{5}$; $\frac{3}{4}$ and $\frac{6}{7}$; $\frac{1}{2}$ and $\frac{5}{7}$; $\frac{3}{4}$ and $\frac{4}{5}$; $\frac{5}{6}$ and $\frac{8}{9}$; $\frac{7}{8}$ and $\frac{5}{7}$.

WRITTEN EXERCISES.

166. 1. What is the length of $\frac{3}{4}$ of a rope that is 168 feet long? Of $\frac{5}{8}$ of it? Of $\frac{1}{2}$ of it? Of $\frac{7}{12}$ of it? Of $\frac{9}{14}$ of it?

2. A load of hay weighs 2268 pounds. What is the weight of $\frac{2}{3}$ of it? Of $\frac{5}{6}$ of it? Of $\frac{1}{3}$ of it?

3. A man had \$2142 in the bank, and took out $\frac{5}{9}$ of it. How much money had he still in the bank?

4. A merchant having a piece of cloth containing 184 yards, sold $\frac{3}{8}$ of it. How much of the piece was still left?

5. What part of a sheet of paper is $\frac{1}{2}$ of $\frac{1}{4}$ of it? $\frac{1}{2}$ of $\frac{1}{8}$ of it? $\frac{1}{3}$ of $\frac{1}{10}$ of it? $\frac{1}{4}$ of $\frac{1}{12}$ of it? $\frac{1}{5}$ of $\frac{1}{15}$ of it?

6. Bought a pound of candy and made it into 6 equal parts, and gave $\frac{1}{3}$ of one part to George. What part of the pound has George received?

7. How many dollars are $\frac{1}{3}$ of $\frac{3}{4}$ of \$84? $\frac{1}{3}$ of $\frac{2}{5}$ of \$90?

8. \$12 are $\frac{2}{3}$ of how many dollars?

SOLUTION.—Since \$12 are $\frac{2}{3}$ of the required number of dollars, the $\frac{1}{3}$ of \$12, or \$4, must be $\frac{1}{3}$.

Again, since \$6 are $\frac{1}{3}$ of the whole, $\frac{1}{3}$ must be 3 times \$6, or \$18.

9. \$9 are $\frac{3}{4}$ of how many dollars?

10. \$24 are $\frac{4}{5}$ of James' money. How much money has he?

11. $\frac{7}{8}$ of a farm contains 161 acres; how many acres in the farm?

12. 36 is $\frac{9}{10}$ of what number? 18 is $\frac{3}{4}$ of what number?

13. A grocer sold 184 pounds of butter, which is $\frac{4}{5}$ of what he has still left. How much butter remains in the store?

14. Change $\frac{3}{5}$ to tenths; $\frac{5}{8}$ to fortieths; $\frac{3}{4}$ to eighty-fourths.

15. If I own $\frac{5}{8}$ of a garden, how many *twenty-fourths* of it do I own? How many *ninety-sixths*?

16. Change to a common denominator $\frac{5}{8}$ and $\frac{2}{3}$; $\frac{7}{10}$ and $\frac{3}{5}$; $\frac{4}{5}$ and $\frac{3}{4}$; $\frac{8}{11}$ and $\frac{2}{3}$; $\frac{3}{4}$ and $\frac{1}{5}$.

17. Find $\frac{7}{10}$ of 480; $\frac{1}{100}$ of 69400; $\frac{5}{7}$ of 301; $\frac{4}{5}$ of 423.

EXERCISES.

of a rope that is 168 feet
of it? Of $\frac{3}{4}$ of it?

ds. What is the weight

and took out $\frac{5}{8}$ of it. How

both containing 184 yards,
was still left?

$\frac{1}{2}$ of $\frac{1}{4}$ of it? $\frac{1}{8}$ of $\frac{1}{8}$ of it?
of it?

divide it into 6 equal parts,
What part of the pound

\$4? $\frac{1}{3}$ of $\frac{2}{3}$ of \$90?

number of dollars, the $\frac{1}{4}$ of
be 3 times \$6, or \$18.

how much money has he?
; how many acres in the

$\frac{3}{4}$ of what number?

utter, which is $\frac{4}{5}$ of what
remains in the store?

as; $\frac{3}{4}$ to eighty-fourths.

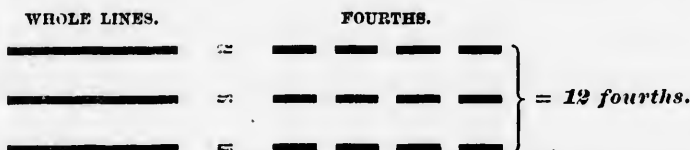
any twenty-fourths of it do

tor $\frac{5}{8}$ and $\frac{2}{3}$; $\frac{7}{10}$ and $\frac{3}{5}$;

of 301; $\frac{4}{5}$ of 423.

ORAL AND WRITTEN EXERCISES.

167. 1. In three equal lines how many fourths of one of them?



SOLUTION.—In 1 line there are 4 fourths. Hence in 3 lines there must be 3 times 4 fourths, which are 12 fourths, as shown in the illustration.

2. In 7 pounds of coffee, how many thirds of a pound?

3. How many fourths of 1 bushel in 5 bushels? In 9 bushels? In 12 bushels? In 16 bu.? In 29 bu.? In 100 bu.?

4. Express 6 gallons as halves of a gallon; as thirds; as ninths; as fifths; as tenths; as twelfths.

5. In $5\frac{2}{3}$ feet, how many thirds of a foot?

SOLUTION.—In 1 foot there are 3 thirds, and in 5 feet there must be 5 times 3 thirds, which are 15 thirds. 15 thirds plus 2 thirds are 17 thirds; hence in $5\frac{2}{3}$ feet there are $\frac{17}{3}$ of a foot.

Observe, 1st. A whole number and a fraction written together, as $5\frac{2}{3}$, is called a *Mixed Number*.

2d. A fraction where the numerator is equal to or greater than the denominator, as $\frac{4}{1}$, $\frac{7}{4}$, is called an *Improper Fraction*.

6. How many fourths of a yard in $6\frac{3}{4}$ yards? In $9\frac{1}{4}$ yards?

7. Change to eighths $8\frac{3}{4}$ feet; $5\frac{1}{2}$ pounds; $9\frac{5}{8}$ gallons.

8. Express in twelfths $4\frac{7}{12}$ dollars; $3\frac{5}{12}$ bushels; $8\frac{1}{2}$ tons.

9. How many tenths of one bushel in $46\frac{9}{10}$ bushels of wheat? In $98\frac{7}{10}$ bu.? In $337\frac{9}{10}$ bu.? In $639\frac{9}{10}$ bu.?

10. How many sixteenths of one pound in $7\frac{7}{16}$ pounds of sugar? In $9\frac{5}{16}$ lb.? In $35\frac{9}{16}$ lb.? In $138\frac{11}{16}$ lb.? In $375\frac{3}{16}$ lb.?

11. How many fifteenths of one yard in $3\frac{4}{15}$ yd.?

12. Express in thirteenths $13\frac{8}{13}$ dollars; $9\frac{1}{13}$ yards; $37\frac{4}{13}$ lb.; $29\frac{7}{13}$ tons; $82\frac{9}{13}$ gallons.

ORAL AND WRITTEN EXERCISES.

168. 1. What part of *one* bushel is *one* peck? *Two* pecks? *Three* pecks? *Four* pecks?

2. In 4 pecks how many bushels? In $\frac{1}{4}$ bushels how many bushels?

3. How many bushels and fourths of a bushel in 9 pecks? In 14 pecks? In 27 pecks? In 35 pecks?

4. How many bushels in $\frac{3}{4}$ of a bushel?

SOLUTION.—Since it takes 4 fourths of a bushel to make one bushel, in 9 fourths of a bushel there are as many bushels as 4 fourths are contained times in 9 fourths, which are $2\frac{1}{4}$.

5. How many pounds in $\frac{2}{3}$ of a pound? In $\frac{1}{3}$ of a pound? In $\frac{2}{6}$ of a pound? In $\frac{4}{6}$ of a pound?

6. How many dollars in $\$ \frac{2}{3}$? In $\$ \frac{1}{4}$? In $\$ \frac{3}{9}$? In $\$ \frac{4}{9}$? In $\$ \frac{6}{9}$? In $\$ \frac{15}{9}$? In $\$ \frac{50}{9}$?

Change each of the following fractions to a whole or mixed number:

7. $\frac{8}{9}$.	11. $\frac{39}{9}$.	15. $\frac{128}{9}$.	19. $\frac{1289}{9}$.
8. $\frac{13}{4}$.	12. $\frac{98}{9}$.	16. $\frac{264}{7}$.	20. $\frac{1735}{36}$.
9. $\frac{18}{5}$.	13. $\frac{47}{8}$.	17. $\frac{529}{9}$.	21. $\frac{4685}{73}$.
10. $\frac{13}{3}$.	14. $\frac{67}{8}$.	18. $\frac{263}{8}$.	22. $\frac{7429}{65}$.

23. *One* pint is what part of a quart? Of a gallon?

24. *One* quart is what part of a gallon? 15 quarts are how many fourths of a gallon?

25. How many gallons and fourths of a gallon in $\frac{3}{4}$ gal.? In $\frac{5}{4}$ gal.? In $\frac{10}{4}$ gal.? In $\frac{18}{4}$ gal.?

26. How many quarts in $\frac{3}{4}$ of a gallon? In $\frac{1}{4}$ gal.?

27. What part of a pound Avoirdupois is 1 ounce, and why? Is 3 oz.? Is 5 oz.? Is 9 oz.? Is 13 oz.?

28. Express $\frac{7}{16}$ of a pound Avoirdupois as ounces, and explain why the change can be made.

29. How many pounds and oz. in $\frac{3}{8}$ of a pound, and why?

ORAL AND WRITTEN EXERCISES.

169. 1. Find the sum of 4 *fifths*, 2 *fifths*, and 3 *fifths*.

SOLUTION.—The sum of 4 *fifths* + 2 *fifths* + 3 *fifths* is 9 *fifths*, which is equal to $\frac{9}{5}$, or $1\frac{4}{5}$.

2. How many are 7 *eighths* + 5 *eighths*? 6 *sevenths* + 5 *sevenths*?

3. How many are $\frac{5}{9} + \frac{2}{9} + \frac{8}{9}$? $\frac{7}{8} + \frac{3}{8} + \frac{4}{8}$? $\frac{5}{11} + \frac{9}{11} + \frac{6}{11}$?

Read and find the sum of each of the following examples:

4. $\frac{5}{7} + \frac{3}{7} + \frac{4}{7}$.

7. $\frac{4}{11} + \frac{6}{11} + \frac{5}{11}$.

10. $\frac{7}{9} + \frac{10}{9} + \frac{2}{9}$.

5. $\frac{7}{9} + \frac{4}{9} + \frac{6}{9}$.

8. $\frac{5}{8} + \frac{3}{8} + \frac{8}{8}$.

11. $\frac{5}{7} + \frac{9}{7} + \frac{4}{7}$.

6. $\frac{8}{12} + \frac{9}{12} + \frac{5}{12}$.

9. $\frac{4}{3} + \frac{5}{3} + \frac{7}{3}$.

12. $\frac{11}{8} + \frac{7}{8} + \frac{6}{8}$.

13. If you want to express the sum of 5 chairs and 3 tables, how would you write the number, and why?

14. To add 2 *thirds* and 5 *sixths*, what must be done, and why?

Fractions that have different denominators must be changed to others having the same denominator before they can be added.

15. Find the sum of $\frac{1}{2}$ and $\frac{3}{4}$; of $\frac{2}{3}$ and $\frac{5}{6}$; of $\frac{3}{4}$ and $\frac{7}{8}$; of $\frac{2}{3}$ and $\frac{1}{2}$.

16. Find the sum of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$; of $\frac{2}{3} + \frac{5}{6} + \frac{7}{12}$; of $\frac{3}{5} + \frac{7}{10} + \frac{9}{20}$.

17. Find the sum of $\frac{2}{3} + \frac{3}{4}$; of $\frac{5}{6} + \frac{1}{3}$; of $\frac{3}{4} + \frac{5}{6}$.

Observe, thirds and fourths can each be made into twelfths; fifths and thirds into fifteenths; fourths and sixths into twelfths (165--12).

18. Find the sum of $\frac{3}{4} + \frac{4}{8}$; of $\frac{5}{6} + \frac{2}{3}$; of $\frac{5}{6} + \frac{7}{8}$; of $\frac{5}{6}$ and $\frac{3}{4}$.

19. Find the sum of $\frac{5}{6} + \frac{3}{12}$; of $\frac{7}{10} + \frac{8}{15}$; of $\frac{11}{15} + \frac{7}{12}$.

20. Henry paid $\frac{2}{3}$ of a dollar for peaches and $\frac{1}{6}$ of a dollar for apples. How much did he pay for both?

21. Mary bought $\frac{3}{4}$ of a pound of tea at one time, $\frac{7}{8}$ at another, and $\frac{5}{8}$ at another. How much tea did she buy in all?

22. Paid $\frac{1}{2}$ of a dollar for eggs, and $\frac{2}{3}$ of a dollar for coffee; how much did I pay for all?

ORAL AND WRITTEN EXERCISES.

170. 1. What is the difference between $\frac{7}{9}$ and $\frac{5}{9}$?

SOLUTION. 7 ninths minus 5 ninths are 2 ninths, which are $\frac{2}{9}$.

2. What is the difference between $\frac{4}{5}$ and $\frac{2}{5}$? $\frac{5}{7}$ and $\frac{4}{7}$? $\frac{7}{10}$ and $\frac{2}{10}$? $\frac{11}{13}$ and $\frac{3}{13}$? $\frac{14}{17}$ and $\frac{6}{17}$?

3. How many are $\frac{3}{10}$ less than $\frac{5}{10}$? $\frac{3}{11}$ less than $\frac{8}{11}$? $\frac{13}{14}$ less than $\frac{21}{14}$? $\frac{54}{99}$ less than $\frac{83}{99}$? $\frac{93}{125}$ less than $\frac{117}{125}$?

4. Find the difference between $\frac{3}{4}$ and $\frac{1}{2}$; $\frac{7}{8}$ and $\frac{3}{4}$; $\frac{8}{9}$ and $\frac{2}{9}$.

Observe, $\frac{1}{2}$ can be changed to fourths, $\frac{3}{4}$ to eighths, $\frac{2}{9}$ to ninths.

Perform the subtraction in the following:

- | | | | |
|--------------------------------------|-------------------------|--------------------------------------|-------------------------------------|
| 5. $\frac{7}{12} - \frac{1}{3}$. | 13. $1 - \frac{1}{2}$. | 21. $\frac{2}{3} - \frac{3}{7}$. | 29. $4\frac{2}{3} - \frac{1}{3}$. |
| 6. $\frac{9}{10} - \frac{2}{5}$. | 14. $1 - \frac{1}{3}$. | 22. $\frac{4}{5} - \frac{3}{4}$. | 30. $2\frac{1}{2} - \frac{1}{4}$. |
| 7. $\frac{14}{15} - \frac{2}{3}$. | 15. $2 - \frac{1}{2}$. | 23. $\frac{5}{9} - \frac{1}{2}$. | 31. $6\frac{5}{8} - \frac{1}{2}$. |
| 8. $\frac{17}{18} - \frac{5}{9}$. | 16. $5 - \frac{1}{8}$. | 24. $\frac{6}{7} - \frac{3}{8}$. | 32. $3\frac{7}{8} - \frac{3}{4}$. |
| 9. $\frac{13}{24} - \frac{3}{8}$. | 17. $1 - \frac{3}{4}$. | 25. $\frac{7}{9} - \frac{3}{8}$. | 33. $9\frac{1}{2} - \frac{3}{4}$. |
| 10. $\frac{27}{36} - \frac{7}{16}$. | 18. $8 - \frac{3}{4}$. | 26. $\frac{5}{8} - \frac{5}{12}$. | 34. $5\frac{9}{14} - \frac{3}{7}$. |
| 11. $\frac{40}{48} - \frac{5}{12}$. | 19. $1 - \frac{2}{7}$. | 27. $\frac{13}{15} - \frac{3}{10}$. | 35. $2\frac{5}{6} - \frac{1}{3}$. |
| 12. $\frac{13}{27} - \frac{4}{9}$. | 20. $9 - \frac{3}{4}$. | 28. $\frac{9}{11} - \frac{1}{4}$. | 36. $4\frac{8}{9} - \frac{5}{9}$. |

37. James had \$3 and gave $\frac{2}{3}$ of a dollar to William. How much money has he left?

38. Mary owes a store bill of $\frac{3}{4}$ of a dollar. If she hands the clerk $\frac{1}{2}$ of a dollar, how much change should she receive?

39. Find the difference between $\$7$ and $\$3\frac{1}{2}$; $\$1\frac{1}{2}$ and $\$5$.

40. Henry had \$4 and gave $\$5\frac{1}{8}$ to James. How much had he left?

Find the difference between:

- | | | |
|---|--|---|
| 41. $\$3\frac{1}{2}$ and $\$3\frac{1}{3}$. | 44. $\$9\frac{5}{8}$ and $\$4\frac{1}{2}$. | 47. $\frac{7}{8}$ oz. and $\frac{1}{4}$ oz. |
| 42. $\$8$ and $\$4\frac{1}{2}$. | 45. $\$5\frac{3}{4}$ and $\$1\frac{1}{4}$. | 48. $\frac{5}{9}$ lb. and $\frac{1}{4}$ lb. |
| 43. $\$6\frac{1}{2}$ and $\$2\frac{1}{4}$. | 46. $\$8\frac{1}{2}$ and $\$3\frac{3}{10}$. | 49. $\frac{4}{5}$ gal. and $\frac{1}{4}$ gal. |

ORAL EXERCISES.

171. 1. Find $\frac{1}{2}$ of $\frac{1}{3}$ of a given line.

Observe, $\frac{1}{3}$ of a line is equal $\frac{2}{3}$ of the same line, thus :

Part taken, $\frac{1}{3}$ of $\frac{1}{3}$ of a line is equal $\frac{2}{9}$ of the same line, thus :

Having made the given *third* into two equal parts, we have $\frac{2}{9}$, and can now take the half of it, thus :

$\frac{1}{2}$ of $\frac{1}{3}$ of a line is equal $\frac{1}{9}$ of the same line, thus :

From these two illustrations we have the following

SOLUTION. $\frac{1}{3}$ is equal to $\frac{2}{3}$, and $\frac{1}{2}$ of $\frac{2}{3}$ is $\frac{1}{3}$; hence, $\frac{1}{2}$ of $\frac{1}{3}$ is $\frac{1}{9}$.

Solve and explain in this way each of the following :

2. What is $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{2}$ of $\frac{1}{5}$? $\frac{1}{2}$ of $\frac{1}{6}$? $\frac{1}{2}$ of $\frac{1}{7}$?
3. What is $\frac{1}{3}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{5}$? $\frac{1}{3}$ of $\frac{1}{6}$? $\frac{1}{3}$ of $\frac{1}{7}$?
4. What is $\frac{1}{4}$ of $\frac{1}{4}$? $\frac{1}{4}$ of $\frac{1}{5}$? $\frac{1}{4}$ of $\frac{1}{6}$? $\frac{1}{4}$ of $\frac{1}{7}$?
5. What is $\frac{1}{5}$ of $\frac{1}{5}$? $\frac{1}{5}$ of $\frac{1}{4}$? $\frac{1}{5}$ of $\frac{1}{7}$? $\frac{1}{5}$ of $\frac{1}{8}$?
6. What is $\frac{1}{6}$ of $\frac{1}{6}$? $\frac{1}{6}$ of $\frac{1}{7}$? $\frac{1}{6}$ of $\frac{1}{8}$? $\frac{1}{6}$ of $\frac{1}{9}$?

7. George had $\frac{1}{4}$ of a dollar and gave $\frac{1}{3}$ of what he had to Ada. What part of a dollar did Ada receive?

8. What part of a peach is $\frac{1}{3}$ of $\frac{1}{2}$ of it? $\frac{1}{2}$ of $\frac{1}{5}$ of it?

9. Henry owned $\frac{1}{5}$ of a boat and sold $\frac{1}{3}$ of it to James. What part of the boat did James own?

10. What part of a garden is $\frac{1}{3}$ of $\frac{1}{4}$ of it? $\frac{1}{5}$ of $\frac{1}{7}$ of it?

11. Robert borrowed $\frac{1}{6}$ of Henry's money, and gave $\frac{1}{3}$ of it to Maggie. What part of Henry's money did Maggie get?

12. Mary bought $\frac{1}{5}$ of a cake and gave $\frac{1}{4}$ of it to Susie. What part of the cake did Susie receive?

13. What part of my money is $\frac{1}{4}$ of $\frac{1}{5}$ of it? $\frac{1}{7}$ of $\frac{1}{8}$ of it?

ORAL EXERCISES.

172. 1. What part of an orange is $\frac{1}{3}$ of $\frac{2}{5}$ of it?

SOLUTION.—Since $\frac{1}{3}$ of $\frac{1}{3}$ of an orange is $\frac{1}{9}$ of it, $\frac{1}{3}$ of $\frac{2}{5}$ of it must be 2 times $\frac{1}{9}$, which are $\frac{2}{9}$.

2. What part of an apple is $\frac{1}{2}$ of $\frac{3}{4}$ of it? $\frac{1}{3}$ of $\frac{3}{4}$ of it? $\frac{1}{4}$ of $\frac{3}{4}$ of it? $\frac{1}{5}$ of $\frac{3}{4}$ of it? $\frac{1}{6}$ of $\frac{3}{4}$ of it? $\frac{1}{7}$ of $\frac{3}{4}$ of it?

Find the required part in the following :

- | | | | |
|--------------------------------------|---------------------------------------|---------------------------------------|--|
| 3. $\frac{1}{2}$ of $\frac{4}{5}$. | 9. $\frac{1}{4}$ of $\frac{3}{4}$. | 15. $\frac{1}{6}$ of $\frac{4}{5}$. | 21. $\frac{1}{8}$ of $\frac{1}{2}$. |
| 4. $\frac{1}{2}$ of $\frac{7}{8}$. | 10. $\frac{1}{4}$ of $\frac{7}{10}$. | 16. $\frac{1}{6}$ of $\frac{8}{9}$. | 22. $\frac{1}{9}$ of $\frac{1}{3}$. |
| 5. $\frac{1}{2}$ of $\frac{3}{10}$. | 11. $\frac{1}{4}$ of $\frac{5}{8}$. | 17. $\frac{1}{6}$ of $\frac{3}{10}$. | 23. $\frac{1}{9}$ of $\frac{2}{10}$. |
| 6. $\frac{1}{3}$ of $\frac{5}{7}$. | 12. $\frac{1}{5}$ of $\frac{2}{3}$. | 18. $\frac{1}{7}$ of $\frac{7}{12}$. | 24. $\frac{1}{10}$ of $\frac{3}{10}$. |
| 7. $\frac{1}{3}$ of $\frac{4}{9}$. | 13. $\frac{1}{5}$ of $\frac{7}{10}$. | 19. $\frac{1}{7}$ of $\frac{5}{11}$. | 25. $\frac{1}{10}$ of $\frac{1}{10}$. |
| 8. $\frac{1}{3}$ of $\frac{8}{10}$. | 14. $\frac{1}{5}$ of $\frac{5}{12}$. | 20. $\frac{1}{8}$ of $\frac{7}{10}$. | 26. $\frac{1}{10}$ of $\frac{1}{10}$. |

27. What part of a peach is $\frac{2}{3}$ of $\frac{3}{4}$ of it?

SOLUTION.—Since $\frac{1}{3}$ of $\frac{3}{4}$ of a peach is $\frac{1}{4}$ of it, $\frac{2}{3}$ of $\frac{3}{4}$ of it must be 2 times $\frac{1}{4}$, which are $\frac{1}{2}$.

28. What part of a cake is $\frac{2}{3}$ of $\frac{4}{5}$ of it? $\frac{3}{4}$ of $\frac{2}{3}$ of it?

29. A boy bought $\frac{3}{4}$ of a pound of candy and gave $\frac{2}{5}$ of it to his sister. What part of the pound did his sister receive?

30. What part of a gallon is $\frac{1}{5}$ of $\frac{3}{7}$ of it? $\frac{5}{8}$ of $\frac{2}{3}$ of it?

Find the required part in each of the following :

- | | | | |
|--------------------------------------|--|---------------------------------------|--|
| 31. $\frac{3}{4}$ of $\frac{4}{5}$. | 34. $\frac{2}{7}$ of $\frac{8}{9}$. | 37. $\frac{5}{8}$ of $\frac{7}{12}$. | 40. $\frac{3}{10}$ of $\frac{1}{10}$. |
| 32. $\frac{2}{3}$ of $\frac{5}{7}$. | 35. $\frac{1}{11}$ of $\frac{8}{9}$. | 38. $\frac{5}{6}$ of $\frac{4}{7}$. | 41. $\frac{7}{10}$ of $\frac{3}{10}$. |
| 33. $\frac{2}{3}$ of $\frac{5}{8}$. | 36. $\frac{9}{10}$ of $\frac{3}{10}$. | 39. $\frac{7}{12}$ of $\frac{5}{6}$. | 42. $\frac{3}{10}$ of $\frac{3}{10}$. |

43. Susie had a pear, and gave $\frac{1}{2}$ of $\frac{3}{4}$ of it to Mary. What part of the pear had she then left?

44. A boy had $\frac{5}{8}$ of a dollar and gave away $\frac{2}{3}$ of it. What part of a dollar had he then left?

45. William had $\frac{4}{6}$ of a melon and gave $\frac{2}{3}$ of it to Robert. What part of the whole melon had he then left?

ORAL AND WRITTEN EXERCISES.

173. 1. At $\frac{3}{4}$ of a dollar for one yard of cloth, what will be the cost of 8 yards?

SOLUTION.—Since 1 yard cost $\frac{3}{4}$, 8 yards must cost 8 times $\frac{3}{4}$, which are $\frac{24}{4}$, equal \$6.

2. Find the cost of 7 bushels of apples at $\frac{4}{5}$ of a dollar for one bushel. At $\frac{3}{5}$ of a dollar. At $\frac{2}{5}$ of a dollar.

3. How much will 6 pounds of tea cost at $\frac{3}{4}$ per pound? At $\frac{1}{2}$ per pound? At $\frac{3}{5}$ per pound? At $\frac{2}{5}$ per pound?

4. A father gave to each of 3 children $\frac{2}{5}$ of a dollar. How much money did he give away in all?

5. A man gave to each of 7 beggars $\frac{1}{5}$ of a dollar. How much did he give away in all?

6. What is the cost of $\frac{3}{5}$ of a pound of sugar, at 15 cents a pound?

SOLUTION.—Since 1 pound cost 15 cents, $\frac{1}{5}$ of a pound must cost $\frac{1}{5}$ of 15 cents, which are 3 cents, and $\frac{3}{5}$ of a pound must cost 3 times 3 cents, which are 9 cents.

7. What is the cost of $\frac{3}{4}$ of a pound of candies, at 36 cents a pound? At 24 cents a pound? At 48 cents a pound?

8. What is the cost of $\frac{5}{8}$ of an acre of land, at \$32 an acre? At \$48 an acre? At \$72 an acre? At \$96 an acre?

9. What is the value of $\frac{7}{12}$ of a garden, worth \$48? Worth \$84? Worth \$108? Worth \$144? Worth \$240?

10. If a load of hay cost \$12, what is the value of $\frac{1}{3}$ of it? Of $\frac{2}{3}$ of it? Of $\frac{3}{4}$ of it? Of $\frac{5}{6}$ of it?

11. If a farm is worth \$9240, what is $\frac{3}{5}$ of it worth? $\frac{5}{7}$ of it? $\frac{1}{4}$ of it? $\frac{3}{8}$ of it? $\frac{7}{15}$ of it? $\frac{1}{10}$ of it?

Observe, $\frac{1}{5}$ of \$9240 = $9240 \div 5 = \$1848$; hence, $\frac{3}{5}$ of \$9240 = $1848 \times 3 = \$5544$.

12. What is the cost of 48 bushels of corn, at $\frac{5}{8}$ of a dollar per bushel? At $\frac{7}{12}$ of a dollar? At $\frac{9}{16}$ of a dollar?

13. What is the cost of 36 pounds of tea at $\frac{2}{3}$ of a dollar per pound? At $\frac{1}{4}$ of a dollar?

ORAL AND WRITTEN EXERCISES.

174. 1. If 1 bushel of corn cost $\$2\frac{2}{3}$, what will be the cost of $4\frac{3}{4}$ bushels?

SOLUTION.—1. $4\frac{3}{4}$ bushels are equal to $1\frac{3}{4}$ of a bushel.

2. Since $\$2\frac{2}{3}$ is the cost of 1 bu., $\frac{1}{4}$ of $\$2\frac{2}{3}$, or $\$1\frac{1}{6}$, is the cost of $\frac{1}{4}$ of a bu.

3. Since $\$1\frac{1}{6}$ is the cost of $\frac{1}{4}$ of a bushel, 19 times $\$1\frac{1}{6}$, or $\$31\frac{1}{6}$, equal $\$31\frac{1}{6}$, is the cost of $1\frac{3}{4}$, or $4\frac{3}{4}$ bushels.

2. If 1 yard of cloth cost $\$1\frac{1}{2}$, what will be the cost of $3\frac{2}{3}$ yards? Of $5\frac{1}{4}$ yards? Of $2\frac{2}{3}$ yards? Of $4\frac{3}{4}$ yards?

3. If 1 bushel of apples cost $\$5$, what will be the cost of $4\frac{1}{2}$ bu.? Of $3\frac{2}{3}$ bu.? Of $5\frac{3}{4}$ bu.? Of $7\frac{1}{2}$ bu.? Of $10\frac{1}{5}$ bu.?

4. Multiply $\frac{2}{3}$ by $\frac{3}{5}$; $\frac{5}{7}$ by $\frac{4}{5}$; $\frac{4}{9}$ by $\frac{3}{4}$; $\frac{7}{8}$ by $\frac{4}{11}$; $\frac{8}{9}$ by $\frac{5}{6}$.

Observe, $\frac{2}{3}$ multiplied by $\frac{3}{5}$, or $\frac{2}{5} \times \frac{3}{3}$, means the same as $\frac{2}{5}$ of $\frac{3}{3}$, or $\frac{2}{5}$ of 1 ; hence the solution is the same as given (172-27).

Perform the work and explain each of the following:

- | | | | |
|--|--|---|--|
| 5. $\frac{5}{8} \times \frac{7}{9}$. | 8. $\frac{3}{4} \times \frac{2}{5}$. | 11. $\frac{13}{4} \times \frac{3}{5}$. | 14. $\frac{208}{500} \times \frac{4}{5}$. |
| 6. $\frac{1}{11} \times \frac{5}{7}$. | 9. $\frac{8}{15} \times \frac{4}{5}$. | 12. $\frac{37}{100} \times \frac{2}{7}$. | 15. $\frac{30}{80} \times \frac{7}{8}$. |
| 7. $\frac{3}{12} \times \frac{5}{6}$. | 10. $\frac{9}{8} \times \frac{7}{9}$. | 13. $\frac{20}{50} \times \frac{4}{5}$. | 16. $\frac{40}{500} \times \frac{5}{6}$. |

17. If 1 pint of milk cost $4\frac{1}{2}$ cents, what will be the cost of $3\frac{2}{3}$ pints?

SOLUTION.—1. $3\frac{2}{3}$ pints are equal to $1\frac{2}{3}$ pints, and $4\frac{1}{2}$ cents are equal to $\frac{9}{2}$ cents.

2. Since $\frac{9}{2}$ ct. are the cost of 1 pint, $\frac{2}{3}$ of $\frac{9}{2}$ ct., or $\frac{3}{1}$ ct., must be the cost of $\frac{2}{3}$ of a pint.

3. Since $\frac{3}{1}$ ct. are the cost of $\frac{2}{3}$ of a pint, 17 times $\frac{3}{1}$ ct., or $15\frac{3}{1}$ ct., equal $15\frac{3}{1}$ cents, must be the cost of $1\frac{2}{3}$, or $3\frac{2}{3}$ pints.

18. If 1 bushel of pears cost $\$2\frac{3}{4}$, what will be the cost of $4\frac{3}{4}$ bushels? Of $3\frac{1}{2}$ bu.? Of $7\frac{1}{2}$ bu.? Of $6\frac{1}{4}$ bu.? Of $9\frac{3}{8}$ bu.?

19. What is the cost of $4\frac{5}{6}$ yards of cloth, at $\$1\frac{1}{4}$ per yard? At $\$3\frac{1}{2}$ per yard? At $\$2\frac{1}{3}$ per yard? At $\$4\frac{2}{5}$ per yard?

20. What is the cost of $\frac{2}{3}$ of a yard of cloth at $\$6$ a yard?

21. $\frac{2}{3}$ of $\$75$ is 2 times what a coat cost; what was the price of the coat?

ORAL AND WRITTEN EXERCISES.

175. 1. How many times can $\frac{1}{2}$ pound of tea be taken from 2 pounds? From 3 pounds? From 5 pounds? From 8 pounds?

SOLUTION.—In 2 pounds there are 4 halves, hence 1 half can be taken 4 times from 2 pounds.

2. How many times can $\frac{1}{3}$ be taken from 1? From 2? From 7?

3. How many *fourths* in 2 peaches? In 4 peaches? In 8 peaches?

4. How many times are $\$ \frac{2}{3}$ contained in \$2? In \$4? In \$8?

SOLUTION.—\$2 are equal to $\$ \frac{2}{3}$, and $\frac{2}{3}$ are contained 3 times in 2.

Observe, the dividend and divisor are made, before dividing, into the same fractional parts.

5. How many times are $\frac{3}{4}$ of an ounce contained in 3 ounces? In 6 ounces? In 9 ounces? In 12 ounces? In 2 ounces?

6. How many times are $\frac{1}{2}$ of a gallon contained in 8 gal.? In 12 gal.?

7. How many apples at $\frac{2}{3}$ of a cent each can be bought for 6 cents?

SOLUTION.—As many as $\frac{2}{3}$ of a cent are contained times in 6 cents, which are 9.

8. How many books at $\$ \frac{1}{3}$ each can be bought for \$6? For \$9? For \$3? For \$12? For \$30? For \$60?

9. When coffee can be bought for $\$ \frac{5}{12}$ a pound, how many pounds can be bought for \$10? For \$30?

10. How many pounds of butter at $\$ \frac{1}{3}$ a pound can be bought for \$2? For \$5? For \$8? For \$4? For \$9? For \$20?

11. If a bushel of apples costs $\frac{2}{3}$ of a dollar, how many bushels can be bought for \$15?

12. If a yard of cloth costs $\$ \frac{1}{3}$, how many yards can be bought for \$20?

13. If a quire of paper costs $\frac{2}{3}$ of a dollar, how many quires can I get for \$18?

ORAL AND WRITTEN EXERCISES.

176. 1. How many times can $\frac{2}{3}$ be taken from $\frac{6}{3}$?

SOLUTION.—As many times as 2, the numerator of the divisor, is contained times in 6, the numerator of the dividend, which are 3.

2. How many times can $\frac{3}{4}$ be taken from $\frac{6}{4}$? From $\frac{12}{4}$? From $\frac{9}{4}$? From $\frac{18}{4}$? From $\frac{21}{4}$? From $\frac{15}{4}$?

3. $\frac{2}{5}$ are contained how many times in $\frac{8}{5}$? In $\frac{4}{5}$? In $\frac{10}{5}$? In $\frac{6}{5}$? In $\frac{13}{5}$? In $\frac{18}{5}$? In $\frac{15}{5}$? In $\frac{21}{5}$?

Perform and explain the division in the following :

4. $\frac{15}{7} \div \frac{3}{7}$.

6. $\frac{42}{50} \div \frac{6}{50}$.

8. $\frac{40}{10} \div \frac{7}{10}$.

5. $\frac{12}{10} \div \frac{4}{10}$.

7. $\frac{36}{41} \div \frac{9}{41}$.

9. $\frac{54}{13} \div \frac{6}{13}$.

10. How many times is $\frac{1}{3}$ of a quart contained in $\frac{6}{3}$ qt.?

Observe, the divisor and dividend must both express the same kind of equal parts, hence the following :

SOLUTION.— $\frac{1}{3}$ of a quart is equal to $\frac{2}{3}$ of a quart, and $\frac{2}{3}$ of a quart are contained 2 times in $\frac{4}{3}$ of a quart.

11. How many times are $\frac{2}{3}$ contained in $\frac{8}{3}$? In $\frac{16}{3}$?

Perform and explain the following :

12. $\frac{12}{8} \div \frac{4}{8}$.

14. $\frac{80}{4} \div \frac{5}{4}$.

16. $\frac{100}{9} \div \frac{5}{9}$.

13. $\frac{15}{2} \div \frac{5}{2}$.

15. $\frac{180}{5} \div \frac{4}{5}$.

17. $\frac{126}{48} \div \frac{3}{8}$.

18. A boy spent $7\frac{2}{3}$ cents in buying pears at $\frac{2}{3}$ of a cent each. How many pears did he buy?

SOLUTION.—He bought as many pears as $\frac{2}{3}$ of a cent are contained times in $7\frac{2}{3}$ cents. $\frac{2}{3}$ of a cent are equal to $\frac{4}{6}$ of a cent, and $\frac{4}{6}$ of a cent are contained 9 times in $7\frac{2}{3}$ cents; hence he bought 9 pears.

19. At $\$ \frac{3}{4}$ a yard, how many yards of cloth can be bought for $\$ \frac{3}{4}$? For $\$ \frac{9}{4}$? For $\$ \frac{11}{4}$? For $\$ \frac{7}{4}$?

20. At $\$ \frac{2}{3}$ a peck, how many pecks of peaches can be bought for $\$ \frac{3}{2}$? For $\$ \frac{9}{2}$? For $\$ 2$? For $\$ 7$? For $\$ 12$?

COMPARISON OF NUMBERS.

177. 1. What part of 4 is 3?

SOLUTION.—Since 1 is $\frac{1}{4}$ of 4, 3 must be 3 times $\frac{1}{4}$, or $\frac{3}{4}$ of 4.

Find the part that

- | | | |
|----------------|-----------------|--------------------|
| 2. 2 is of 7. | 6. 6 is of 18. | 10. 8 is of 56. |
| 3. 4 is of 8. | 7. 9 is of 54. | 11. 10 is of 80. |
| 4. 3 is of 9. | 8. 5 is of 35. | 12. 25 is of 100. |
| 5. 6 is of 10. | 9. 10 is of 24. | 13. 200 is of 600. |

14. 2 pecks are what part of 3 pecks? Of 4 pk.? Of 7 pk.? Of 10 pk.?

15. 1 peck is what part of a bushel? Of 2 bu.? Of 3 bu.?

Observe, the two numbers compared must express the same unit; hence the given bushels are expressed in pecks, and then the comparison is made.

16. 5 ounces are what part of 9 ounces? Of 15 oz.? Of 25 oz.? Of 40 oz.?

17. 1 ounce is what part of a pound Avoirdupois? Of a pound Troy?

18. 1 pint is what part of a quart? Of 2 qt.? Of 3 qt.?

19. 7 pecks are what part of 3 bushels? Of 5 bu.? Of 9 bu.? Of 7 bu.?

20. 10 ounces are what part of 2 pounds Avoirdupois?

21. $\frac{1}{4}$ of a pound is what part of $\frac{5}{8}$ of a pound?*Observe*, that before two fractions can be compared they must both express equal parts of the same kind; hence the following:SOLUTION.— $\frac{1}{4}$ of a pound is equal to $\frac{2}{8}$, and 2 eighths of a pound are $\frac{2}{8}$ of 6 eighths of a pound.22. $\frac{1}{3}$ is what part of $\frac{2}{4}$? $\frac{1}{3}$ is what part of $\frac{5}{6}$? Of $\frac{4}{6}$?23. $\frac{1}{4}$ is what part of $\frac{5}{12}$? $\frac{2}{3}$ is what part of $\frac{7}{10}$?24. $\frac{2}{3}$ is what part of $\frac{12}{15}$? $\frac{5}{8}$ is what part of $\frac{25}{32}$?25. $\frac{3}{5}$ is what part of $\frac{4}{5}$? $\frac{2}{3}$ is what part of $\frac{10}{15}$?26. $\frac{5}{9}$ is what part of $\frac{2}{3}$? $\frac{2}{3}$ is what part of $\frac{20}{30}$?

DEFINITIONS.

178. A *Fractional Unit* is one of the equal parts of anything regarded as a whole.

179. A *Fraction* is one or more of the equal parts of a unit or whole.

180. The *Numerator* is the number above the dividing line in the expression of a fraction, and indicates how many *equal parts* are in the *fraction*.

181. The *Denominator* is the number below the dividing line in the expression of a fraction, and indicates how many *equal parts* are in the *whole*.

182. The *Terms* of a fraction are the numerator and denominator.

183. *Reduction* is the process of changing the terms of a fraction without altering its value.

184. A fraction is reduced to *Higher Terms* when its numerator and denominator are expressed by larger numbers. Thus, $\frac{2}{3} = \frac{4}{6}$.

185. A fraction is reduced to *Lower Terms* when its numerator and denominator are expressed by smaller numbers. Thus, $\frac{6}{12} = \frac{1}{2}$.

186. A *Common Denominator* is a denominator that belongs to two or more fractions.

187. A *Proper Fraction* is one whose numerator is less than the denominator, as $\frac{3}{4}$, $\frac{5}{7}$.

188. An *Improper Fraction* is one whose numerator is equal to or greater than the denominator, as $\frac{4}{3}$, $\frac{7}{3}$.

189. A *Mixed Number* is a number composed of an integer and a fraction, as $5\frac{2}{3}$, $12\frac{3}{8}$.

DENOMINATE NUMBERS.

CANADIAN AND UNITED STATES MONEY.

190. The following table includes Canadian and U. S. money:

TABLE OF UNITS.

10 mills (m.)	make	1 cent	. . .	ct.
10 cents	"	1 dime	. . .	d.
10 dimes	"	1 dollar	. . .	\$.
10 dollars	"	1 eagle	. . .	E.

$$\$1 = 10 \text{ d.} = 100 \text{ ct.} = 1000 \text{ m.}$$

- How many cents in \$2? In \$4? In \$9? In \$25?
- How many dollars in 100 ct.? In 300 ct.? In 500 ct.? In 1200 ct.?
- Change \$16 to cents; \$23; \$84; \$95; \$372.
- In \$2 how many mills? In \$7? In 53 ct.? In 85 ct.?
- Express 435 cents as dollars and cents.
Observe, the 400 cents make \$4, hence the 435 cents make \$4 and 35 cents, which we write thus: \$4.35 (58-3).
- In 786 cents, how many dollars and cents? In 932 ct.? In 5384 ct.?
- In 360 eagles how many dollars? How many dimes?
- Express 8420 cents in dimes. In dollars.
- Express in dollars and cents the following:

375 ct.	1237 ct.	605 ct.	5360 ct.
856 ct.	5786 ct.	807 ct.	9408 ct.
732 ct.	8527 ct.	426 ct.	6210 ct.
205 ct.	1006 ct.	503 ct.	3040 ct.
430 ct.	8020 ct.	130 ct.	7204 ct.

WRITTEN EXERCISES.

191. The character @ is followed by the price of a unit or one article. Thus, 9 yards of cloth @ \$2, means 9 yards of cloth at \$2 a yard.

Find the cost of the following (see Art. 122) :

- | | |
|--------------------------------|------------------------------------|
| 1. 5 yards of cloth @ \$.20. | 9. 36 yards of ribbon @ \$1.84. |
| 2. 9 yards of cloth @ \$.35. | 10. 43 yards of silk @ \$2.95. |
| 3. 7 bu. of wheat @ \$1.25. | 11. 79 bu. of peaches @ \$2.38. |
| 4. 12 pk. of peaches @ \$.85. | 12. 83 acres of land @ \$43.25. |
| 5. 8 gal. of vinegar @ \$.37. | 13. 56 tons of coal @ \$7.45. |
| 6. 6 lb. of tea @ \$1.48. | 14. 93 cords of wood @ \$4.53. |
| 7. 9 yards of muslin @ \$.38. | 15. 237 acres of land @ \$65.75. |
| 8. 14 pairs of boots @ \$7.54. | 16. 89 barrels of apples @ \$3.46. |

17. A farmer sold 46 sheep @ \$3, 7 tons of hay @ \$14.50, 184 pounds of butter @ \$.43, and 35 barrels of apples @ \$3.75. How much did he receive for the whole?

18. A grocer sold a man 16 lb. tea @ \$.85, 96 lb. sugar @ 12 ct., 25 lb. butter @ \$.38, and 3 barrels of flour @ \$8.50. How much did he receive for the whole?

19. How much must I pay for the following bill of articles :

- | | |
|---------------------------|-----------------------------|
| 39 lb. of coffee @ \$.45. | 89 lb. of flour @ 4 ct. |
| 85 lb. of butter @ \$.39. | 42 lb. of dry beef @ 19 ct. |
| 19 lb. of cheese @ \$.13. | 64 lb. of sugar @ 13 ct. |

20. A merchant bought 346 yards of cotton @ 9 ct., and 86 yards of silk @ \$1.36. How much did he pay for both?

21. A man bought 385 acres of land @ \$49, and 36 head of cattle @ \$42.50. What did the whole cost?

22. What is the difference in the cost of 57 yards of silk @ \$2.85, and 532 yards of muslin @ \$.37?

23. Which will cost the most and how much, 84 barrels of flour @ \$7.60, or 136 barrels of apples @ \$3.85?

EXERCISES IN ENGLISH AND OTHER MONEY.

192. English or Sterling Money is the money of Great Britain.



The *Standard Unit* of English money is the *Sovereign* or *Pound Sterling*.



A Sovereign is equal to \$4.866½ Canadian Money.

TABLE OF UNITS.

4 farthings (far.)	make	1 penny	. . . d.
12 pence	"	1 shilling	. . . s.
20 shillings	"	1 pound	. . . £.
2 shillings	"	1 florin	. . . fl.
5 shillings	"	1 crown	. . . cr.

193. French Money is the money of France.



The *Standard Unit* of French money is the *Franc* of the *Republic*.



A Franc is equal to \$.193 Canadian Money.

TABLE OF UNITS.

10 millimes (m.)	make	1 centime	. . . ct.
10 centimes	"	1 decime	. . . dc.
10 decimes	"	1 franc	. . . fr.

EXERCISES IN ENGLISH AND OTHER MONEY.

194. German Money is the money of the German Empire.



The *Standard Unit* of the German Empire is the *Mark*. The mark is subdivided into 100 *Pfennings*.



The coins referred to in Canada are the

Mark, equal to $23\frac{3}{10}$ cents Canadian Money.

Silver Thaler, equal to $74\frac{6}{10}$ ct. " "

Silver Groschen, equal to $2\frac{1}{2}$ ct. " "

Pfenning, equal to $\frac{1}{100}$ of a mark.

1. How many farthings in 1 penny? In 3 pence? In 5 pence? In 9 pence? In 1 shilling? In 20 pence?
2. How many pence in 3 shillings? In 5s.? In 10s.? In £1?
3. How many shillings in 4 crowns? In 9 florins? In £6?
4. How many pence in 3s. 6d.? In 5s. 9d.? In £1 8s. 9d.?
5. How many decimes in 3 francs? In 7 fr.? In 12 fr.? In 40 fr.?
6. Express 5 francs in centimes; in millimes.
7. What is the value in Canadian Money of 1 franc? Of 3 fr.? Of 7 fr.? Of 9 fr.? Of 10 fr.? Of 100 fr.? Of 30 fr.? Of 400 fr.?
8. What is the value in Canadian Money of £1? Of £2? Of £5? Of £10? Of £100? Of £20
9. How many pfennings in 1 mark? In 7 marks?

OTHER

EXERCISES IN UNITS OF WEIGHT.

195. 1. *Troy Weight* is used in weighing gold, silver, and precious stones, and in philosophical experiments.

TABLE OF UNITS.

24 grains (gr.)	make	1 pennyweight	. pwt.
20 pennyweights	"	1 ounce	. . . . oz.
12 ounces	"	1 pound	. . . . lb.

2. *Apothecaries' Weight* is used by physicians and apothecaries in compounding *dry* medicines.

TABLE OF UNITS.

20 grains (gr.)	make	1 scruple	. . sc. or ℥.
3 scruples	"	1 dram	. . . dr. or ℥.
8 drams	"	1 ounce	. . . oz. or ℥.
12 ounces	"	1 pound	. . . lb.

The pound, ounce, and grain are the same in Troy and Apothecaries' weight.

3. How many grains in 2 pwt.? In 5 pwt.? In 10 pwt.?
 4. How many scruples in 3 10? In 3 15? In 3 30?
 5. Express in grains 5 pwt. ; 10 pwt. 7 gr. ; 8 pwt. 13 gr.
 6. Express in ounces 3 lb. 4 oz. ; 5 lb. 9 oz. ; 10 lb. 7 oz.
 7. Change to grains 2 lb. 6 oz. ; 5 lb. 10 oz.
 8. Express in scruples 3 lb. 4 oz. ; 6 lb. 3 8 3 5.
 9. How many powders weighing each 9 grains can be made from 3 3? From 3 15? From 3 1 2 2 gr. 8?
- Observe,* each number must be made into grains before dividing by the 9 grains.
10. How many tablespoons, each weighing 2 oz., can be made from 1 lb. of silver? From 5 lb.? From 12 lb. 8 oz.?
 11. How many ounces in 3 1 1 1 lb.? In 2 1 1 lb.? In 4 1 1 lb.?

EXERCISES IN UNITS OF WEIGHT.

196. Avoirdupois Weight is used in weighing groceries and all heavy articles and drugs at wholesale.

TABLE OF UNITS.

16 ounces (oz.)	make	1 pound	lb.
100 pounds	"	1 hundredweight .	cwt.
20 cwt. or 2000 lbs.	"	1 ton	T.

1 pound contains 7000 grains *Troy*.

The following denominations are also used :

100 pounds of grain or flour	make	1 cental.
100 pounds of dry fish	"	1 quintal.
196 pounds of flour	"	1 barrel.
200 pounds of pork	"	1 barrel.

1. How many ounces in 2 pounds? In 4 lb.? In 10 lb.?
2. How many are the $\frac{1}{2}$ of 8 oz.? $\frac{1}{2}$ of 16 oz.? $\frac{1}{4}$ of 16 oz.?
3. How many ounces in $\frac{1}{2}$ lb.? In $\frac{1}{4}$ lb.? In the $\frac{1}{8}$ of 2 lb.?
4. How many pounds in 40 oz.? In 112 oz.? In 192 oz.?
5. In 5 lb. 9 oz., how many ounces?
6. In 4 cwt. 37 lb., how many pounds? In 13 cwt. 84 lb.?
7. What is the cost of 2 lb. 13 oz. of candy, at 3 cents an ounce? Of 4 lb. 7 oz., at 5 cents an ounce?
8. A coal dealer sold 9 T. 12 cwt., at 25 ct. a hundredweight. How much did he get for the whole?

Observe, the tons must be changed to hundredweights.

9. When coal sells at 35 ct. a hundredweight, what is the cost of 5 T. 16 cwt.? Of 8 T. 13 cwt.? Of 12 T. 18 cwt.?
10. What is the cost of 5 barrels of flour at 2 ct. a pound?
11. What is the cost of 8 quintals of fish at 7 ct. a pound? At $9\frac{1}{2}$ ct. a pound?

UNITS OF LENGTH.

197. A yard is the *Standard Unit* in linear measure.

TABLE OF UNITS.

I. *Used in measuring lines or ordinary distances.*

12 inches (in.)	make	1 foot	. . . . ft.
3 feet	"	1 yard	. . . . yd.
$5\frac{1}{2}$ yd. or $16\frac{1}{2}$ ft.	"	1 rod	. . . . rd.
40 rods	"	1 furlong	. . . fur.
8 furlongs	"	1 mile	. . . . mi.
3 miles	"	1 league	. . . l.

II. *Used in measuring roads and boundaries of land.*

$7\frac{1}{10}$ inches	make	1 link	. . . . l.
25 links	"	1 rod	. . . . rd.
4 rods	"	1 chain	. . . . ch.
80 chains	"	1 mile	. . . . mi.

III. *Used in measuring cloth sold by the yard.*

$2\frac{1}{4}$ inches ($2\frac{1}{4}$ in.)	make	1 sixteenth of a yard,	$\frac{1}{16}$ yd.
2 sixteenths ($4\frac{1}{2}$ in.)	"	1 eighth of a yard,	$\frac{1}{8}$ yd.
2 eighths (9 in.)	"	1 fourth of a yard,	$\frac{1}{4}$ yd.
4 quarters	"	1 yard.	

IV. *Used to measure the kind of distances named.*

60 geographical or	{	make 1	{	degree of Latitude on a Me-
$69\frac{1}{100}$ statute miles				ridian, or of Longitude on
				the Equator.
360 degrees	"			1 circumference of the earth.
$1\frac{1}{100}$ statute miles	"			1 geog. mi. } used to measure
3 geographical mi.	"			1 league } distances at sea.
6 feet	"			1 fathom } used to measure
				depths at sea.
4 inches	"			1 hand } used to measure the
				height of horses at the
				shoulder.

EXERCISES IN UNITS OF LENGTH.

198. 1. How many inches in 2 feet? In 4 ft.? In 7 ft.? In 9 ft.? In 20 ft.?

2. Express in inches 1 yard; 3 yards; 10 yards; 100 yards.

3. How many inches in 4 yd. 2 ft. 7 in.?

SOLUTION.—1. Since 3 feet make one yard, in 4 yd. there must be 3 times 4 or 12 ft., and 12 feet plus 2 feet are 14 feet.

2. Since 12 inches make 1 foot, in 14 feet there must be 12 times 14, or 168 inches, and 168 in. plus 7 in. are 175 in. Hence, etc.

Express in inches each of the following :

4. 2 ft. 8 in. 7. 1 yd. 2 ft. 10. 2 yd. 1 ft. 7 in.

5. 5 ft. 9 in. 8. 3 yd. 1 ft. 11. 3 yd. 2 ft. 9 in.

6. 9 ft. 11 in. 9. 7 yd. 2 ft. 12. 10 yd. 1 ft. 4 in.

13. How many inches in $1\frac{1}{2}$ yard? In $3\frac{1}{2}$ yd.? In $5\frac{1}{2}$ yd.?

Observe, $\frac{1}{2}$ of a yard = 18 inches, and $\frac{3}{4}$ of a yard = 27 inches.

14. How many inches in 1 rod? In 2 rods? In 5 rods? In 10 rods?

15. Express in yards, feet, and inches, 129 inches.

SOLUTION.—1. Since 12 inches make 1 foot, there are as many feet in 129 inches as 12 inches are contained times in 129 in., which are 10 and 9 in. remaining.

2. Since 3 feet make 1 yard, in 10 feet there are 3 yards and 1 foot remaining. Hence in 129 inches there are 3 yd. 1 ft. 9 in.

16. Express in feet and inches 30 in.; 50 in.; 78 in.; 100 in.; 180 in.

17. Express in yards and feet 14 ft.; 20 ft.; 29 ft.; 40 ft.; 62 ft.

18. How many yards, feet, and inches in 68 in.? In 95 in.? In 175 in.? In 273 in.?

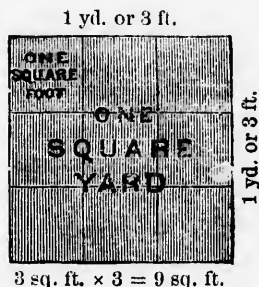
19. How many inches in 1 sixteenth of a yard? In 2 sixteenths? In 7 sixteenths?

EXERCISES IN UNITS OF SURFACE.

199. 1. A *Surface* has two dimensions, *length* and *breadth*.

2. A *Square* is a surface bounded by four equal lines, and having four right angles, thus :

This figure represents one *square yard*, each side of which is 1 yard or 3 feet long.



3. In 1 row across the top of the square yard there are 3 sq. ft.; how many such rows in the whole surface?

4. How many sq. ft. in 1 sq. yd.? In 2 sq. yd., and why?

Draw figures on your slate representing the number of sq. ft. in surfaces that are :

- | | |
|----------------------------|----------------------------|
| 5. 5 ft. wide 6 ft. long. | 8. 9 ft. wide 12 ft. long. |
| 6. 3 ft. wide 7 ft. long. | 9. 4 ft. wide 16 ft. long. |
| 7. 7 ft. wide 12 ft. long. | 10. 9 ft. wide 9 ft. long. |

11. What is the cost of a walnut board 3 ft. wide and 16 ft. long, at 12 cents per square foot?

12. How many square feet in the floor of a room that is 9 feet wide and 12 feet long?

13. There are 5 rooms in a house and each room is 14 ft. wide and 16 ft. long; how many sq. ft. in the floor of all the rooms, and how much did the floor cost at 4 cents a sq. ft.?

14. How many sq. ft. of boards will it take to cover a sidewalk that is 5 ft. wide and 734 ft. long?

15. How many square inches in a board 6 in. wide and 18 in. long? In a board 1 foot square, and why?

16. What will be the cost of putting a floor in a barn that is 49 feet wide and 70 feet long, at 2 cents per sq. ft.?

EXERCISES IN UNITS OF SURFACE.

200. A *Square Yard* is the *Standard Unit* in surface measure.

TABLE OF UNITS.

1. Used in measuring the surface of land, boards, plaster, etc.

144 square inches (sq. in.)	make 1 square foot . .	sq. ft.
9 square feet	" 1 square yard . .	sq. yd.
30½ square yards	" 1 sq. rod or perch.	sq. rd., P.
160 square rods	" 1 square acre . .	A.

2. Used by surveyors in computing the area or contents of land, and is usually called *Surveyors' Measure*.

625 square links (sq. l.)	make 1 pole	P.
16 poles	" 1 square chain .	sq. ch.
10 square chains	" 1 acre	A.
640 square acres	" 1 square mile .	sq. mi.

Observe, Gunter's Chain is used in measuring land. It is 22 yards long, and is divided into 100 links.

3. How many square inches in 1 square foot? In 2 sq. ft.?
In 3 sq. ft.? In 10 sq. ft.?

4. How many square feet in 1 square yard? In 2 sq. yd.?
In 5 sq. yd.? In 20 sq. yd.? In 50 sq. yd.?

5. How many sq. inches in 1 sq. ft. 97 sq. in.? In 7 sq. ft.
115 sq. in.?

6. How many poles in 2 sq. ch.? In 10 sq. ch.?

7. How many poles in 2 A. 5 sq. ch. 8 P.? In 7 A. 9 sq. ch.
12 P.?

8. How many acres in 10 sq. ch.? In 20 sq. ch.? In 50
sq. ch.?

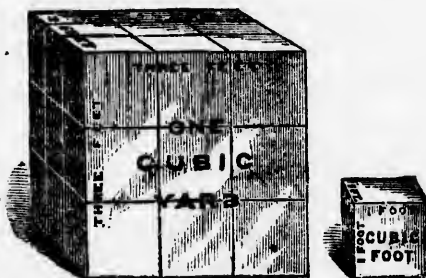
9. How many acres in 250 sq. ch.? In 917 P.?

FACE.

EXERCISES IN UNITS OF VOLUME.

201. A *Solid* or *Volume* has three dimensions—*length*, *breadth*, and *thickness*.

202. A *Cube* is a solid or volume bounded by six equal squares called faces, thus :



The first of these figures represents a cubic yard, and each edge represents one yard long.

The second represents a cubic foot, and each edge represents one foot long.

1. How many square feet in each face of a cubic yard? How do you find the number of square feet?

2. If a slab a foot thick is taken off the top or side of a cubic yard, how many cubic feet will it contain?

3. How many slabs a foot thick in 1 cubic yard? How many cubic feet in each slab?

4. How many cubic feet in 1 cubic yard? In 5 cu. yd.?

5. *Cubic* or *Solid Measure* is used in measuring timber, wood, stone, etc.

TABLE OF UNITS.

1728 cubic inches (cu. in.) make 1 cubic foot . . cu. ft.

27 cubic feet " 1 cubic yard . . cu. yd.

6. How many cubic feet in a slab of stone 1 foot thick, 3 feet wide, and 5 feet long? In 2 such slabs?

7. A block of stone is 3 feet deep, 4 feet wide, and 8 feet long. How many cubic feet does it contain?

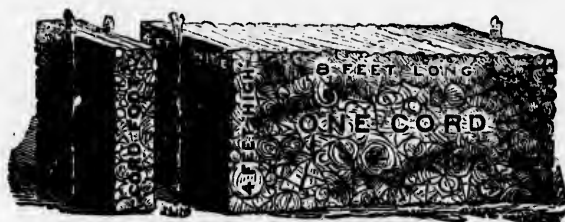
Observe, a slab of the top of the block 1 foot thick contains $4 \times 8 = 32$ cu. ft., and there are 3 such slabs in the block.

8. How many cubic feet of earth in a bank that is 5 feet deep, 8 feet wide, and 12 feet long, and what would be the cost of removing the earth at $\frac{3}{4}$ of a cent per cubic foot?

EXERCISES IN UNITS OF VOLUME.

203. *Wood Measure* is used in measuring wood, rough stone, and masonry.

204. A *Cord* is a pile of wood, stone, etc., 8 feet long, 4 feet wide, and 4 feet high.



205. A *Cord Foot* is 1 foot long, 4 feet wide, and 4 feet high, and contains $\frac{1}{8}$ of a cord.

TABLE OF UNITS.

16 cubic feet	make	1 cord foot	. . .	Cd. ft.
8 cord feet or	}	"	1 cord	. . . . . Cd.
128 cubic feet				
24 $\frac{3}{4}$ cubic feet	"	1	{ perch of stone or of masonry. }	Pch.

1. How many cord feet in 1 cord? In 2 Cd.? In 9 Cd.?
2. How many cubic feet in 1 cord foot? In 2 Cd. ft.? In 6 Cd. ft.? In 8 Cd. ft.? In 10 Cd. ft.?
3. How many cords in 8 Cd. ft.? In 16 Cd. ft.? In 56 Cd. feet?
4. Express, in Cd. and Cd. ft., 368 cubic feet; 696 cu. ft.
5. What is the cost of 3 cords of wood, at 40 cents for every cord foot?
6. What part of a cord is a cord foot? 2 Cd. ft.? 7 Cd. ft.?
7. A pile of wood is 4 feet wide, 6 feet high, and 16 feet long. How many cubic feet in it? How many cords?

UNITS OF CAPACITY.

206. Liquid Measure is used in measuring all kinds of liquids, as oil, milk, water, etc.

The measures in use are of various sizes, thus:



TABLE OF UNITS.

4 gills (gi.)	make	1 pint	. . .	pt.
2 pints	"	1 quart	. . .	qt.
4 quarts	"	1 gallon	. . .	gal.

NOTE.—A barrel of beer contains 36 gals.

A hogshead of beer " 54 gals.

A hogshead of wine " 63 gals.

The Imperial or standard gallon contains 277.274 cubic inches.

Units used in measuring liquid medicine :

60 minims (℥)	make	1 fluid drachm	. f 3.
8 fluid drachms	"	1 fluid ounce	. f 3.
16 fluid ounces	"	1 pint	. . . . O.
8 pints	"	1 gallon	. . . Cong.

1. How many gills in 2 pints? In 7 pints? In 9 pints? In 12 pints?

2. In 8 quarts how many pints? How many gills?

3. Express in pints 2 gallons; 7 gallons; 10 gallons.

4. Express in gallons and quarts 276 gills; 339 pints.

EXERCISES IN LIQUID MEASURE.

- 207.** 1. Express in pints 5 gal. 3 qt. 1 pt. ; 12 gal. 2 qt. 1 pt.
 2. What is the cost of 4 gal. 3 qt. of milk, at 4 ct. a pint ?
 3. How many gallons in 93 qt. ? In 63 pints ?
 4. How many minims in $f\ 3\ 7$? In $f\ 3\ 12$?
 5. Express in fluid ounces 2 gal. 7 pints.
 6. Express in minims 42 fluid drachms ; 83 fluid drachms.
 7. A grocer sold 5 gal. 2 qt. of vinegar, at $4\frac{1}{2}$ cents a pint. How much did he receive for the whole ?
 8. A farmer sold 5 gal. 3 qt. milk, at $3\frac{1}{2}$ cents a pint. How much did he receive for the whole ?

Find the cost of each of the following quantities of milk :

9. 7 gal. 3 qt. at 8 ct. a qt. 12. 10 gal. 1 qt. at 8 ct. a pt.
 10. 16 gal. 2 qt. at $9\frac{1}{2}$ ct. a qt. 13. 8 gal. 2 qt. at $3\frac{1}{2}$ ct. a pt.
 11. 9 gal. 3 qt. at $7\frac{2}{3}$ ct. a qt. 14. 12 gal. 3 qt. at $4\frac{1}{3}$ ct. a pt.
 15. What is the cost of 8 gal. 3 qt. of syrup at 14 ct. a qt. ?
 16. One quart is what part of a gallon ? Of 2 gal. ?
 17. Three quarts are what part of a gallon ? Of 5 gal. ?
 18. How many gallons in 4 barrels ? In 2 bbl. ? In 12 bbl. ? In 24 bbl. ? In 100 bbl. ?
 19. What is the cost of 4 hogsheads of molasses at 30 cents a gallon ? Of 7 hhd. at 36 ct. a gal. ?
 20. A grocer sold 1 hoghead of syrup at 16 cents a quart. How much did he receive ?
 21. What is the cost of $O\ 5\ f\ 3\ 14\ f\ 3\ 6$, at 5 cents for each fluid drachm ?
 22. A milk dealer supplies a family with 4 quarts of milk each day for 20 weeks, at $3\frac{1}{2}$ cents a pint. What is the amount of the bill for the 20 weeks ?
 23. How many pints of water will fill a vessel which holds 19 gal. 3 qt. 1 pt. ?

URE.

UNITS OF CAPACITY.

208. Dry Measure is used in measuring grain, roots, fruits, salt, etc.

The measures in use are of various sizes, thus :



TABLE OF UNITS.

2 pints (pt.) make	1 quart . . .	qt.
8 quarts	"	1 peck . . .
4 pecks	"	1 bushel . . .
		bu.

The following table shows the weight of a bushel of the article named :

Wheat,	60 lb.	Potatoes,	60 lb.	Buckwheat,	48 lb.
Clover seed,	60 "	Corn,	56 "	Barley,	48 "
Peas,	60 "	Rye,	56 "	Oats,	34 "
Beans,	60 "	Flax seed,	58 "	Timothy seed,	48 "

NOTE.—By the "Weights and Measures" Act of 1873, the Imperial bushel, containing eight "Imperial gallons" of 277.274 cubic inches in each, is the standard bushel in Canada. The following articles, according to the same Act, are to be estimated by the *Cental* of 100 lbs. : Barley, beans, charcoal, corn, oats, pease, potatoes, rye, salt, seeds, and wheat. In Great Britain, 8 bushels make 1 quarter.

EXERCISES IN DRY MEASURE.

209. 1. Express 5 bu. 3 pk. in quarts ; 3 bu. 2 pk. 5 qt. in pints.

2. How many bushels in 12 pk. ? In 17 pk. ? In 128 qt. ?

3. What is the cost of 7 bu. 3 pk. of peaches, at 50 cents a peck ? At 35 cents ? At 65 cents ?

4. A grocer sold 3 bu. 2 pk. clover seed for 9 cents a quart. How much did he receive for the whole ?

5. What is the value of a load of beans weighing 2700 pounds, at \$1.85 a bushel ?

6. A farmer sold 4,250 pounds of oats at 40 cents a bushel. How much did he receive ?

7. A grocer sold 12 barrels of apples, each containing $2\frac{1}{2}$ bu., at 33 cents a peck. How much did he receive for the 12 bbl. ?

8. A wheat merchant bought at \$1.15 a bushel, 5 loads of wheat, each weighing 3000 pounds, and 3 loads, each weighing 4500. What did he pay for the whole ?

9. What is the cost of 4984 pounds of corn at 5 cents a bushel ?

10. What is the cost of 1 bu. 3 pk. of berries, at $4\frac{1}{2}$ ct. a pint ?

11. How many bushels in 234 pt. ? In 510 pt. ?

12. A man bought 10 car loads of oats, each weighing 4590. pounds. How many bushels did he buy ?

13. How many bushels of timothy seed in 360 pounds ? In 540 lb. ? In 800 lb. ? In 1000 lb. ?

14. What is the cost of 3700 pounds of corn meal, when it can be bought at \$1.50 a bushel ?

15. A grocer bought 40 bushels of potatoes at 75 cents a bushel, and sold them at 22 cents a peck. How much did he gain on the transaction ?

16. When apples sell at 15 ct. a peck, how much are they a bushel ?

17. How many bushels in 12 pk. ? In 32 qt. ? In 126 qt. ?

UNITS WHICH VARY IN SIZE.

210. 1. Circular measure is used in measuring angles or the arcs of circles.

TABLE OF UNITS.

60 seconds (")	make	1 minute	. . . '.
60 minutes	"	1 degree	. . . °.
30 degrees	"	1 sign	. . . s.
12 signs, or 360°	"	1 circumference	. Cir.

Observe the following names of parts of a circumference:

180 degrees, or $\frac{1}{2}$ of a Cir., are called a *Semi-circumference*.

90 degrees, or $\frac{1}{4}$ of a Cir., are called a *Quadrant*.

60 degrees, or $\frac{1}{6}$ of a Cir., are called a *Sextant*.

30 degrees, or $\frac{1}{12}$ of a Cir., are called a *Sign*.

2. A certain class of articles are counted in dozens or scores, in buying and selling them.

TABLE OF UNITS.

12 units, or things,	make	1 dozen.
12 dozen	"	1 gross.
12 gross, or 144 dozen	"	1 great gross.
20 things	"	1 score.

3. The paper trade use the following:

TABLE OF UNITS.

24 sheets	make	1 quire	. . qr.
20 quires	"	1 ream	. . rm.
2 reams	"	1 bundle	. . bun.
5 bundles	"	1 bale	. . . B.

1. How many degrees in one quadrant? In 4 quadrants? In 7? In 5 sextants? In 6 signs?

2. Express 3 degrees in minutes; 8 degrees; 2 signs.

3. How many *sextants* in 1 circumference? In 3 Cir.? In 12 Cir.? In 300°? In 730°?

UNITS OF TIME.

211. Units of Time are used in measuring a portion of duration.

TABLE OF UNITS.

60 seconds (sec.)	make	1 minute. . . m.
60 minutes	"	1 hour . . . hr.
24 hours	"	1 day . . . da.
7 days	"	1 week . . . wk.
365 days, or 12 calendar mo. }	"	1 common year. yr.
366 days	"	1 leap year. . yr.

DIVISIONS OF A YEAR.

SEASONS.	WINTER.	1 January,	Jan.	31 days.
		2 February,	Feb.	28, in leap year 29 da.
	SPRING.	3 March,	Mar.	31 days.
		4 April,	Apr.	30 "
		5 May,	May	31 "
	SUMMER.	6 June,	June	30 "
		7 July,	July	31 "
		8 August,	Aug.	31 "
	AUTUMN.	9 September,	Sept.	30 "
		10 October,	Oct.	31 "
		11 November,	Nov.	30 "
	WINTER.	12 December,	Dec.	31 "

12 calendar months = 365 days, or 1 year.

NOTE.—The leap years are those that can be divided by 4 without a remainder.

1. How many seconds in 4 m. ? In 2 hr. ? In 5 hr. ?
2. How many minutes in 1 da. ? In 3 da. ? In 6 da. 7 hr. ?
3. Express in hours 2 weeks ; 5 da. 10 hr. ; 3 wk. 4 da. 3 hr.
4. How many days in 24 hr. ? In 96 hr. ? In 7220 m. ?

ANSWERS.

The answers to oral exercises and the more simple examples have been omitted.

The answers for examples taken from the Arithmetical Tables commence on page 150.

Art. 53.

2. 2022.
3. 2296.
4. 22374.
5. 99241.
6. 171703.
7. 202523.
8. 21400.
9. 23985.
10. 22020.
11. 181359.
12. 103465.
13. 352959.

Art. 57.

1. 6975 lb.;
9915 lb.
2. 792 A.
3. 564 bu.
4. \$735.
5. 546.
6. 1411 yd.
7. \$4575.
8. \$109.
9. 425 lb.;
234 lb.
10. \$1776;
\$1378;
\$3251.
11. 249 bu.;
483 bu.
12. 438 lb.
13. \$1123;
\$1933;
\$4263.

Art. 58.

1. \$397.48.
2. \$1140.47.
3. \$1260.41.

Art. 59.

1. \$181.36.
2. \$1104.37.
3. \$1442.49.
4. \$749.40.

Art. 60.

1. \$1531.54.
2. \$2846.17.
3. \$2457.03.
4. \$1347.28.
5. \$2381.60.
6. \$1701.77.
7. \$1686.37.
8. \$2335.16.
9. \$1836.03.
10. \$1875.30.
11. \$536.23.
12. \$1984.81.
13. \$2168.44.

Art. 61.

1. \$5.98.
2. \$17.02.
3. \$17.10.
4. \$345.47.
5. \$23.60.
6. \$28.39.
7. \$58.20.
8. \$59.90.

9. \$13.48.
10. \$48.80.
11. \$14.65.
12. \$71.75.
13. \$1159.19.

Art. 62.

1. \$771.85.
2. \$1901.78.
3. \$4645 pu.
4. \$189.50.
5. \$2107.71.
6. \$4664.64.
7. \$1908.02.
8. \$29.80.
9. 11609 tr.
10. \$36.06.

Art. 83.

1. 276.
2. 347.
3. 367.
4. 176.
5. 178.
6. 168.
7. 169.
8. 275.
9. 188.
10. 558.
11. 173.
12. 2252.
13. 188.
14. 3528.
15. 349.
16. 169.

17. 4256.
18. 1774.
19. 3587.
20. 2578.
21. 2444.
22. 3555.
23. 3777.
24. 2889.
25. 1788.
26. 3645.
27. 4378.
28. 827.
29. 1487.
30. 2468.
31. 1266.
32. 1579.
33. 1579.
34. 7277.

Art. 89.

1. \$45.
2. \$157;
\$856;
\$353.
3. \$566.
4. 187 lb.
5. \$48.
6. 436 A.
7. 54.
8. 71 lb.
9. 188 bu.
10. 29 tons.
11. 91 yd.
12. \$297.
13. 124 tons.

Art. 90.

2. \$26.25.
3. \$54.21.
4. \$52.25.
5. \$29.28.
6. \$227.42.
7. \$248.62.
8. \$233.87.
9. \$146.52.
10. \$740.38.
11. \$225.08.
12. \$1.81.
13. \$43.57.
14. \$7.65.
15. \$24.46.
16. \$55.
17. \$4.58.

Art. 91.

1. \$327.84.
2. \$11.31.
3. \$165.58.
4. \$86.74.
5. \$213.58.
6. \$382.60.
7. \$81.25.
8. \$254.56.
9. \$14.03.
10. \$301.88.
11. \$18.49.
12. \$21.31.

Art. 107.

2. 1155.
3. 4844.
4. 5184.
5. 1988.
6. 7677.
7. 47472.
8. 9224.
9. 42545.
10. 42581.
11. 27855.
12. 241080.
13. 354042.
14. 123340.

15. 395340.
16. 699993.
17. 585228.
- 752436.
- 250812.
- 668832.
- 418020.
18. 1527921.
- 2546535.
- 3565149.
- 4074456.
- 1018614.
- 4583763.
19. 83000.
- 49800.
- 74700.
20. 6321000.
- 4515000.
- 2709000.
- 7224000.

21. 353535.
22. 242424.
23. 545454.
24. 454572.
25. 630063.
26. 399996.
27. 333330.
28. 303030.
29. 249276.
30. 233331.
31. 799992.
32. 166665.
33. 355552.
34. 300008.
35. 111110.
36. 485442.
37. 356076.
38. 161418.
39. 727272.
40. 553455.
41. 192045.
42. 187611.
43. 545436.
44. 351400.
45. 804366.
46. 298240.
47. 581665.

Art. 112.

1. 25228.
2. 65442.
3. 55765.
4. 10952.
5. 54855.
6. 32676.
7. 73008.
8. 25116.
9. 531295.
10. 789958.
11. 134714.
12. 444906.

Art. 120.

1. \$5019.
2. 25660800'.
3. 1728 lb.
4. 56056 lb.
5. 810000.
6. \$13.
7. \$535.
8. 95900.
9. \$18525.
10. \$656.
11. \$172.
12. 6240 bu.
13. 287985 yd.

Art. 122.

2. \$24.35.
3. \$84.33.
4. \$459.48.
5. \$943.13.
6. \$239.96.
7. \$258.35.
8. \$192.93.
9. \$128.25.
10. \$31.755.
11. \$484.42.
12. \$55.61.
13. \$481.55.

Art. 126.

2. 5442 gr.
3. \$1455.
4. 8232 oz.

5. 17200 lb.
6. 74 ct.
7. \$23.75.
8. 1764 lb.
9. 21528 gr.
10. \$20.56.
11. 13278 oz.
12. 192015 oz.
13. \$672.00.
14. \$64.16.
15. 792 pwt.
16. 1600 lb.
- 25600 oz.

Art. 133.

1. 900 bbl.
2. 230 bbl.
- 312 bbl.
3. 21 T.
- 501 T.
- 900 T.
4. 431 da.
5. 700 cd.
- 310 cd.
- 900 cd.
6. 800 hr.
7. 600 suits.
- 800 suits.
8. 40 sheep.
- 70 sheep.
- 902 sheep.
- 602 sheep.
9. 30 wk.
- 60 wk.
10. 20 wk.
- 30 wk.
- 70 wk.
11. 600 hr.
12. 2341 bags.
13. 3210.
- 1230.
- 3123.
14. 621 calves.
- 700 calves.
- 902 calves.
15. 910; 210;
- 801; 601.

17200 lb.
74 ct.
\$23.75.
1764 lb.
21528 gr.
\$20.56.
13278 oz.
192015 oz.
\$672.00.
\$64.16.
792 pwt.
1600 lb.
25600 oz.

Art. 133.

900 bbl.
230 bbl.
312 bbl.
21 T.
501 T.
900 T.
431 da.
700 cd.
310 cd.
900 cd.
800 hr.
600 suits.
800 suits.
40 sheep.
70 sheep.
902 sheep.
602 sheep.
30 wk.
60 wk.
20 wk.
30 wk.
70 wk.
600 hr.
2341 bags.
3210.
1230.
3123.
621 calves.
700 calves.
902 calves.
910; 210;
801; 601.

16. 620 bbl.
710 bbl.
920 bbl.
17. 71210.
142420.

Art. 136.

2. 786.
3. 347.
4. 583.
5. 837.
6. 485.
7. 387.
8. 354.
9. 734.
10. 856.
11. 648.
12. 697.
13. 859.
14. 87 cd.
15. 59 bbl.
83 bbl.
375 bbl.
16. 39 wk.
17. 179 acres.
18. 58 T.
93 T.
363 T.

Art. 137.

1. 437.
2. 839.
3. 789.
4. 345.
5. 738.
6. 584.
7. 643.
8. 839.
9. 389.
10. 738.
11. 647.
12. 583.
13. 739.
14. 837.
15. 485.
16. 537.
17. 863.

18. 749.
19. 837.
20. 579.
21. 758.
22. 496.
23. 695.
24. 738.
25. 597.
26. 836.
27. 948.
28. 379.
29. 957.
30. 657.
31. 598.
32. 639.
33. 957.

Art. 138.

2. 574.
3. 397.
4. 739.
5. 436.
6. 7358.
7. 5698.
8. 4837.
9. 2564.
10. 9843.
11. 6457.
12. 3872.
13. 3629.
14. 367 weeks.
15. 543 hr.
672 hr.
473 hr.
16. 876 times.
273 times.
17. 435 pieces.
18. 894 times.
935 times.

Art. 141.

1. 20 ct.
2. \$54.
3. 99 ct.
4. \$17.
5. \$3209.
6. \$1828.

7. 345 acres.
8. 483 bn.
9. \$7573.
10. 251 lb.
11. 32 mi.
12. \$98.
13. \$1554.
14. \$28764.
15. \$9513.
\$6342.
\$3171.

Art. 142.

1. 30.
2. 90.
3. 70.
4. 40.
5. 90.
6. 80.
7. 900.
8. 300.
9. 500.
10. 900.
11. 500.
12. 800.
13. 7000.
14. 3000.
15. 6000.
16. 9000.
17. 8000.
18. 7000.
1. 50.
2. 60.
3. 400.
4. 700.
5. 9000.
6. 8000.

Art. 143.

1. 25.
2. 72.
3. 61.
4. 254.
5. 517.
6. 615.
7. 227-43.
8. 962.

9. 472.
10. 207.
11. 1128.
12. 156.
13. 18-1.
14. 367-221.
15. 343.
16. 245.
17. 237.
18. 383-156.
19. 181-518.
20. 182-469.
21. 285-157.
22. 526-120.
23. 474-44.
24. 1878-31.
25. 319.
26. 508-170.
27. 655-279.
28. 686-645.
29. 789-499.
30. 465.
31. 4072-91.
32. 652-154.
33. 758-438.
34. 274-76.
35. 756-110.
36. 536-8.

Art. 146.

1. 9 yr.; 13 yr.
2. \$125.
\$2000.
3. \$4230.
\$2820.
\$2115.
\$1692.
4. 8 bbl.
5. 32 lb.
896 lb.
3072 lb.
4800 lb.
6. 526.
7. 342 bu.
760 bu.
1064 bu.
1748 bu.

8. 28 bbl.
9. 70 sheep.
10. \$6008.
11. 75 doz.
12. 988 lb.
13. 456.
14. 482 acres.

Art. 156.

4. 45 hhd.
5. \$3.68.
\$6.44.
\$16.56.
\$115.92.
6. 1260 qt.
10080 gi.
7. 27 gal.
30 gal.
8. 11 gal.
14 gal.
19 gal.
9. 2 gal.
12 gal.
74 gal.
10. 4 gal.
7 gal.
9 gal.
74 gal.

Art. 166.

7. \$21; \$12.
8. \$18.
9. \$12.
10. \$30.
11. 184 A.
12. 40; 42.
13. 414 lb.
14. $\frac{6}{10}$; $\frac{25}{40}$; $\frac{39}{84}$.
15. $\frac{15}{16}$; $\frac{60}{96}$.
16. $\frac{16}{21}$; $\frac{19}{24}$;
 $\frac{10}{16}$; $\frac{37}{48}$;
 $\frac{10}{16}$; $\frac{37}{48}$;
 $\frac{10}{16}$; $\frac{37}{48}$;
 $\frac{10}{16}$; $\frac{37}{48}$;
 $\frac{10}{16}$; $\frac{37}{48}$;
17. 336; 9022;
215; 188.

Art. 168.

15. 25 $\frac{3}{4}$.
16. 37 $\frac{7}{8}$.
17. 58 $\frac{7}{8}$.
18. 43 $\frac{5}{8}$.
19. 53 $\frac{1}{4}$.
20. 48 $\frac{7}{8}$.
21. 64 $\frac{1}{2}$.
22. 78 $\frac{1}{8}$.

Art. 169.

15. 1 $\frac{1}{2}$; 1 $\frac{1}{2}$;
1 $\frac{5}{8}$; 1 $\frac{1}{2}$.
16. $\frac{7}{8}$; 2 $\frac{1}{2}$; 1 $\frac{3}{4}$.
17. 1 $\frac{5}{8}$; 1 $\frac{1}{2}$;
1 $\frac{1}{8}$.
18. 1 $\frac{1}{2}$; 1 $\frac{3}{4}$;
1 $\frac{1}{4}$; 1 $\frac{3}{8}$.
19. $\frac{7}{8}$; 1 $\frac{7}{8}$; 1 $\frac{7}{8}$.
20. 2 $\frac{1}{4}$.

Art. 170.

41. \$3 $\frac{1}{2}$.
42. \$7 $\frac{3}{4}$.
43. \$4 $\frac{1}{2}$.
44. \$5 $\frac{3}{4}$.
45. \$4 $\frac{1}{2}$.
46. \$5 $\frac{1}{2}$.
47. $\frac{5}{16}$ oz.
48. $\frac{1}{30}$ lb.
49. $\frac{1}{20}$ gal.

Art. 173.

11. \$6600;
\$6720;
\$3090;
\$4812;
\$4831.
12. \$30;
\$28;
\$27.

Art. 174.

14. $\frac{28}{25}$.
15. $\frac{1}{8}$.
16. $\frac{1}{7}$.
18. \$12 $\frac{5}{8}$;

- \$10 $\frac{3}{5}$;
\$20 $\frac{3}{5}$;
\$18 $\frac{1}{4}$;
\$26 $\frac{1}{2}$.
19. \$8 $\frac{1}{4}$;
\$16 $\frac{1}{2}$;
\$18 $\frac{3}{5}$;
\$21 $\frac{1}{5}$.

Art. 175.

8. 8 books;
12 books;
4 books;
16 books;
40 books;
80 books.
9. 24 pounds;
72 pounds.
10. 6 pounds;
15 pounds;
24 pounds;
12 pounds;
27 pounds;
60 pounds.

Art. 176.

11. 2 times;
4 times.
12. 3.
13. 5.
14. 4.
15. 6.
16. 5.
17. 7.
19. 4 yd.;
7 yd.;
5 yd.;
9 yd.
20. 4 pk.;
5 pk.;
3 pk.;
10 $\frac{1}{2}$ pk.;
18 pk.

Art. 177.

26. 11 $\frac{1}{2}$; 21 $\frac{1}{2}$; 11 $\frac{1}{2}$.
27. 1 $\frac{2}{3}$; 1 $\frac{1}{4}$.
28. 1 $\frac{1}{6}$; 1 $\frac{1}{4}$.

Art. 191.

1. \$1.00.
2. \$3.15.
3. \$8.75.
4. \$10.20.
5. \$2.63.
6. \$8.88.
7. \$3.42.
8. \$105.56.
9. \$66.24.
10. \$141.60.
11. \$188.02.
12. \$3589.75.
13. \$417.20.
14. \$421.29.
15. \$15582.75.
16. \$307.94.
17. \$449.87.
18. \$60.12.
19. \$73.03.
20. \$148.10.
21. \$30395.
22. \$62.89.
23. \$114.80.

Art. 194.

7. \$.193;
\$.579;
\$1.351;
\$1.737;
\$1.93;
\$19.30;
\$5.79;
\$77.20.
8. \$4.866 $\frac{1}{2}$;
\$9.733;
\$24.331;
\$48.665;
\$486.65;
\$97.33.

Art. 195.

7. 14400 gr.;
33600 gr.
8. \oslash 960;
 \oslash 1935.
9. 20; 100; 12.

10.
11.

A
4.

5.
6.

7.

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9.

10.

11.

12.
13.

14.

15.

16.

17.

Art. 191.

\$1.00.
\$3.15.
\$8.75.
\$10.20.
\$2.93.
\$8.81.
\$3.42.
\$105.56.
\$66.24.
\$141.60.
\$188.02.
\$3589.75.
\$417.20.
\$421.29.
\$15582.75.
\$307.94.
\$449.87.
\$60.12.
\$73.03.
\$148.10.
\$30395.
\$62.89.
\$114.80.

Art. 194.

\$1.93;
\$5.79;
\$1.351;
\$1.737;
\$1.93;
\$19.30;
\$5.79;
\$77.20.
\$4.8664;
\$9.733;
\$24.331;
\$48.665;
\$486.65;
97.33.

Art. 195.

4400 gr.;
3600 gr.
960;
1935.
; 100; 12.

10. 6; 30; 76.
11. 42 oz.;
27 oz.;
52 oz.

Art. 196.

4. 2½ lb.;
7 lb.;
12 lb.
5. 89 oz.
6. 437 lb.;
1384 lb.
7. \$1.35;
\$3.55.
8. \$48.
9. \$40.60;
\$60.55;
\$90.30.
10. \$19.60.

Art. 198.

9. 276 in.
10. 91 in.
11. 141 in.
12. 376 in.
13. 54 in.;
126 in.;
198 in.
14. 198 in.;
396 in.;
990 in.;
1980 in.
15. 3 yd. 1 ft.
9 in.
16. 2 ft. 6 in.;
4 ft. 2 in.;

- 6 ft. 6 in.;
8 ft. 4 in.;
10 ft. 10 in.
17. 4 yd. 2 ft.;
6 yd. 2 ft.;
9 yd. 2 ft.;
13 yd. 1 ft.;
20 yd. 2 ft.
18. 1 yd. 2 ft.
8 in.
2 yd. 1 ft.
11 in.
4 yd. 2 ft.
7 in.
7 yd. 1 ft.
9 in.
19. 2½ in.;
4½ in.;
15½ in.

Art. 200.

5. 241 sq. in.;
1123 sq. in.
6. 32 P.;
160 P.
7. 408 P.;
1276 P.
8. 1 A.; 2 A.;
5 A.
9. 25 A.;
51½ A.

Art. 202.

7. 96 cu. ft.
8. 48 cu. ft.;
\$3.20

Art. 205.

4. 2 Cd. 7 Cd.
ft.;
5 Cd. 3 Cd.
ft. 8 cu.
5. \$9.60.
6. ½ Cd.;
½ Cd.;
½ Cd.
7. 384 cu. ft.;
3 Cd.

Art. 207.

1. 47 pt.;
101 pt.
2. \$1.52.
3. 23½ gal.
7 gl. 7 pt.
4. m 420;
m 720.
5. f 3 368.
6. m 2520.
m 4980.
7. \$1.98.
8. \$1.61.
9. \$2.48.
10. \$6.27.
11. \$2.99.
12. \$6.56.
13. \$2.38.
14. \$4.42.
15. \$4.90.
16. ½; ½.
17. ¾; ¾.
18. 144 g

- 72 gal.
432 gal.
864 gal.
3600 gal.
19. \$75.60;
\$158.76.
20. \$40.32.
21. \$37.90.
22. \$39.20.
23. 159 pt.

Art. 209.

1. 184 qt.;
234 pt.
2. 3 bu.;
4½ bu.;
4 bu.
3. \$15.50;
\$10.85;
\$20.15.
4. \$10.08.
5. \$83.25.
6. \$50.
7. \$39.60.
8. \$546.25.
9. \$4.45.
10. \$5.04;
11. 3½ bu.;
7½ bu.
12. 1350 bu.
13. 7½ bu.
11¼ bu.
16½ bu.
20½ bu.
14. \$99.10.
15. \$5.20.
16. \$60.

ANSWERS TO ARITHMETICAL TABLES.

Observe, the answers to examples taken from the Arithmetical Tables are in every case arranged in the order the pupil is directed to take the examples from the Tables. The letters over the sets of answers indicate the columns of the Table used, and the black figures in the margin the number of the answer.

Art. 47. Columns of three figures.

	A.	B.	C.	D.	E.	F.	G.	H.
1	10	18	12	16	21	19	16	17
2	11	16	19	19	17	16	15	17
3	12	15	20	15	18	12	16	21
4	13	13	20	20	14	13	20	16
5	13	16	14	19	13	20	17	17
6	12	17	14	16	11	24	20	18
7	17	18	15	17	14	20	18	21
8	22	14	20	17	14	20	21	18

Art. 48. Columns of four figures.

	A.	B.	C.	D.	E.	F.	G.	H.
1	14	23	21	23	24	21	24	23
2	17	18	26	24	23	20	18	25
3	15	21	24	23	23	19	25	23
4	17	21	23	26	16	22	25	23
5	18	19	21	21	17	28	23	26
6	20	24	19	25	19	27	27	23
7	26	22	23	23	16	29	26	25

Art. 48. Columns of five figures.

	A.	B.	C.	D.	E.	F.	G.	H.
1	20	25	28	28	30	25	27	31
2	20	24	30	32	28	27	27	27
3	19	29	27	29	25	28	30	30
4	22	24	30	28	20	30	31	32
5	26	26	26	30	25	31	30	31
6	29	28	27	31	21	36	35	27

TABLES.

Arithmetical Tables
used to take the
answers indicate
the margin the

Art. 48. Columns of six figures.

	A.	B.	C.	D.	E.	F.	G.	H.
1	23	31	32	36	35	32	36	33
2	24	32	33	38	30	36	32	34
3	24	32	34	31	29	36	36	39
4	30	31	35	37	28	33	38	37
5	35	30	34	36	27	40	38	35

Art. 48. Columns of seven figures.

	A.	B.	C.	D.	E.	F.	G.	H.
1	27	39	35	40	37	41	41	40
2	29	35	40	42	34	44	38	43
3	32	39	39	40	37	39	43	44
4	39	35	43	43	30	42	46	41

Art. 48. Columns of eight figures.

	A.	B.	C.	D.	E.	F.	G.	H.
1	32	42	42	44	41	49	47	49
2	37	42	45	49	42	47	45	48
3	41	43	47	46	39	48	51	48

Art. 55. Exercise with two numbers of two figures.

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	118	95	159	102	128	92	137
2	73	42	127	83	139	97	85
3	87	78	92	134	156	169	101
4	109	101	121	119	102	137	182
5	78	88	95	156	73	143	141
6	101	117	83	144	153	135	63
7	95	61	121	123	139	99	104
8	84	44	53	144	151	127	131
9	80	105	64	149	106	171	124

Art. 55-2. *Exercise with three numbers of two figures.*

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	138	100	216	177	187	182	143
2	140	115	162	142	236	176	183
3	129	106	178	194	161	227	188
4	145	161	130	215	170	222	239
5	143	145	160	204	158	193	150
6	141	121	130	219	207	184	161
7	149	101	127	192	236	177	190
8	110	109	111	224	160	220	219

Art. 55-2. *Exercise with four numbers of two figures.*

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	205	173	251	236	284	261	241
2	182	143	248	202	241	234	267
3	165	166	187	290	229	312	245
4	210	218	204	263	255	272	248
5	173	149	216	279	212	242	245
6	185	161	136	288	304	262	247
7	175	166	185	272	245	270	228

Art. 55-2. *Exercise with five numbers of two figures.*

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	247	201	337	296	289	319	325
2	218	203	257	298	309	319	324
3	230	223	261	338	314	362	254
4	240	222	251	336	309	321	343
5	227	189	222	348	309	320	331
6	211	226	194	368	313	365	285

Art. 55-2. *Exercise with six numbers of two figures.*

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	283	261	346	392	357	404	382
2	283	260	331	346	394	369	333
3	260	227	308	413	368	411	349
4	294	262	257	407	406	399	429
5	253	254	280	428	318	413	369

figures.

Art. 55-2. Exercise with seven numbers of two figures.

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	348	318	420	440	442	454	391
2	313	264	378	421	448	418	428
3	314	267	314	482	465	489	435
4	320	327	315	487	415	492	467

Art. 55-2. Exercise with eight numbers of two figures.

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	378	322	467	515	496	563	482
2	367	304	384	490	545	496	514
3	340	332	372	562	374	582	473

Art. 56-3. Exercise with three number. of three figures.

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	1400	1016	2177	1787	1882	1843
2	1415	1162	1642	1436	2376	1783
3	1306	1078	1794	1961	1627	2288
4	1461	1630	1315	2170	1722	2239
5	1445	1469	1704	2058	1593	1950
6	1321	1230	1319	2207	2084	1861
7	1501	1027	1292	1936	2377	1790
8	1109	1111	1124	2260	1620	2219

Art. 56-3. Exercise with four numbers of three figures.

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	2073	1751	2536	2384	2861	2641
2	1843	1448	2502	2041	2434	2367
3	1666	1687	1890	2929	2312	3145
4	2118	2204	2063	2655	2572	2748
5	1749	1516	2179	2812	2142	2445
6	1861	1636	1388	2904	3062	2647
7	1766	1685	1872	2745	2470	2728

Art. 56-3. *Exercise with five numbers of three figures.*

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	2501	2037	3396	2989	2919	3225
2	2203	2057	2598	3000	3119	3224
3	2323	2261	2638	3414	3162	3654
4	2422	2351	2538	3409	3121	3243
5	2289	1922	2248	3509	3120	3231
6	2126	2294	1968	3713	3155	3585

Art. 56-3. *Exercise with six numbers of three figures.*

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	2861	2646	3492	3957	3604	4082
2	2860	2631	3346	3494	3969	3733
3	2627	2308	3113	4168	3711	4149
4	2962	2657	2607	4106	4099	4029
5	2554	2580	2828	4318	3213	4169

Art. 56-3. *Exercise with seven numbers of three figures.*

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	3518	3220	4240	4442	4454	4591
2	3164	2678	3821	4248	4518	4228
3	3167	2714	3182	4865	4689	4935
4	3227	3315	3187	4915	4192	4967

Art. 56-3. *Exercise with eight numbers of three figures.*

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	3822	3267	4715	5196	5003	5086
2	3704	3084	3890	4945	5496	5014
3	3432	3372	3762	5674	4782	5873

figures.

Art. 56-3. Exercise with three numbers of four figures.

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	14016	10177	21787	17882	18843
2	14162	11642	16436	14376	23783
3	13078	10794	17961	19627	16288
4	14630	16315	13170	21722	17239
5	14439	14704	17058	20593	15950
6	13230	12319	13207	22084	20861
7	15027	10292	12936	19377	23790
8	11111	11124	11260	22620	16219

figures.

Art. 56-3. Exercise with four numbers of four figures.

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	20751	17536	25384	23861	28641
2	18448	14502	25041	20434	24367
3	16687	16890	18929	29312	23145
4	21204	22063	20655	26572	25748
5	17516	15179	21812	28142	21445
6	18636	16388	13904	29062	30647
7	17685	16872	13745	27470	24728

e figures.

Art. 56-3. Exercise with five numbers of four figures.

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	25037	20396	33989	29919	29225
2	22057	20598	26009	30119	31224
3	23261	22638	26414	34162	31654
4	24251	22538	25409	34121	31243
5	22922	19248	22509	35120	31231
6	21294	22968	19713	37155	31585

figures.

Art. 56-3. Exercise with six numbers of four figures.

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	28646	26492	34957	39604	36082
2	28631	26346	33494	34969	39733
3	26308	23113	31138	41711	37149
4	29657	23607	26106	41999	41029
5	25580	25828	28318	43213	32169

FGH.

3225

3224

3654

3243

3231

3585

FGH.

4082

3733

4149

4029

4169

FGH.

4591

4228

4935

4967

FGH.

5086

5014

5873

Art. 56-3. *Exercise with seven numbers of four figures.*

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	35220	32240	42442	44454	44591
2	31678	26821	38248	42518	45228
3	31714	27182	31865	48689	46935
4	32315	33187	31915	49192	41967

Art. 56-3. *Exercise with eight numbers of four figures.*

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	38267	32715	47196	52003	50086
2	37084	30890	38945	49496	55014
3	34372	33762	37674	56782	47873

Art. 87. *Examples taken as directed in 1 and 2.*

	AB.	BC.	CD.	DE.	EF.	FG.	GH.
1	12	21	19	86	32	78	21
2	33	32	13	67	21	83	73
3	47	68	22	16	38	11	92
4	25	45	51	1	92	21	14
5	6	32	77	36	63	27	27
6	29	3	65	48	17	35	48
7	35	53	27	27	31	1	86
8	24	36	41	6	43	29	9
9	28	25	52	11	88	15	48

Art. 87. *Examples taken as directed in 3 and 4.*

	AB-BC.	BC-CD.	CD-DE.	DE-EF.	EF-FG.	FG-GH.
1	7	31	5	46	37	27
2	16	33	62	72	73	72
3	15	52	18	16	31	84
4	6	38	24	38	18	19
5	14	58	26	55	53	26
6	24	51	87	28	17	28
7	8	17	26	37	35	41
8	26	43	28	21	5	46
9	14	34	63	28	19	8
10	39	7	22	71	84	55

figures.

Art. 88. *Examples with three numbers taken as directed in 1.*

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.
1	121	219	186	868	322	779
2	332	313	133	679	217	827
3	468	678	216	162	389	108
4	245	449	501	8	921	214
5	68	323	764	363	627	273
6	297	35	652	483	165	348
7	353	527	273	269	301	14
8	236	359	406	57	429	291
9	275	252	511	112	885	152

figures.

Art. 88. *Examples with three figures taken as directed in 2.*

	ABC-BCD.	BCD-CDE.	CDE-DEF.	DEF-EFG.	EFG-FGH.
1	69	305	54	463	373
2	167	338	628	727	728
3	148	518	184	169	316
4	62	376	238	382	181
5	142	574	255	547	526
6	249	513	872	283	172
7	83	174	263	365	341
8	257	428	279	205	54
9	131	337	628	281	192
10	393	78	229	716	845

Art. 88. *Examples with four figures taken as directed in 1.*

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.
1	1219	2186	1868	8678	3221
2	8313	3133	1321	6783	2173
3	4678	6784	2162	1611	3892
4	2449	4499	5008	79	9214
5	677	3236	7637	3627	6273
6	2965	848	6517	4835	1652
7	3527	5273	2731	2699	3014
8	2359	3594	4057	571	4291
9	2748	2511	5112	1115	8848

Art. 88. *Examples with four figures taken as directed in 2.*

	ABCD-BCDE.	BCDE-CDEF.	CDEF-DEFG.	DEFG-EFGH.
1	695	3054	537	4627
2	1662	3372	6273	7272
3	1482	5181	1831	1681
4	624	3762	2382	3319
5	1426	5745	2547	5474
6	2487	5128	8717	2328
7	826	1737	2695	3639
8	2572	4279	2795	2654
9	1337	3371	6281	2898
10	3922	771	2284	7155

Art. 113. *Multiplicand three figures, multiplier one.*

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.	GHI.	HIJ.
1	1014	5536	2775	1548	5256	1696	3704	3195
2	2180	3312	4098	2508	738	3460	3712	2230
3	825	5313	2384	7704	3160	2925	1778	1096
4	3558	2811	3366	1496	3395	2577	2985	8748
5	7614	2315	4473	3528	2781	2184	1470	2154
6	2233	1755	1914	2316	6344	3752	3438	2478
7	2623	3474	6336	4620	2232	3388	5094	3943
8	7392	984	2803	4795	4295	5373	2928	5376
9	1036	1288	7614	1868	5400	3795	5337	3748
10	6678	2135	1116	6352	5688	3880	4295	5346
11	2445	7160	6678	1644	4374	3472	5480	5154

Art. 113. *Multiplicand five figures, multiplier one.*

	ABCDE.	BCDEF.	CDEFG.	DEFGH.	EFGHI.	FGHIJ.
1	50775	415548	833256	51692	467704	423195
2	262098	110508	136738	418460	147712	551280
3	110384	607704	298160	866925	442778	65396
4	534366	187496	262395	224577	242985	773748
5	592473	417528	191781	314184	185470	164154
6	63914	78316	766344	231752	714438	281478
7	526336	289620	713232	647388	149094	387944
8	554908	172795	234295	617373	257928	418376
9	466014	73868	677400	233795	608337	303748
10	297116	342352	167688	635880	474295	437346
11	342678	268644	859374	219472	389480	521154

ted in 2.

Art. 114. *Multiplicand four figures, multiplier two.*

FG-EFGH.

4627
5272
1684
2319
5474
2328
3659
2054
2808
7155

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.	FGHI.	GHIJ.
1	115056	574775	333288	178296	537832	236964	394315
2	257712	353568	430668	267808	92300	374112	445680
3	102083	562104	286224	818720	373175	315638	183456
4	374031	365586	344816	202095	354707	300895	352348
5	803985	264423	504968	365211	352374	224270	101334
6	252405	180044	229896	278064	666792	459718	355818
7	902634	393856	673540	545632	240948	368524	577524
8	776664	113528	313895	514425	507223	555768	361416
9	139968	145834	795898	224400	574515	447986	558078
10	705565	231066	134112	683528	644980	413015	507046
11	283910	778998	697004	213554	457592	416880	589874

one.

Art. 114. *Multiplicand six figures, multiplier four.*

HIJ.

3195
2290
1096
8748
2154
2178
3943
5376
3748
5346
5154

	ABCDEF.	BCDEFG.	CDEFGH.	DEFGHI.	EFGHIJ.
1	1157047688	5796235496	3418223432	1790631664	5428373115
2	2604853068	3548130308	4324351900	2723363712	940388180
3	1034309324	5685345520	2897543175	8281094638	3777576656
4	3795237216	3681503595	3476067507	2047412795	3576267948
5	8107588968	2687529111	5074549074	3684639770	3548075534
6	2532343966	1810639664	2379517992	2809423318	6741964218
7	3082373940	3973062032	6812984948	5526897624	2427279624
8	7839307895	1154065825	3167247123	5208615768	5104442616
9	1419596798	1467796900	8031509115	2272034387	5809002578
10	7092197112	2317722728	1360532960	6903350415	6506406246
11	2875115404	7825652154	7060293992	2166208380	4618344474

one.

Art. 139. *Dividend three figures, divisor one.*

FGHIJ.

423195
554280
65396
773748
164154
281478
387944
418376
303748
437346
521154

	ABC.	BCD.	CDE.	DEF.	EFG.	FGH.	GHI.	HIJ.
2	24-2	189-2	239	111-6	92-7	118-2	94-5	86-4
3	134	52-5	86-7	319-1	117-2	145-4	82-5	218-1
4	47-1	92-8	73-2	84-2	106	107-1	98-1	136-6
5	149-1	80-2	117-6	64-1	289-1	88-1	193-3	85-3
6	46-7	379	116-3	118-6	36-2	44	81-1	165-2
7	10-4	36-6	315-2	236-1	123	96-2	96-1	94-1
8	95-2	143-1	105-4	132	120-4	108-1	99-1	107-5
9	56-4	322-2	75-8	139-5	98	103	45-5	94-2
10	108	60-5	268-1	66-3	488	109-5	136-4	212-1
11	34-2	149-1	51-4	91-1	61-5	112-1	243-3	84-2
12	147-1	149	315-2	59-1	82	55	171-1	74-5

Art. 139. *Dividend five figures, divisor one.*

	ABCDE.	BCDEF.	CDEFG.	DEFGH.	EFGHI.	FGHIJ.
2	9739	13540-3	5315	26118-2	13928-1	4461-4
3	6711-7	12319-1	13917-2	15979	6527	43718-1
4	5673-2	10459-2	5248-6	16857-1	24765	6136-6
5	10689-2	12064-1	41289-1	2866-2	11593-3	9960-3
6	7516-3	10833-1	6480-6	13877-2	4081-1	8832-1
7	17649	14736-1	15789-4	11846-2	8307-2	5522-5
8	12248-3	19132	9245-1	6608-1	19299-1	7218-6
9	4409-2	16139-5	17098	9325-2	6545-5	11594-2
10	21619-2	5399-6	42988	8538-2	19536-4	19212-1
11	3051-4	10692-4	7731-3	7987-1	9743-3	9973-1
12	19649	11184-1	10526-4	6769-2	14771-4	4834-5

Art. 144. *Dividend four figures, divisor two.*

	ABCD.	BCDE.	CDEF.	DEFG.	EFGH.	FGHI.	GHIJ.
2	22-77	182-14	177-4	99-14	89-79	99-5	83-48
3	114-11	47-29	89-69	273-32	104-50	126-49	80-77
4	41-7	88-7	63-90	77-43	100-29	99-38	79-35
5	207-90	79-1	111-33	61-17	199-25	83-83	166-55
6	45-68	303-8	102-18	105-31	34	38-65	78-23
7	91-16	35-42	206-1	182-6	115-26	78-43	89-26
8	91-19	122-5	101-23	104-12	112-17	99-61	84-12
9	54-26	248-11	71-23	131-8	80-7	96-59	40-34
10	95-25	58-45	220-17	64-88	361-21	102-34	126-45
11	32-26	126-31	47-79	84-5	57-21	106-71	199-7
12	128-6	142-1	249-11	53-21	76-13	51-34	148-18

Art. 144. *Dividend six figures, divisor three.*

	ABCDEF.	BCDEFG.	CDEFGH.	DEFGHI.	EFGHIJ.
2	369-390	3397-72	603-177	897-137	2270-332
3	685-603	442-517	1954-250	1684-547	848-621
4	296-106	1425-267	420-349	907-394	1700-58
5	1110-117	650-279	1924-400	874-138	605-93
6	1402-98	1309-415	792-592	860-169	478-23
7	636-321	904-34	3588-154	739-95	1486-117
8	1812-320	777-538	1916-73	458-326	1464-192
9	1002-47	1004-536	1053-590	1692-43	405-714
10	778-50	1229-288	927-439	2173-109	1295-419
11	400-18	764-725	604-25	934-119	459-67
12	923-599	2300-38	1056-153	486-9	974-305

ne.

	FGHIJ.
1	4461-4
	43718-1
	6136-6
3	9960-3
1	8892-1
2	5522-5
1	7218-6
5	11594-2
4	19212-1
3	9973-1
4	4824-5

two.

II.	GHIJ.
5	83-48
49	80-77
38	79-35
83	166-55
65	78-23
43	89-26
61	84-12
59	40-34
34	126-45
71	199-7
34	148-18

three.

	EFGHIJ.
	2270-332
	848-621
	1700-58
	605-93
	478-23
	1486-117
	1464-192
	405-714
	1295-419
	459-67
	974-305

