CIHM
Microfiche
Series
(Monographs)

ICMH
Collection de
microfiches
(monographies)

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1995

Technical and Bibliographic Notes / Notes technique et bibliographiques

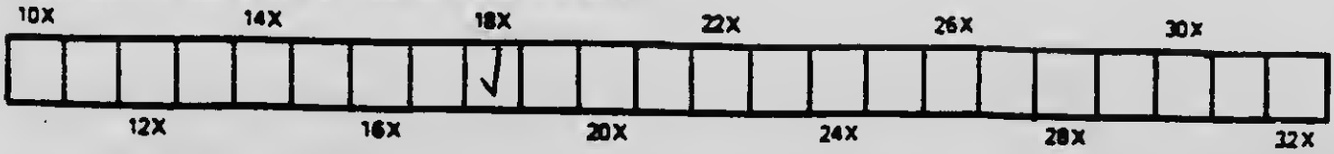
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- [x] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [ ] Coloured maps / Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [ ] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [x] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- [ ] Additional comments / Commentaires supplémentaires:

L'Institut a microfilmé le meilleur examplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modifications dans la méthode normale de filmage sont indiqués ci-dessous.

- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [x] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary material / Comprend du matériel supplémentaire
- [ ] Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pagee totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- [ ] Opposing pages with varying colouretion or discolourations are filmed twice to ensure the best possible image / Lee pages s'opposant ayant dee colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleur image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.



The copy filmed here has been reproduced thanks to the generosity of:

National Library of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol → (meaning "CONTINUED"), or the symbol ▽ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:

L'exemplaire filmé fut reproduit grâce à la générosité de:

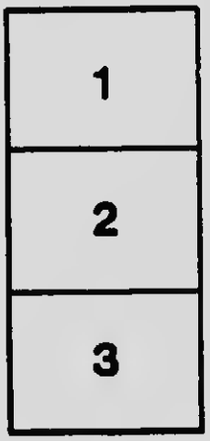
Bibliothèque nationale du Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

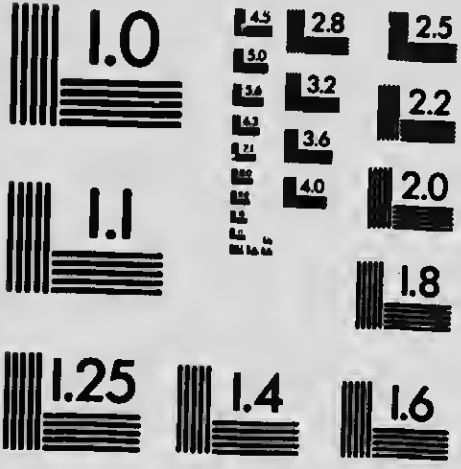
Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole → signifie "A SUIVRE", le symbole ▽ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

QA
E(
C.2
V.1

E5
C

THE DOMINION
ELEMENTARY ARITHMETIC

FOR PUBLIC SCHOOLS

PART I

Authorized by the Minister of Education for Alberta

THE EDUCATIONAL BOOK CO., LIMITED
TORONTO

QA 106
D6
c. 2
Vol 1

Entered according to Act of Parliament of Canada, in the year one thousand nine hundred and eight, by W. J. GAGE & CO., LIMITED, in the office of the Minister of Agriculture.

11950516

PREFACE

During the last decade great changes have taken place in the methods of teaching many of the subjects of the school course. In no subjects have the changes been more apparent than in the mathematical ones, geometry, algebra, and arithmetic. The present book is an effort to meet a pressing demand on the part of the teachers of Canada for an elementary arithmetic, conceived on modern lines, and suited to the needs of the public schools.

The book consists of two parts. Part I. is designed for Grades IV. and V., or for Form III. of the public schools. A child is incapable of using a text-book intelligently before the third book class is reached. At this point a text may with advantage be placed in his hands, and Part I. will, we believe, be found specially suited to the purpose.

Part I. begins with two chapters on number work, covering the ground already familiar to the pupil. These exercises, reviewing as they do the ordinary number relations and containing simple problems based upon them, will serve to familiarize the child with the use of a text-book. Then follows a series of short chapters presenting the main facts of arithmetic with practical applications in a way which we believe will be found suited to the intelligence of children at this period of their school life.

A short chapter on simple fractions has been introduced after the simple rules. This chapter does little more than state definitely facts already familiar to the pupils. In later chapters vulgar and decimal fractions and percentage are introduced in an elementary way. This is done to enable those pupils who leave school at the end of the Third Form to have a general, if elementary, idea of these subjects, so important from a practical point of view.

Part II. is designed to complete the public school course. Throughout, the principles and facts set forth in Part I. are reviewed; such new material and extensions of the subject as are deemed necessary have been added; the exercises will be found to contain more difficult and complex problems.

The inductive method of presenting the subject has been followed as far as possible. The pupil is called upon all the way through to express what he has discovered, thus arriving at exact definitions and statements of facts. Review exercises relating to the particular part of the subject under discussion, and also special review sections covering the whole ground already familiar to the pupil, are introduced with each chapter. This will, we believe, secure to the child all the advantages of the "spiral method" without its many evident disadvantages. Each chapter ends with a series of problems which requires the pupils to be independent of special rules or suggestions arising out of chapter headings.

The book is not a book of problems only. This, we believe, will commend it to teachers. We are firmly convinced that a careful and exact statement of facts, by means of definitions, will be found helpful to both pupil and teacher. Want of exactness in statement and the lack of appreciation of the precise meaning of words are among the chief causes of defective teaching, especially in subjects which may be classified as exact sciences. Rules, therefore, we have omitted, but definitions have been plainly stated after the facts which make them necessary have been worked out. Occasionally a chapter begins with a statement of fact or a definition, but where such is the case it is because the facts upon which it is based have become familiar through previous work.

Further, we have not hesitated to introduce solutions where it seems necessary to make clear the process involved and to guide the pupil in a method of doing his work. Many years of experience as teachers and examiners in mathematical subjects have convinced us that not enough attention is paid to securing, on the part of pupils, clear statements of the meaning of the steps involved in the working of problems.

We have introduced, under denominate numbers in Part I., only the tables of measures in common use in this country. The metric system, tables of English money, Troy weight, etc., will be found at the end of Part II. Teachers who desire can present these tables earlier. This arrangement has been adopted to avoid confusion in the elementary stages.

THE AUTHORS.

July, 1908.

CONTENTS

CHAP.		PAGE
I.	NUMBER WORK	9
II.	REVIEW EXERCISES	
	I. Notation and Numeration	25
	II. Addition	26
	III. Subtraction	29
	IV. Multiplication	30
	V. Division	31
III.	NOTATION AND NUMERATION	
	I. Arabic Notation and Numeration	33
	II. Roman Notation	35
IV.	ADDITION AND SUBTRACTION	
	I. Addition	37
	II. Subtraction	44
	Oral Exercise	52
V.	MULTIPLICATION AND DIVISION	
	I. Multiplication	53
	II. Division	63
	Abbreviated Process in Division	70
	Miscellaneous Problems	76
	Oral Exercise	80
VI.	SIMPLE FRACTIONS	81
VII.	DENOMINATE NUMBERS	
	I. Definitions and Tables	85
	II. General Review	101
VIII.	PROBLEMS INVOLVING THE PREVIOUS RULES	
	I. Bills	103
	II. Aggregates and Averages	106

CHAP. PAGE

VIII. PROBLEMS INVOLVING THE PREVIOUS RULES—*Continued*

III. Sharing 108
IV. Simple Measurements 109
(*a*) The Rectangle 109
(*b*) Carpeting 112
(*c*) Plastering 114
(*d*) Papering 115
(*e*) Measurement of Lumber . . . 116
(*f*) Roofing 117
(*g*) Rectangular Solids 118
Oral Exercise 119
V. General Review 120

IX. FACTORS, CANCELLATION, MEASURES, MULTIPLES

I. Factors 123
II. Cancellation 125
III. Highest Common Factor 127
IV. Least Common Multiple 129
Oral Exercise 132
V. General Review 133

X. VULGAR FRACTIONS

I. Proper Fractions, Improper Fractions . 135
II. Reduction of Fractions 136
(*a*) Reduction of Whole or Mixed Numbers to Improper Fractions . . 136
(*b*) Reduction of Improper Fractions to Whole or Mixed Numbers . . 137
(*c*) Reduction to Lowest Terms . . 137
(*d*) Reduction to Common Denominator 140
III. Addition of Fractions 141
IV. Subtraction of Fractions 142

CHAP. PAGE

X. VULGAR FRACTIONS—*Continued*

v. Multiplication and Division of Fractions . 144

(*a*) To Multiply a Fraction by a Whole Number 144

(*b*) To Divide a Fraction by a Whole Number 145

(*c*) To Multiply a Whole Number or a Fraction by a Fraction . . 146

(*d*) To Divide a Whole Number or a Fraction by a Fraction. . . 147

Oral Exercise 150

VI. General Review 151

XI. DECIMALS

I. Definitions 153

II. Addition 155

III. Subtraction 156

IV. Multiplication 157

V. Division 159

Oral Exercise 161

VI. General Review 161

XII. PERCENTAGE

I. Definition 163

II. Applications of Per Cent. . . . 166

(*a*) Profit and Loss 166

(*b*) Interest 167

Oral Exercise 168

III. General Review 169

ANSWERS 171

ELEMENTARY ARITHMETIC

PART I

CHAPTER I

NUMBER WORK

EXERCISE 1

1. How many watches are there in the bottom line?

2. How many watches are there in the top line?

3. How many watches are there altogether?

4. If a watch is taken away, how many will be left?

5. Make three dots on your slate and rub out two. How many are left?

6. One dot and two dots are how many dots?

7. If I give each of three girls a flower, how many flowers do I give away?

8. If I had three pieces of pie and should put each piece on a plate by itself, how many plates would it take?

9. Three kittens are how many more than one kitten?

10. △ and △ △ are how many triangles?

EXERCISE 2

1. How many tops are there?
2. How many are in the top row?
3. How many are in the bottom row?
4. Make four dots on your slate. Rub out one and how many are left?
5. Make four triangles and cover up two of them. How many can you now see?
6. Take four blocks. Play that they are birds and that three flew away. How many were left?
7. How many squares are □ and □ □ □?
8. How many hands have two little girls?
9. Shut your eyes and pick out four blocks.
10. How many pairs of boots does it take for May and Ned? How many boots?

There is another way of writing two and two are four:

$$2+2=4.$$

The sign + means *and*, and the sign = means *are*.

11. Read $1+3=4$; $3+1=4$; $2+2=4$.

There is another way of writing four less one are three:

$$4-1=3.$$

The sign − means *less*.

12. Copy and complete the following:

$2+2=$? $1+3=$? $4-2=$?

$3+1=$? $4-1=$? $4-4=$?

EXERCISE 3

1. Place four blocks on your desk and put one more. How many blocks have you on the desk?

2. Make five crosses on your slate.

3. Four and one are how many?

4. A boy had five cents and spent one. How many cents had he left?

5. Alice had five apples. She gave Jane three of them. How many had she left?

6. How many are □ □, □ □ and □ squares?

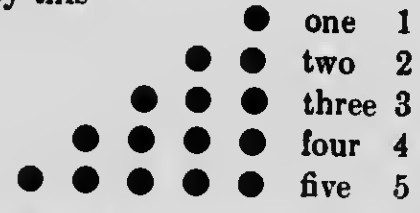
7. Show me five blocks. Put away four. How many blocks are left?

8. There were five little kittens in a basket and two of them got out. How many remained in the basket?

9. Take five splints and play that they are birds and that three flew away. How many would remain?

10. How much will be left out of five cents, if I buy two two-cent stamps?

11. Copy this



12. Copy and complete the following:

4 + 1 = ?	5 − 4 = ?	4 − 2 = ?
3 + 2 = ?	5 − 1 = ?	4 − 1 = ?
2 + 3 = ?	5 − 2 = ?	5 − 5 = ?
1 + 4 = ?	5 − 3 = ?	4 − 3 = ?

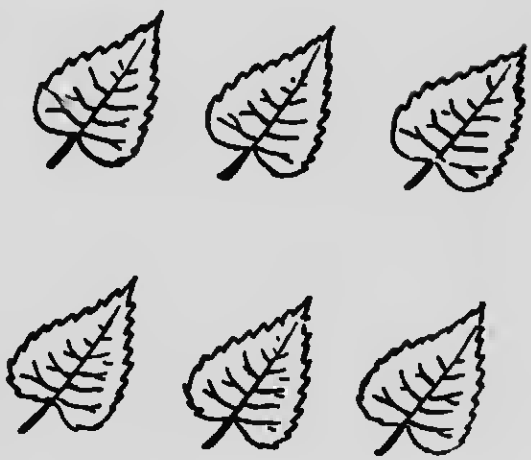
EXERCISE 4

1. How many leaves are there in the top row?

2. How many leaves are there in the bottom row?

3. How many leaves are there in the two rows?

4. How many leaves are two leaves and four leaves?



5. There are six scholars in a class; four are girls. How many are boys?

6. Nellie had six candies but she gave Mary three of them. How many had she left?

7. Draw a line four inches long and divide it into two equal parts. How long is each part?

8. Draw a line six inches long and divide it into two equal parts. How long is each part?

NOTE.—Each of the two equal parts of anything is called *a half*.

9. Take four blocks and find one-half of them.

10. A boy had six cents and spent half of them. How many cents did he spend?

11. Copy and complete the following:

$5+1=?$	$6-4=?$	$?+2=6$	$6-1=?$
$4+2=?$	$6-5=?$	$6-?=4$	$4+?=6$
$1+5=?$	$6-2=?$	$3+3=?$	$2+?=6$

EXERCISE 5

1. How many boys are there in the boat?
2. How many girls are there in the boat?

3. How many children are there in the boat?
4. How many are six blocks and one block?
5. Place two blocks on one end of your desk and five upon the other. How many blocks are there on the desk?
6. Place seven blocks on your desk and bring me one of them. How many have you left?
7. Tell me a story of seven blocks minus one block.
8. There were seven sparrows sitting on a branch. Two flew away. How many were left?
9. There are seven cows in a field; four of them are lying down. How many are standing up?
10. Copy and complete the following:

$6+1=?$	$5+2=?$	$4+3=$	$2+?=7$
$1+6=?$	$7-5=?$	$7-?=4$	$7-?=0$
$7-1=?$	$2+5=?$	$3+?=7$	$3+2=?$

EXERCISE 6

1. Place seven blocks on your desks. Put one more block beside the seven. How many blocks have you now?

2. Make seven stars upon your work books. Make one more star. How many are seven stars and one star?

3. Rub out one star. How many stars left?

4. If eight sparrows are feeding in the road and one flew away, how many remained?

5. Eight minus one is how much?

6. Two umbrellas and six umbrellas are how many?

7. How many are three tops and five tops?

8. If five watches are sold from eight watches, how many watches are left?

9. How many are four umbrellas and four umbrellas?

10. What two equal numbers make eight?

11. What is the half of eight?

12. Count the umbrellas to find what four equal numbers make eight.

13. Measure eight inches and find half this distance.

14. Copy and complete the following:

$7+1=?$	$8-?=4$	$6+2=?$	$?+3=8$
$6+?=8$	$2+?=8$	$8-?=2$	$7+?=8$
$8-2=?$	$8-?=6$	$?+5=8$	$4+3=?$

EXERCISE 7

1. How many cherries do you see in the picture?

2. How many are there in each bunch?

3. Six cherries and three cherries are how many cherries?

4. How many leaves are there on each branch?

5. How many are five leaves and four leaves?

6. If three cherries are taken from nine cherries, how many will remain?

7. How many are seven blocks and two blocks?

8. Place nine blocks on your desks. Remove seven of them. How many blocks are still on the desks?

9. Five and two and how many are nine?

10. Nine minus what number is four?

11. If I had nine cents and bought three two-cent postage stamps, how many cents would I have left?

12. Three and three and how many are nine?

13. Tell me two numbers that added together will make nine. Another pair; another pair; another pair.

14. Copy and complete the following:

2+7=?	3+?=9	9−5=?	9−?=8
4+?=9	?−7=2	4+?=9	9−7=?
8+?=9	7+?=9	6+3=?	?+5=9
9−?=6	8+?=9	5+4=?	?−3=6
?+3=9	6+?=9	2+7=?	?+3=8

EXERCISE 8

1. Count the number of pears.

2. How many are nine pears and one pear?

3. If one pear is taken away how many will remain?

4. How many are two blocks and eight blocks?

5. From ten blocks take away two blocks.

6. Make three crosses and then seven crosses. How many crosses have you made?

7. Rub out seven crosses. How many are left?

8. Tell me a story of ten crosses minus three crosses.

9. How many are five dots and five dots?

10. What is the half of ten?

11. From ten leaves, if I take away five leaves, how many leaves will be left?

12. Copy and complete the following:

$5+?=10$	$4+6=?$	$?+7=10$	$10-?=5$
$?+9=10$	$10-?=5$	$7+3=?$	$10-10=?$
$10-4=?$	$\frac{1}{2}$ of $10=?$	$8+?=10$	$?+6=10$

13. Copy and add:

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

EXERCISE 9

1. Take ten splints and put an elastic band round them. Take one more splint. How many splints have you now? How many splints are ten splints and one splint?

NOTE.—The pupil should hold the tens in the left hand and single splints in the right.

2. Express the number eleven on the blackboard.

3. Show me the *one* that stands for one bundle of ten and the *one* that stands for one splint.

4. Name two numbers which added together will make eleven.

5. Mary had eleven cents and bought four two-cent postage stamps. How many cents had she left?

6. Copy and complete the following:

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

7. Copy and add the following:

5	3	1	3	1	5	4
5	4	6	2	5	3	2
1	2	3	6	4	3	5
—	—	—	—	—	—	—

8. Copy and subtract the following:

10	11	9	11	10	11	11
2	5	3	7	5	3	4
—	—	—	—	—	—	—
2						

EXERCISE 10

1. Take ten splints and put an elastic band round them. Take two more splints. How many splints have you now? How many splints are ten splints and two splints?

2. Express the number twelve on the blackboard.

3. Draw a line a foot long and cut off four inches from it. How many inches are in the other part?

4. Divide twelve splints into two equal parts. How many splints are there in each part?

5. Place twelve blocks in groups of three blocks each. How many groups have you? What is the third of twelve?

6. Draw a line seven inches long. How many more inches must be added to this line to have a line a foot long?

7. Draw a line a foot long and divide it into four equal parts. How many inches are in each of the equal parts? What is the fourth part of twelve?

8. Copy and complete the following:

10 + 2 =	12 − 2 =	9 + 3 =	12 − 6 =
6 + 6 =	12 − 5 =	4 + 7 =	12 − 3 =
7 + 5 =	12 − 4 =	3 + 8 =	12 − 8 =
4 + 8 =	12 − 7 =	5 + 6 =	12 − 1 =
2 + 10 =	12 − 10 =	7 + 5 =	12 − 9 =

9. Copy and add:

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

EXERCISE 11

1. Take a bundle of ten splints and three more splints. How many splints have you?

2. How many are ten splints and three splints?

3. I walked six miles yesterday and seven miles to-day. How far did I walk in the two days?

4. Find the sum of nine cents and four cents.

5. Mary had thirteen cents and spent five of them. How many had she left?

6. If I take six nuts from thirteen nuts, how many nuts remain?

7. Write down all the pairs of numbers that added together make thirteen.

8. What number must be added to the sum of three and seven to make thirteen.

9. How many are nine apples and three apples?

10. Fill up these blanks:

10 + 3 =	13 − 7 =	10 + ? = 13
7 + 6 =	13 − 2 =	13 − ? = 8
8 + 3 =	13 − 5 =	13 − 7 = ?
7 + 5 =	13 − 10 =	13 − 3 = ?
4 + 9 =	13 − 6 =	? + 5 = 13

11. Copy and add:

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

12. Copy and subtract:

12	13	13	13	13	13	13
7	3	8	4	6	5	2

EXERCISE 12

1. How many splints must be taken along with a bundle of ten splints to make fourteen splints?

2. Ten cents and four cents are how many cents?

3. Count by twos up to fourteen.

4. Find the half of fourteen plums.

5. How many are eight books and six books?

6. Mary had fourteen cents. She bought five two-cent postage stamps. How many cents had she left?

7. How many are four and four and six?

8. Fill out the following:

7 + 7 = ?	14 − 7 = ?	½ of 14 = ?
9 + 5 = ?	8 + 6 = ?	7 + 5 = ?
14 − 9 = ?	9 + 3 = ?	13 − 8 = ?
14 − 10 = ?	8 + 5 = ?	14 − 3 = ?
14 − 4 = ?	14 − 5 = ?	14 − 6 = ?

9. Copy and add:

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

10.

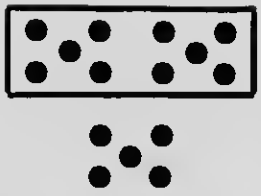
From	12	14	13	14	12	14	14
Take	5	7	3	4	8	9	6

11. Fill in the missing number:

2 + 4 + 4 =	3 + 3 + 6 =	5 + 5 + 4 =
5 + 7 + 2 =	6 + 3 − 4 =	7 + 4 − 3 =
6 + 6 − 4 =	8 + 6 − 5 =	14 − 2 − 3 =
14 − 3 − 3 =	12 + 2 − 7 =	10 + 4 − 6 =

EXERCISE 13

1. How many are ten and five?



2. There are fifteen pears in a bag. To how many boys can I give each five pears?

3. Write on your work book enough of threes to make fifteen. How many did you write?

4. Tom is fifteen months old. How many months more than a year is that?

5. A farmer has eight cows in one field and seven in another. How many has he in both fields?

6. Add the following:

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

7.

From	15	13	15	15	15	15
Take	7	4	10	9	8	6

8.

Multiply	5	6	3	4	5	4
By	2	2	3	3	3	2

9. Copy and finish:

2 times 1 =	2 times 5 =	2 times 3 =
2 " 2 =	2 " 6 =	2 " 0 =
2 " 3 =	2 " 7 =	3 " 3 =
2 " 4 =	3 " 2 =	3 " 5 =

10. Copy and complete the following:

7 + 8 = ?	15 − 6 = ?	5 + 3 + 7 = ?
9 + 6 = ?	15 − ? = 12	4 + 9 + ? = 15
8 + ? = 15	15 − ? = 9	3 + 7 + ? = 15
5 + ? = 15	15 − 8 = ?	5 + 6 + 4 = ?

EXERCISE 14

1. Take ten splints and six splints. How many splints have you?

2. Divide your splints into two equal parts. How many splints are in each part?

3. What is the half of sixteen?

4. Count by twos to 16.

5. Count by fours to 16.

6. Count by threes to 15.

7. Measure 16 inches. How many feet and inches are there in 16 inches?

8. Draw a line sixteen inches long and divide it into four equal parts. How long is each part?

9. Find all the pairs of numbers which added together make sixteen.

10. How many horses can be shod with sixteen shoes?

11. Write in your book a sufficient number of fours to make sixteen. How many fours are there in sixteen?

12. Add the following:

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

13.

From	14	16	15	16	16
Take	6	9	8	10	8

14. Copy and finish:

3 times 2 =	2 times 5 =	3 times 3 =
3 " 5 =	3 " 4 =	2 " 6 =
2 " 8 =	2 " 7 =	3 " 0 =

EXERCISE 15

1. How many are ten splints and seven splints?
2. How many are ten splints and eight splints?
3. Divide 18 splints into two equal parts.
4. Divide 18 splints into three equal parts.
5. What is one-half of 18?
6. What is one-third of 18?
7. Add the following:

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

8.

From	15	13	16	17	17
Take	7	10	9	8	12

9.

2 times 8 =	3 times 5 =	3 times 3 =
2 " 7 =	3 " 6 =	4 " 4 =
2 " 5 =	3 " 4 =	4 " 3 =

EXERCISE 16

1. Count nineteen splints. Put a rubber band round ten of them. How many loose splints are there?

2. Count twenty splints. Put ten into a bundle. How many loose splints are left? Put a band round these. How many bundles of ten splints have you?

3. How many are ten and ten?

4. Complete the following:

20 − 7 =	8 + 9 =	12 + 6 =
18 − 9 =	15 + 5 =	20 − 7 =
20 − 5 =	12 + 8 =	14 + 6 =

5. Add the following:

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

6. From 20 20 20 20 19
Take 4 7 17 15 12

7. 2 times 8 = 2 times 10 = 3 times 5 =
2 " 7 = 3 " 6 = 3 " 3 =

EXERCISE 17

1. How many are 20 apples and 10 apples?

2. I have 30 pens in one box and 20 in another. How many pens have I?

3. How many are 20 and 10 and 10?

4. Count by 5's up to 50.

5. How many tens are there in sixty?

6. Find the sum of 2 tens and 3 tens.

7. Count by 10's up to 90.

8. Count backward from 80 by tens.

9. John had 24 peanuts and gave half of them to Ned. How many did he give to Ned?

10. Add the following:

20	21	32	14	42
30	31	22	31	31
40	41	42	41	12

11. From 20 36 42 57 45
Take 6 31 21 24 12

CHAPTER II

REVIEW EXERCISES

I. NOTATION AND NUMERATION

EXERCISE 18

1. Read the following numbers: 47, 84, 95, 61, 100.

2. Write in figures: Fifty-four, twenty, ninety-two, sixty-nine.

3. Read as tens and units: 17, 59, 95; 99.

4. Write as one number: Seven tens and eight units, nine tens and one unit, four tens and eight units.

5. Express in figures the following: V, X, II, VI, XIII, IV, L, XIX, XXIV, XC, XLIV.

6. Express the following in two ways: four, seven, ten, twenty-four, forty-nine.

7. Write in words: 36, XXVIII, 44, 99, XIV.

8. Find a number equal to $4+5-3+7-5$.

9. Find the value of $3 \times 5 \times 2 \times 6$.

10. Find the value of $IV + VI + X - IX$.

11. Write the following, using figures: From four times six take three times four; find the sum of five times seven and four times eight.

12. Find a number equal to three tens, two tens, and four tens together. Write this number in figures.

13. Write the number of pages in the first two chapters of this book in figures.

14. How many more pages are there in the first chapter of the book than in the second?

II. ADDITION

EXERCISE 19

Add:

1.

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

2.

22	25	14	51	34	44
32	32	41	15	43	55
33	24	52	25	15	22
12	42	25	34	24	33
21	33	35	24	43	21
31	45	53	32	32	14
23	24	42	42	24	41
42	54	34	51	34	35
32	35	43	42	45	53

3.

4	6	5	4	42	36	46
3	3	6	4	24	43	34
3	4	3	6	61	45	43
5	5	5	6	16	54	64
6	6	6	5	15	66	59
5	3	3	6	34	23	44
6	4	5	5	43	32	66
6	5	6	6	65	46	34
5	3	3	6	56	64	63

4.	7	5	3	4	64	56	76
	7	6	4	6	64	54	67
	7	7	5	7	63	53	77
	7	4	6	4	62	55	66
	7	4	7	6	62	65	74
	7	7	7	7	63	64	47
	7	6	6	4	64	63	57
	6	5	5	6	46	65	56
	7	7	4	7	45	46	65
	6	7	3	5	44	63	67
5.	5	8	8	6	87	66	48
	6	8	7	7	78	68	84
	7	8	7	8	68	88	57
	8	7	8	6	86	86	75
	8	7	8	7	58	58	85
	7	7	7	8	85	85	68
	6	6	8	6	48	67	86
	5	6	7	7	84	78	58
	8	6	8	8	88	87	64
	8	8	7	5	78	78	48
6.	7	6	4	8	89	28	64
	8	7	5	6	68	72	46
	9	8	9	5	49	82	68
	4	9	7	6	78	38	86
	9	9	8	9	45	83	75
	7	9	9	9	36	94	57
	9	9	8	9	45	49	69
	9	8	9	8	48	76	96
	9	7	7	7	94	67	48
	9	6	5	7	84	48	84
	8	5	9	6	65	83	95

7. Add by columns and lines:

7 + 8 + 4 + 9 + 6 + 5 + 7 + 5 + 7 + 9 =
3 + 7 + 7 + 6 + 7 + 8 + 5 + 9 + 7 + 6 =
6 + 5 + 5 + 4 + 6 + 9 + 7 + 8 + 9 + 5 =
7 + 5 + 7 + 7 + 8 + 9 + 6 + 3 + 9 + 7 =
7 + 6 + 2 + 5 + 9 + 5 + 4 + 5 + 2 + 6 =
9 + 7 + 3 + 4 + 3 + 4 + 7 + 9 + 7 + 5 =
8 + 8 + 6 + 3 + 6 + 8 + 4 + 4 + 5 + 9 =
4 + 4 + 7 + 6 + 7 + 0 + 5 + 7 + 9 + 3 =
6 + 9 + 8 + 7 + 8 + 5 + 6 + 5 + 3 + 8 =
7 + 6 + 9 + 8 + 9 + 6 + 7 + 4 + 6 + 4 =

8. There are eight rows of trees, with nine trees in each row. How many trees are there?

9. How many quarts of water will fill 4 jugs, if each jug holds three quarts?

10. There are 24 sheets of paper in a quire. How many sheets are there in five quires?

11. A farmer sold five acres of land at $84 an acre. How much did he get for this land?

12. George sold 7 pigeons at 55 cents each. How much money did he receive for them?

13. There are 12 inches in one foot. How many inches are there in six feet?

14. A room is 18 feet long and 15 feet wide. How long a string will exactly stretch ound its walls?

15. A woman spent 84 cents on meat, 73 cents on groceries, and 24 cents on bread. How much did she spend in all?

16. Find the cost of six dozen eggs at 27 cents a dozen.

III. SUBTRACTION

EXERCISE 20

Subtract:

1.	48	39	47	58	47	84	79
	23	16	32	17	25	22	36
2.	97	84	96	79	59	48	96
	13	21	26	45	36	32	44
3.	40	50	60	40	50	60	70
	11	13	14	24	16	28	19
4.	45	84	93	94	62	75	83
	26	46	37	48	24	64	27

5.	45 – 15 =	76 – 42 =	93 – 48 =	85 – 17 =
6.	74 – 18 =	75 – 46 =	66 – 37 =	37 – 18 =
7.	35 – 16 =	46 – 17 =	67 – 18 =	88 – 49 =
8.	84 – 28 =	35 – 26 =	64 – 29 =	75 – 38 =

Add and subtract:

9.	28	65	74	85	78	93	85
	16	16	37	39	49	47	76
10.	75	75	67	45	72	63	54
	29	49	52	19	18	36	19
11.	67	47	54	72	57	94	80
	19	28	16	29	29	49	37

12. John earns 48 cents and James 54 cents in a day. How much more does James earn than John in 3 days?

13. How many bouquets can I make of 3 dozen roses, if I put 9 roses in each bouquet?

14. A school-room has 48 seats in 8 equal rows. How many seats are there in a row?

15. A room is 14 yards long and 12 yards wide. How many more feet are there in its length than in its width?

16. A milkman bought 25 gallons of milk and sold 23 gallons. How many quarts did he not sell?

IV. MULTIPLICATION

EXERCISE 21

1. Tell the result:

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

2. Write the table of 4 times up to 4 times 9.
3. Write the table of 6 times up to 6 times 12.
4. Write the table of 8 times up to 8 times 9.

5. Multiply the following:

12	25	36	48	16
3	3	4	5	6
24	34	25	43	15
6	7	5	8	9
27	35	47	28	45
7	8	6	8	9

6. Find the value of each of the following:

24 × 3	32 × 5	45 × 6	35 × 2
15 × 4	37 × 4	23 × 7	37 × 4
18 × 5	17 × 6	32 × 8	73 × 5
26 × 3	18 × 5	42 × 5	84 × 6

7. If a man pays $5 for a sheep, how much should he pay for 48 sheep?

8. A man sold 8 pigs at $10 each. He received $35 in cash. How much money was still owing to him?

9. I bought 4 pigs at $12 each and 9 sheep at $5 each. How much more did the pigs cost than the sheep?

10. How many inches are there in 6 feet?

11. If a farmer sows 2 bushels of grain on an acre. How many bushels are required to sow 45 acres?

V. DIVISION

EXERCISE 22

1. How many 2's are there in 4? in 10? in 12?

2. Divide 24 by 2; 42 by 2; 64 by 2.

3. Tell the result:

36 ÷ 4	32 ÷ 7	70 ÷ 9	36 ÷ 9
40 ÷ 8	45 ÷ 8	36 ÷ 7	48 ÷ 7
16 ÷ 2	37 ÷ 6	45 ÷ 6	45 ÷ 4
18 ÷ 5	27 ÷ 5	55 ÷ 9	39 ÷ 7

4. Divide:

24 by 3;	by 8;	by 6;	by 4;	by 5.
36 by 4;	by 9;	by 6;	by 12;	by 8.
40 by 5;	by 8;	by 10;	by 7;	by 6.
48 by 4;	by 6;	by 8;	by 2;	by 9.

5. If 5 oranges cost 30 cents, what will 1 orange cost? What will 4 cost?

6. A newsboy spent 36 cents in buying papers at 3 cents each. He sold all at 5 cents each. How much did he gain?

7. If 3 cords of wood cost $15, what will 5 cords cost?

8. Find the cost of a dozen apples at 3 for 5 cents.

9. If 5 exercise-books cost 35 cents, what will be the cost of 4 exercise-books?

10. There are 72 sheaves in 9 stooks. How many sheaves are there in each stook?

11. How many school-days are there in 20 weeks?

12. A room is 24 feet long and 18 feet wide. How many yards is it round the room?

13. Tom went to the store to buy 6 pounds of sugar at 6 cents a pound. How much change did he get out of 50 cents?

14. How many times can a jug holding 4 quarts be filled from a can holding 48 quarts?

15. Mary has 7 apples. John has 3 times as many and 4 more. How many apples has John?

CHAPTER III

NOTATION AND NUMERATION

I. ARABIC NOTATION AND NUMERATION

1. There are three methods of expressing numbers, viz. :

(1) By words ; as, one, two, ten, twenty-nine.

(2) By figures ; as, 1, 2, 10, 29, called Arabic notation.

(3) By letters ; as, i, ii, x, xxix, called Roman notation.

2. Notation is the expression of numbers by means of symbols.

3. The people of Europe learned to use the figures 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 from the Arabians. Hence, they are called the Arabic numerals.

4. Numeration is the method of naming or reading numbers expressed in symbols.

EXERCISE 23

Read the following numbers as hundreds, tens, and units :

1.	207,	371,	185,	190,	368,	638,	683,	836.
2.	570,	472,	807,	909,	990,	764,	746,	647.
3.	368,	584,	760,	321,	999,	576,	675,	756.
4.	394,	786,	475,	728,	700,	709,	770,	707.
5.	506,	300,	407,	730,	397,	509,	905,	950.

Write in figures the following numbers :

6. One hundred and forty-nine ; three hundred and eight ; nine hundred and seventy-four.

7. 7 hundreds, 3 tens, and 5 units; 9 hundreds and 6 tens; 4 hundreds and 6 units.

8. 3 hundreds and 9 units; 8 tens, 6 hundreds and 7 units; 2 units, 7 tens, and 4 hundreds.

5. The following plan for reading numbers shows the names of the periods:

Billions			Millions			Thousands			Units		
Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones
								1	4	5	9
							7	8	4	6	7
						8	4	5	3	9	5
					2	4	3	7	5	8	4
		7	8	0	6	0	7	8	0	0	9

The third number is eight hundred and forty-five thousand three hundred and ninety-five.

The last number is seven billion, eight hundred and six million, seventy-eight thousand and nine.

EXERCISE 24

Express in words:

1.	4859,	4059,	4509,	4590,	4009.
2.	6078,	7068,	8706,	7608,	6708.
3.	7009,	7090,	7900,	9070,	9007.
4.	9100,	9011,	9001,	1900,	1090.

Write the following numbers in figures:

5. Six thousand and six; four thousand three hundred; nine thousand and eighty.

6. Three thousand seven hundred; seven thousand nine hundred and six; three thousand and eighty-four.

Express in words:

7.	36789,	37689,	38769,	39876,	36897.
8.	70008,	70800,	70809,	78009,	70890.
9.	87005,	80705,	85700,	80570,	80057.
10.	90005,	95000,	95555,	55090,	50905.
11.	730601,	900005,	905050,	190076,	910000.
12.	986048,	908085,	980580,	700870,	906008.

Write the following numbers in figures:

13. Ninety-nine thousand; ninety-nine thousand nine hundred; ninety thousand nine hundred.

14. Nine thousand and ninety; ninety-nine thousand and nine; ninety-nine thousand and ninety-nine.

15. Nine hundred thousand and seven; seven hundred and nine thousand; eight hundred thousand and eighty-eight; eight hundred thousand and eight hundred.

II. ROMAN NOTATION

6. Roman Notation is the method of expressing numbers by means of certain capital letters called **Roman Numerals.** The following is a brief description of this notation and the method of using it:

1st. Instead of *figures* being used to express numbers, the following *letters* are employed, viz.:

I, V, X, L, C, D, M, of which the simple values are respectively:

1, 5, 10, 50, 100, 500, 1000.

2nd. Every time a letter is repeated, its value is repeated; thus X = 10, XX = 20.

3rd. By writing a letter to the right of one of greater value, the sum of their values is represented; thus VI = 6, XI = 11.

4th. By writing a letter to the left of one of greater value, the difference of their values is represented; thus XL = 40, IX = 9.

5th. When a letter is placed between two letters, each of greater value than itself, it is combined with the one to the right; thus LIX = 59, XIV = 14.

6th. One place in Arabic notation must be represented in Roman numerals before going to the next place.

Example. Express 1908 in Roman numerals.

1908 = 1000, 900; 8.

1000 = M. 900 = CM. 8 = VIII.

Hence, 1908 = MCMVIII.

EXERCISE 25

Write in Roman numerals:

1. 19, 24, 49, 84, 99, 44, 39, 94.
2. 187, 208, 781, 962, 999, 444, 409, 904.
3. 1301, 1390, 1684, 1815, 1878, 1900, 1909, 1499.
4. 1409, 1499, 1949, 1994, 1409, 1904, 1940, 1999.

Write in figures:

5. XLIV, LXIX, XCIV, LXXI.
6. XCIX, CXXIX, CLXXVII.
7. DLV, MDCIV, MDCCCXIX, MXC, MCMII.
8. MCCXC, MIX, MCDXC, MCM, MCMIV.

NOTE.—This exercise should be followed by much mental drill.

CHAPTER IV

ADDITION AND SUBTRACTION

I. ADDITION

7. If a lady sold 10 pounds of butter at one time, 12 pounds at another, and 3 pounds at another, she would have sold 25 pounds in all.

The result, 25 pounds, is found by a process called **Addition**; 10, 12, and 3 are the **Addends**; 25 is the **Sum.**

8. Addition is the process of combining two or more numbers of the same kind so as to make **one** number.

9. The Addends are the numbers to be added together.

10. The Sum is the single number which results from the addition.

11. The Sign of addition is a small upright cross, +. It is read *plus*, and is placed between the numbers to be added. Thus 6 + 5 is read 6 *plus* 5, and means that 6 and 5 are to be added.

12. The Sign of Equality is two short, horizontal lines, =. When placed between two numbers, it shows that they are equal. Thus 2 + 3 = 5 is read 2 *plus* 3 *equals* 5.

13. The following should be carefully noted :

1. *Only like numbers can be added together ;* thus 4 apples and 5 apples can be added, but not 4 feet and 5 pounds.

2. *The sum is always of the same kind of numbers as the addends.* Thus 4 feet + 5 feet = 9 feet.

3. *The sum is not affected by changing the order of the addends ;* thus

$$3 + 5 + 7 = 5 + 7 + 3 = 7 + 5 + 3, \text{ etc.}$$

Example 1. Find the sum of 476, 368, 49, 58, and 7.

476
368
49
58
7
958

For convenience in adding, units are written under units, tens under tens, etc.

Beginning at the right-hand side and adding, we find the first column contains 38 units, or 3 tens and 8 units. The 8 is placed under the column of units and the 3 is carried to the column of tens. Adding, we have 25 tens, or 2 hundreds and 5 tens. The 5 is placed under the column of tens and the 2 is carried to the column of hundreds. Adding, we have 9 hundreds. The 9 is written under the column of hundreds, giving the result 958.

EXERCISE 26

Find the sum of

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

13.	14.	15.	16.	17.
96	97	19	73	78
78	98	89	78	79
86	36	73	69	52
68	53	45	62	97
65	95	79	98	66
87	54	95	44	77
30	76	87	57	78
77	89	73	78	87
65	68	36	99	73

18.	19.	20.	21.	22.
298	736	366	444	655
789	44	777	666	869
333	799	884	869	317
976	857	967	317	978
868	358	768	978	864
704	246	549	866	754
217	987	496	754	647
579	46	38	647	448
897	9	598	447	792
660	738	594	555	658

EXERCISE 27

Find the sum of

1. $72 + 733 + 33 + 854 + 69$.
2. $62 + 56 + 83 + 8 + 32 + 876$.
3. $43 + 284 + 621 + 8 + 65$.
4. $50 + 705 + 30 + 999 + 97$.
5. $6007 + 583 + 83 + 85 + 64$.
6. $845 + 832 + 81 + 432 + 87 + 99$.
7. $823 + 21 + 70 + 504 + 67 + 79$.
8. $127 + 434 + 805 + 782 + 87 + 768$.

9. $10 + 8756 + 405 + 66782 + 9 + 17 + 874 + 78.$
10. $7560 + 804 + 7854 + 87400 + 576 + 8 + 678 + 94.$
11. $1525 + 920 + 820 + 16 + 37800 + 6874 + 27 + 9.$
12. $8439 + 7246 + 297 + 800 + 2094 + 73825 + 493.$
13. $12345 + 91 + 879 + 784 + 29 + 3456 + 71 + 846.$
14. $36 + 84 + 978 + 569 + 7865 + 4768 + 96 + 847.$
15. $7 + 89 + 897 + 987 + 9284 + 756 + 87 \times 37 + 557.$

EXERCISE 28

Add vertically and horizontally :

1.

				TOTALS
496	542	768	369	
79	847	8	649	
800	947	684	596	
677	846	785	369	
847	468	587	639	
TOTALS				

2.

				TOTALS
458	763	645	897	
387	85	964	75	
769	384	725	888	
678	845	527	987	
784	487	784	879	
TOTALS				

3.

784	45	587	495	
9	784	549	768	
687	587	495	328	
584	748	945	832	
783	847	796	598	
TOTALS				

4.

954	687	387	297
567	309	97	809
875	760	748	980
758	607	478	895
589	385	835	538
TOTALS			

5.

967	758	697	859
548	49	976	895
796	893	967	964
384	389	694	946
547	839	804	407
TOTALS			

6.

785	796	967	679
875	679	761	452
857	773	282	257
469	74	478	691
496	396	396	964
TOTALS			

16. Write all the pairs of numbers that make up ten, and use your knowledge in adding the following vertically and horizontally:

4	6	3	7	9	1 =
6	4	7	3	1	9 =
2	8	5	5	7	3 =
8	2	5	5	3	7 =
7	3	2	8	4	6 =
3	7	8	2	6	4 =
5	5	6	4	2	8 =
5	5	4	6	8	2 =
1	9	7	3	3	7 =
9	1	3	7	7	3 =
—	—	—	—	—	— ___
					=

17. Copy the following, being careful to place cents under cents and dollars under dollars. Add vertically and horizontally:

$ 25.07	$ 725.42	$ 64.81 =
141.78	896.38	9.79 =
37.92	74.75	256.34 =
4.28	5.35	368.45 =
1118.36	82.78	79.65 =
242.54	145.62	8725.34 =
79.64	2008.34	9.47 =
9.56	79.86	81.53 =
201.57	9.25	765.28 =
728.73	5.84	35.82 =
———	———	——— ———
		=

EXERCISE 29

1. *A* gave $27 for a cow, $45 for an ox, and $150 for a horse. What did they all cost?

2. *A* has 120 acres of land, *B* has 310 acres, *C* has 515 acres, and *D* has 715 acres. How many acres have they all together?

3. There are 31 days in January, 28 in February, 31 in March, and 30 in April. How many days are there in these four months?

4. A man travelled 215 miles one week, 195 the next, 273 the next, and 378 the next. How far did he travel?

5. *A* weighs 127 pounds, *B* 215 pounds, *C* 176 pounds, *D* 184 pounds, and *E* 234 pounds. What is the sum of their weights?

6. A farmer raised 576 bushels of corn, 918 bushels of oats, 3149 bushels of wheat, and 2785 bushels of rye. How many bushels did he raise in all?

7. In one book there are 725 pages, in another there are 337 pages, and in another book there are as many as in both the former. How many pages are there in all?

8. A merchant bought cloth for $756, silk for $859, muslin for $367, and calico for $255. How much did all cost?

9. *A* paid $325 for a span of horses, and $248 more than this for a carriage. For how much must he sell them both to gain $275?

10. *A* gains in one year $465, *B* gains $136 more than *A*, and *C* gains as much as *A* and *B* together. How much did *B* gain? How much did *C* gain? How much did they all gain?

EXERCISE

1. A man dying willed his estate as follows: To his wife, $5500; to each of his four sons, $3200; to each of his three daughters, $2800; to a church, $1950; to a school, $2430. How much was his estate?

2. In 1907 in the Province of Ontario there were 7638 miles of railway track; in Quebec, 3516 miles; in New Brunswick, 1503 miles; in Nova Scotia, 1329 miles; in Prince Edward Island, 267 miles; in Manitoba, 3074 miles; in Alberta, 1323 miles; in Saskatchewan, 2025 miles; in British Columbia, 1685 miles; and in Yukon Territory, 90 miles. How many miles of railway track were there in Canada in 1907?

3. During the year ending June 30th, 1905, Canada exported cheese to the value of $20300500; butter, $5930379; eggs, $712866; bacon, $12194458; wheat, $12386743; oats, $862040; and hay, $1261210. Find the total value of these exports.

4. During the same period, Canada imported hides to the value of $5147073; wool, $1553431; bacon and hams, $484442; Indian corn, $6155671; flaxseed, $211585; hemp, $787101; tobacco, $2377359; and hops, $216055. Find the total value of these imports.

5. From Port Arthur to Sault Ste. Marie is 273 miles; from Sault Ste. Marie to Sarnia, 318 miles; from Sarnia to Port Colborne, 308 miles; from Port Colborne to Port Dalhousie, 27 miles; from Port Dalhousie to Kingston, 170 miles; from Kingston to Montreal, 178 miles; and from Montreal to Quebec, 160 miles. How far is it from Port Arthur to Quebec by water?

6. *A* paid $250 for a piano; $309 more than this sum for furniture; $751 more than the cost of the furniture for a house. He still had $5897 in the bank. What sum had he at first?

7. *B* bought a farm for $3750. He spent $575 in improving the house and barn, and $457 in fencing a part of the farm; then he sold it for $1353 more than the whole cost him. How much did he receive for the farm?

II. SUBTRACTION

14. A person has 75 cents and spends 50 cents; he has 25 cents left.

The result, 25 cents, is found by a process called **Subtraction**; 75 cents is the **Minuend**; 50 cents is the **Subtrahend**; and 25 cents is the **Remainder** or **Difference.**

15. Subtraction is the process of finding the difference between two numbers.

16. The Minuend is the larger of the two numbers.

17. The Subtrahend is the number which is taken from the minuend.

18. The Remainder or **Difference** is the number found by taking the subtrahend from the minuend.

19. The sign of subtraction, $-$, is called **Minus,** and when placed between two numbers shows that the one on the right of the sign is to be taken from the one on the left of it. Thus $6 - 2$, is read 6 minus 2, and means that 2 is to be taken from 6.

20. The following should be carefully noted:

1. *Only similar numbers can be subtracted; thus 4 boys from 7 boys; 6 cents from 8 cents, &c.*

2. *The minuend is the sum of the subtrahend and the difference.*

Example 1. From 522 subtract 285.

21. *The Computers' method:*

522
285
237

This method depends upon Art. 20, § 2. To 5, 7 must be added to make up 12; place 7 under the units. Carry 1 to 8, making 9; to 9, 3 must be added to make up 12; place 3 under the tens and carry 1 to 2, making 3; to 3, 2 must be added to make up 5; place 2 under the hundreds.

Example 2. From 2100 take the sum of 452, 367, 584 and 8.

2100
452
367
584
8
689

8 + 4 + 7 + 2 = 21; to 21, *9* must be added to make up 30; place 9 under the units and carry 3 to the tens. 3 + 8 + 6 + 5 = 22; to 22, *8* must be added to make up 30; place 8 under the tens and carry 3 to the hundreds. 3 + 5 + 3 + 4 = 15; to 15, *6* must be added to make up 21; place 6 under the hundreds.

NOTE.—The teacher is recommended to use this method. The following methods are also in common use:

22. *The method of "Borrowing" or Decomposition:*

4 11 12
5 2 2
2 8 5
2 3 7

We cannot take 5 units from 2 units, so 1 ten is taken from 2 tens and added to the 2 units, making 12 units. 12 units − 5 units = 7 units. 8 tens cannot be taken from 1 ten, so 1 hundred is taken from 5 hundreds and added to 1 ten, making 11 tens. 11 tens − 8 tens = 3 tens. 4 hundreds − 2 hundreds = 2 hundreds.

23. *The method of Equal Additions:*

This method depends upon the principle that adding equal numbers to both minuend and subtrahend does not alter the remainder.

522
285
237

5 units cannot be taken from 2 units; add 10 units to the minuend. 2 + 10 = 12; 5 from 12 leaves 7. As 10 units are added to the minuend, 10 units must be added to the subtrahend. 10 units = 1 ten; (8 + 1) tens = 9 tens. 9 tens cannot be taken from 2 tens; add 10 tens. (2 + 10) tens = 12 tens. 12 tens − 9 tens = 3 tens. As 10 tens are added to the minuend, 10 tens or 1 hundred must be added to the subtrahend; (2 + 1) hundreds = 3 hundreds. 5 hundreds − 3 hundreds = 2 hundreds.

EXERCISE 31

1.	2.	3.	4.	5.	6.
8672	5283	8175	2534	6735	7219
3728	2426	2836	1235	5376	1972
7.	8.	9.	10.	11.	12.
8522	7135	6347	8135	7345	4372
6243	1872	2563	2453	2876	2583
13.	14.	15.	16.	17.	18.
35672	43763	87253	73875	63527	53413
23828	24235	34365	38376	14238	28401
19.	20.	21.	22.	23.	24.
40001	70000	60606	90800	73002	70101
18765	8924	28476	12576	18456	12347
25.	26.	27.	28.	29.	30.
57108	70564	67853	60000	50406	90001
13842	18727	19875	18906	18293	78478

EXERCISE 32

1. From 700000 take 57604; from 584006 take 7089.
2. From 672850 take 49709; from 784300 take 19756.
3. From 600084 take 125006; from 100000 take 99999.
4. From 800008 take 90099; from 707070 take 90909.
5. From 505005 take 99009; from 333333 take 42506.
6. From 1000001 take 123057; from 4203451 take 600607.

Find the values of:

7.	6004 – 2576	9001 – 4752	7600 – 2456.
8.	9090 – 5407	7060 – 5094	8000 – 5264.
9.	7007 – 3009	5555 – 2089	7000 – 5387.
10.	8201 – 7056	7253 – 1847	5000 – 2754.
11.	9400 – 1085	9000 – 2784	8100 – 2576.
12.	7070 – 3807	5500 – 3068	6308 – 1235.

EXERCISE 33

1. A horse was bought for $125, and sold for $117. How much was lost by the sale?

2. A roll of carpet contained 156 yards, but 79 yards were sold from it. How much remained?

3. A house cost $5440, and was sold for $6000. How much was the gain?

4. A man died in 1901 at the age of 75 years. When was he born?

5. A town which 10 years ago had a population of 3745, has now a population of 6996. What is the gain?

6. I went to a store and bought a knife for 56 cents, and gave the storekeeper a four-dollar bill (400 cents) to pay for it. How much change did he give me back?

7. Two little girls picked 74 quarts of blackberries one summer. If one picked 37 quarts, how many quarts did the other pick?

8. Mr. Robinson's horse and carriage cost $400. What did the horse cost, if the carriage cost $225?

9. Smith bought of Brown 875 acres of land for $23400. For 500 acres of the tract he paid $11379. How many acres were in the remainder of the tract, and for what sum was it purchased?

10. Winnipeg station is 757 feet above the sea level; Regina station, 1885 feet; Calgary station, 3428 feet; Edmonton, 2188 feet; and the summit of Kicking Horse Pass, 5329 feet. How much higher is (*a*) Calgary than Winnipeg? (*b*) the summit of Kicking Horse Pass than Regina? (*c*) Regina than Winnipeg? (*d*) Edmonton than Regina?

EXERCISE 34

1. Find the remainder after taking 897 as often as possible from 5005.

2. The greater of two numbers is 7003, and the difference between them is 745. Find the smaller number.

3. To what number must 5784 be added so that the sum may be 10000?

4. From the difference between 75006 and 91804 take 578.

5. From the difference between 80070 and 90009 take the difference between 57008 and 58707.

6. From the difference between 75846 and 64368 take the sum of 364, 458, 379 and 5909.

7. The subtrahend is the sum of 807, 789 and 375; the remainder is the difference between 7856 and 7983. Find the minuend.

8. After 984 was subtracted four times in succession from a certain number, 507 was left. Find the number from which 984 was taken.

9. Find a number which added to 1487 will give the difference between one million and nine hundred and ninety-nine.

10. The remainder is the sum of 784 and 379; the minuend is the difference between 807 and 2000. Find the subtrahend.

11. The sum of seven numbers is 10000. Five of them are 348, 476, 584, 907, and 876. If the sixth one is 1234, find the seventh.

EXERCISE 35

Find the result of:

1. $768 + 276 - 369 + 284 - 782$.
2. $369 + 784 + 468 - 266 - 368 - 248$.
3. $1764 - 839 + 786 + 724 - 368 - 256$.
4. $136 - 769 - 284 + 968 + 268 + 372$.
5. $269 - 1846 + 368 - 274 + 2976 + 769$.
6. $769 + 785 + 368 - 784 - 369 - 249$.
7. $1869 - 2846 + 362 - 489 + 3007 + 249$.
8. $2845 + 3624 - 78695 + 784 + 93768$.
9. $7369 - 245 - 12456 + 85769 - 2572$.
10. $3004 + 2006 - 5008 - 3604 + 7200$.
11. $5784 - 3607 + 7859 + 4863 - 4795 - 7145$.
12. $8007 + 4597 - 7438 - 5782 + 7384 - 2359$.

EXERCISE 36

1. A man owing \$1369, paid at one time \$264, and at another \$748. How much did he still owe?

2. A man bought a farm for \$6780; he spent \$1875 for improvements and \$977 for stock; he then sold the whole for \$9000. Did he gain or lose, and how much?

3. The sum of four numbers is 936287; the first is 23789, the second is 11892 less than the first; the third is 35416 more than the second. What is the fourth?

4. What number increased by the difference between 1458 and 2362 will make the sum of 3641, 789 and 7008?

5. A collector received $1200 from four men; from the first he got $352; from the second $67 more, and from the third $94 less than this. How much did he receive from the fourth?

6. At an election, in which there were two candidates, the whole number of votes was 3694; the defeated candidate received 1369 votes. What was the majority?

7. A boy shot an arrow up the road 173 feet and another down the road 234 feet; his little brother brought them to him. How far did he walk to get them?

8. John and James play marbles. John has 24 at the beginning and James 36. In the first game John wins 4, the next he wins 6, the next he loses 5, the next he loses 3, the next he wins 2. How many marbles has each now?

9. The following table shows the population of the British Islands in 1891 and 1901:

PART.	1891.	1901.	
		MALES.	FEMALES.
England and Wales -	29002525	15721728	16804347
Ireland - - -	4704750	2197739	2258807
Scotland - - -	4025647	2173151	2298849
Small Islands - -	147842	70691	79908

(*a*) Find the increase in population of these islands.

(*b*) How many more females are there than males in 1901?

(*c*) By how many does the population of England and Wales exceed that of the rest of the British Islands in 1901?

(*d*) Find the increase or decrease of each part during the decade, and from these find the total increase.

10. By the census of 1901 the rural population of Ontario was found to be 1247190 and the urban population 935752, as against 1295323 and 818998, respectively, in 1891. How much did the population of Ontario increase during these ten years?

EXERCISE 37

1. On a farm of 640 acres there are 310 acres in wheat, 75 acres in oats, 15 acres in peas, 13 acres in hoed crop, and the rest in pasture. How many acres are in pasture?

2. In a box there are red, blue, green, and black balls. The red, blue, and green balls together number 198; the blue and black, 123; and the red and blue, 160. If there are 47 black balls, how many are there altogether?

3. Queen Victoria was born in the year 1819 and died in 1901; Gladstone was born in 1809 and died in 1898. How much older than Victoria was Gladstone when he died?

4. In 1901 the rural population of Quebec was 992667, and the urban 656231. In 1891 these numbers were 988820 and 499715 respectively. What was the increase (*a*) in rural population; (*b*) in urban; and (*c*) in both?

5. In 1901 and 1891 the population of Montreal was respectively 267730 and 216644, and in the same two years that of Toronto was 207971 and 181220. By how much more did the population of Montreal increase than that of Toronto during this decade?

6. William had 85 marbles, George had 54, and John had 45. William gave John enough to make his number up to George's. How many had William left for himself?

7. John has 527 marbles; Tom has 129 less than John; Harry has 274 more than Tom. How many has Will, if he has 86 less than Tom and Harry together?

NOTE.—The oral exercises which follow are merely suggestions of the kind which the teacher should prepare for the pupil.

ORAL EXERCISE

1. Find the sum of 7, 5, 3, 8, 6, 7.

2. How much are 7 and 8? 17 and 8? 27 and 8?

3. A farmer has 12 acres in oats, 24 in barley, and 31 in wheat. How many acres has he in grain?

4. A woman had $20; she spent $14. How much had she left?

5. Jane is now 16 years old. How old was she 7 years ago?

6. From the sum of 7, 6, and 9 take 8.

7. The sum of four numbers is 32. Three of them are 5, 9 and 7. Find the fourth one.

8. Out of $50, a man spent $12 at one time and $16 at another. How much money had he remaining?

9. Find the value of $9+5+7+4-16$.

10. Simplify $8+4-6+3-8+7+5-4$.

11. Begin with 3 and count to 51 by 4's. Thus 3, 7, 11, etc.

12. From a pile of wood containing 70 cords, 9 cords were sold on Monday and 8 on Tuesday. How many cords remained?

13. What number must be added to the sum of 7 and 6 to make 23?

14. $5+4+6+7-3-4-8+7-2+5-9=$

15. Find the result of $22-8+13-7+4-5$.

16. From 81 take the sum of 6, 7, 5, 8, and 24.

17. Mary was born 7 years before Anna. Mary is now 21 years old. How old is Anna?

CHAPTER V

MULTIPLICATION AND DIVISION

I. MULTIPLICATION

24. If a person purchase 5 hats at \$3 each, he pays \$15 for the lot.

The result, \$15, is obtained by using \$3, the cost of a hat, as an addend 5 times. The process is called **Multiplication**; \$3 is the **multiplicand** and 5 is the **multiplier.**

25. Multiplication is the process of finding the result of using a number, called the multiplicand, as an addend as often as is indicated by another number, called the multiplier.

26. The Multiplicand is the number to be taken as an addend, that is, the number to be multiplied.

27. The Multiplier is the number which shows how many times the multiplicand is to be taken as an addend.

28. The Product is the result of the multiplication; thus \$15 is the product.

29. The Sign of Multiplication is an oblique cross, thus $\times$.

It is read *multiplied by* when the multiplicand precedes it, and *times* when the multiplier precedes it.

Thus \$5 $\times$ 4 is read \$5 multiplied by 4; and 4 $\times$ \$5 is read 4 times \$5.

30. The Factors of a number are those numbers which, multiplied together, will produce it. Thus 5 and 3 are the factors of 15.

The *multiplier* and the *multiplicand* are the factors of the *product.*

MULTIPLICATION TABLE

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

In this table the 1's are written in the first row, or in the first column, the 2's in the second row, or in the second column, etc. To find any product, as 3 times 8, find the number common to the third column and to the eighth row, or to the eighth column and to the third row, 24.

31. The following must be carefully noted :

1. Number, when used merely as number, must be clearly distinguished from number used to represent a quantity. Thus 3, 7, 8, when used to represent number only, are called *Abstract numbers* ; but when used to show a quantity, as 3 boys, $7, 8 feet, they are called *Concrete numbers or quantities.*

2. *The multiplier is always an abstract number.*

3. *The product is always of the same kind of number as the multiplicand.*

4. *The product of two numbers is not affected by changing the order of the factors.* Thus $4 \times 7 = 7 \times 4$.

Example 1. Multiply 387 by 4.

$$\begin{array}{r} 387 \\ \times\ 4 \\ \hline 1548 \end{array}$$

Beginning at the right to multiply by 4, 4 times 7 units are 28 units, or 2 tens 8 units. Place 8 under the units' column and carry 2 tens to the product of the tens. 4 times 8 tens are 32 tens; 32 tens + 2 tens = 34 tens = 3 hundreds and 4 tens. Place 4 under the tens' column and carry 3 hundreds to the product of the hundreds, etc.

EXERCISE 38

Multiply:

1. 315 by 6.
2. 480 by 7.
3. 614 by 5.
4. 7842 by 3.
5. 6843 by 7.
6. 8742 by 8.
7. 9764 by 8.
8. 8973 by 6.
9. 78394 by 2, by 3, by 4, by 5, by 6, by 7.
10. 94876 by 3, by 4, by 5, by 6, by 7, by 8.
11. 74593 by 4, by 5, by 6, by 7, by 8, by 9.
12. 84637 by 5, by 6, by 7, by 8, by 9, by 10.
13. 95784 by 6, by 7, by 8, by 9, by 10, by 5.

Example 2. Multiply 742 by 12, using factors.

$12 = 6 \times 2$, or 4×3.

$$\begin{array}{r} 742 \\ \times\ 12 \\ \hline 8904 \end{array}$$

$$\begin{array}{r} 742 \\ \times\ 6 \\ \hline 4452 \\ \times\ 2 \\ \hline 8904 \end{array}$$

$$\begin{array}{r} 742 \\ \times\ 4 \\ \hline 2968 \\ \times\ 3 \\ \hline 8904 \end{array}$$

$$\begin{array}{r} 742 \\ \times\ 3 \\ \hline 2226 \\ \times\ 4 \\ \hline 8904 \end{array}$$

It is thus seen that the *multiplicand multiplied by the multiplier, gives the same product as when multiplied by any set of factors into which the multiplier can be separated, and that the result is the same, no matter in what order the factors are used.*

EXERCISE 39

Multiply, using factors:

1. 478 by 25.
2. 976 by 42.
3. 1879 by 63.
4. 1362 by 49.
5. 8936 by 54.
6. 4729 by 72.
7. 2345 by 81.
8. 3764 by 64.
9. 2978 by 45.
10. 3475 by 18.
11. 7649 by 24.
12. 9365 by 144.

EXERCISE 40

1. Multiply 5, 7, 9, 12, and 15 each by 10.

It will be seen that any number is multiplied by 10 by affixing a cypher to the number.

2. Multiply 17, 19, 24, and 32 each by 20, by 30, by 40.

3. Multiply 5, 6, 7, 8, and 14 each by the factors of 100.

It will be seen that any number is multiplied by 100 by affixing two cyphers to the number.

4. Multiply 27, 34, 48, and 96 each by 200, by 300, by 500.

Find the result of the following:

5. 84×50.
6. 57×70.
7. 78×600.
8. 87×500.
9. 245×800.
10. 367×700.

Example 3. Compare the result of multiplying 289 by the factors of 42 with the result of multiplying 289 by the

parts of 42 as 40 and 2, and then adding the partial products together.

$$\begin{array}{r} 289 \\ 7 \\ \hline 2023 \\ 6 \\ \hline 12138 \end{array} \qquad \begin{array}{rcrcl} 289 & & 289 & & \\ 40 & & 2 & & \\ \hline 11560 & + & 578 & = & 12138 \end{array}$$

From this it is seen that *a number is multiplied by another when it is multiplied by the parts of the other and the partial products added together.*

Example 4. Find the value of 546 multiplied by 487.

$$487 = 400 + 80 + 7.$$

I.

$$\begin{array}{r} 546 \\ 487 \\ \hline 3822 \\ 43680 \\ 218400 \\ \hline 265902 \end{array}$$

II. *The usual form.*

$$\begin{array}{rcl} 546 & & \\ 487 & & \\ \hline 3822 & = & 7 \text{ times } 546 \\ 4368 & = & 80 \quad \text{"} \quad 546 \\ 2184 & = & 400 \quad \text{"} \quad 546 \\ \hline 265902 & = & 487 \quad \text{"} \end{array}$$

In the second case the 0's are omitted because they count for nothing in the addition; but they must be supposed to be there that the other figures may be kept in their proper columns.

EXERCISE 41

Multiply:

1. 744 by 635.
2. 895 by 336.
3. 972 by 243.
4. 825 by 682.
5. 973 by 745.
6. 4569 by 886.
7. 28352 by 345.
8. 41678 by 287.

9. 34073 by 43.
10. 40735 by 62.
11. 6484 by 637.
12. 7856 by 337.
13. 6748 by 633.
14. 4878 by 343.
15. 5847 by 773.
16. 25473 by 44.
17. 73519 by 47.
18. 81897 by 34.
19. 21346 by 314.
20. 47309 by 452.
21. 25737 by 452.
22. 43629 by 285.

Example 5. Multiply 2479 by 4006.

```
 2479
 4006
14874
9916
9030874
```

4006 times 2479 equals 4000 times 2479 plus 6 times 2479. 6 times 2479 is 14874; 4000 times 2479 is 9916000. These partial products are written one under the other, as before, the 0's being omitted.

EXERCISE 42

Multiply:

1. 415 by 307.
2. 7004 by 902.
3. 2769 by 708.
4. 1364 by 5004.
5. 9006 by 7036.
6. 8009 by 7008.
7. 1684 by 4008.
8. 2002 by 4103.
9. 3678 by 7068.
10. 9999 by 8008.
11. 3674 by 200901.
12. 3798 by 90809.

EXERCISE 43

Find the value of:

1. 473×600.
2. 847×700.
3. 9642×6300.
4. 1875×6340.
5. 27×9000.
6. 6000×43.
7. 18000×623.
8. 6400×640.
9. 650×650.
10. 83600×7500.
11. 9230×7000.
12. 8000×61000.

EXERCISE 44

1. In 1 ream of paper there are 480 sheets. How many sheets are there in 947 reams?

2. If a cotton mill manufactures 637 yards of cloth in one day, how many yards will it make in 307 days?

3. At $125 each what will 49 horses cost?

4. A merchant bought 29 pieces of cloth; in each piece there were 57 yards. How many yards were there in the whole?

5. If 19008 pounds of hay are required for the horses of a cavalry regiment for one day, how many pounds will be needed for 206 days?

6. What would be the cost of constructing 309 miles of plank road at $3975 a mile?

7. How many apples will an orchard containing 208 trees produce, if the average yield is 1269 apples for each tree?

8. In 3 editions of 750 books each, how many pages are there, if each book contains 407 pages?

9. How many yards of sheeting are there in 57 bales, each bale containing 25 pieces and each piece 43 yards?

10. In a cotton mill there are 29 looms; each loom can weave 42 yards daily. At this rate how many yards can be woven in 159 days?

11. A lot cost $420. How much will 105 lots cost at the same rate?

12. A drover has 460 cows worth $30 each. How much are they all worth?

13. A field has 205 rows of potatoes and 307 hills in a row. How many hills are there in the field?

EXERCISE 45

1. How much will it cost to build 307 miles of railroad at $4060 a mile?

2. A contractor built 604 miles of railroad at $6500 a mile. How much did he get for it?

3. If it requires 720 barrels of provisions to supply an army for one day, how many barrels will be required for 365 days?

4. If 1 acre of land cost $9620, how much will 736 acres cost?

5. If it cost $98650 to build one mile of railroad, how much will it cost to build 2809 miles?

6. There are 15 fields of corn; in each field there are 97 rows, and 256 hills in each row. How many hills are there in the 15 fields?

7. How many yards of cloth are there in 43 bales, each bale containing 72 pieces, and each piece 29 yards?

8. If a railway train goes 18 miles an hour, how far will it go in 17 days of 24 hours each?

9. A merchant had 26 pieces of cloth of 54 yards each, which he sold for 45 cents a yard. How much did he get for the cloth?

10. A flouring mill grinds 125 barrels of 196 pounds each per day. How many pounds of flour will this mill grind in 9 weeks of 6 days each?

11. A rectangular field has a fence 6 rails high round it; there are 124 panels in each side and 84 panels in each end. How many rails are there in the fence?

12. A farmer bought 29 cows at $23 each, and 97 pigs at $7 each. How much more did the pigs cost than the cows?

EXERCISE 46

Simplify :

1. $(784 + 368) \times (967 - 285)$.

2. $927 + 764 \times 907 - 365 \times 708$.

3. $549 \times 708 + (345 - 149) \times 579$.

4. $549 \times 708 + 345 - 149 \times 579$.

5. Two factors of a number are 427 and 403. Find the number.

6. Find the continued product of 11, 13, 17, and 19.

7. The multiplicand is the difference between one million and nine thousand and nine; the multiplier is the sum of 365, 486, and 789. Find the product.

8. How much must be taken from the product of 786 and 639 to get the product of 786 and 539?

9. One of the three equal factors of a number is 407. Find the number.

10. Multiply the sum of the odd numbers by the sum of the even numbers in the following: 47, 54, 61, 68, 75, 82, 89, 96.

11. A farmer has 734 bushels of wheat and 1318 bushels of oats; a bushel of wheat weighs 60 pounds and one of oats 34 pounds. How many more pounds of oats than of wheat has he?

12. After subtracting 289 thirty-seven times from a certain number, the remainder is 261. What is the number?

EXERCISE 47

1. *B* bought a house for $2960, and gave for it 98 cows at $24 each, and the rest in money. How much money did he pay?

2. One army contains 4575 men, and another 36 times as many, lacking 1936. How many men are there in the second army?

3. Mr. Peters has 2461 gallons of coal oil, Mr. Martin has 1146 gallons, and Mr. Benson has 147 times as much as both. How much has Mr. Benson?

4. A farmer sold 129 cows at $37 each, and received in payment $2000. How much yet remains due?

5. *B* sold 76 hens at 73 cents each, 96 turkeys at 324 cents each, and received in payment 24000 cents. How much remains due?

6. *A*'s barn cost $2485, his house cost 3 times as much, and his farm cost as much as both. What was the cost of the house? What was the cost of the farm?

7. A drover bought 36 horses at $145 a head, and 96 cows at $28 a head. Which cost the most, and how much?

8. *A*'s book contains 248 pages, with 2850 letters on a page, and *B*'s contains 325 pages, with 3465 letters on a page. How many letters are there in *A*'s book? How many in *B*'s?

9. A man has 75 bags of apples, each bag containing 2 bushels. How much will be received for them at 125 cents a bushel?

10. A farmer sold 25 firkins of butter, each firkin containing 126 pounds, and received for each pound 37 cents. How much did he receive for it all?

11. Find the product of the sum and difference of 784 and 397.

12. If 472 men cut 800 cords of wood in two days, how long would it take one man to do it?

II. DIVISION

32. If a hat costs \$3, 5 hats will cost \$15.

This example in multiplication gives rise to two converse problems:

(1) If 5 hats cost \$15, what will 1 hat cost? The result is \$3.

(2) If a hat costs \$3, how many hats can be bought for \$15? The result is 5.

Thus it is seen when a product and one factor are given the other factor may be found. The process of finding the second factor is called **Division**; \$15 is the **Dividend**, \$3 or 5 is the **Divisor.**

33. Division is the process of finding how many times one number is contained in another.

34. The Dividend is the number to be divided.

35. The Divisor is the number by which the dividend is to be divided.

36. The Quotient is the result of the division and expresses how many times the divisor is contained in the dividend.

37. When the divisor is not contained an exact number of times in the dividend, there is a remainder. Thus $17 \div 5 = 3$ and 2 remainder. Hence the **remainder** is what is over when the divisor is not contained exactly in the dividend.

38. The Remainder, being part of the Dividend, will always be of the same kind or denomination as the Dividend.

39. The sign of Division is $\div$. It shows that the number to the left of it is to be divided by the number

to the right. Thus $21 \div 7 = 3$ is read 21 divided by 7 equals 3.

40. Division is also indicated by writing the dividend above the divisor, with a short horizontal line between them, thus $\frac{21}{7}$, or by writing the divisor to left of the dividend, thus 7)21.

41. Note the following:

1. *When the Divisor and Dividend are similar numbers, the quotient is an abstract number.*

2. *When the divisor is an abstract number, and the dividend concrete, the quotient is concrete, and of the same unit as the dividend.*

3. *The Remainder is always of the same unit as the Dividend.*

EXERCISE 48

1. Indicate that the product of 7 and 8 increased by 4 is 60.
2. Indicate that 60 divided by 12 gives 5 for quotient.
3. Divide by 2: 8, 12, 16, 20, 18, 24, 22.
4. Divide by 3: 9, 18, 15, 21, 12, 36, 24.
5. Divide by 4: 12, 16, 24, 36, 44, 20, 48.
6. Divide by 5: 15, 25, 45, 35, 40, 60, 50.
7. Divide by 6: 24, 36, 18, 42, 54, 72, 66.
8. Divide by 7: 21, 35, 14, 28, 77, 42, 63.
9. Divide by 8: 32, 48, 24, 56, 88, 64, 96.
10. Divide by 9: 63, 81, 54, 72, 36, 26, 108.

Example 1. Divide 72 by 8. Break 72 up into any parts, as 40 and 32, 24 and 48, etc., divide each of these parts by 8 and find the sum of the quotients.

$$8)\overline{72} \quad 8)\overline{40} \quad 8)\overline{32}$$
$$9 \quad 5 \quad + \quad 4 \quad = \quad 9$$

42. *From this example it is seen that a number is divided by another when the several parts of the given number are each divided by the given divisor and the quotients added together.*

Example 2. Divide 72 by 3.

)7 tens + 2 units
3)6 tens + 12 units
2 tens + 4 units = 24

3)72
24

7 tens ÷ 3 = 2 tens and 1 ten over. 1 ten + 2 units = 12 units. 12 units ÷ 3 = 4 units.

Example 3. Divide 852 by 3.

)8 hundreds + 5 tens + 2 units
3)6 hundreds + 24 tens + 12 units
2 hundreds + 8 tens + 4 units = 284.

3)852
284

8 hundreds ÷ 3 = 2 hundreds and 2 hundreds over. 2 hundred = 20 tens. 20 tens + 5 tens = 25 tens. 25 tens ÷ 3 = 8 tens and 1 ten over. 1 ten + 2 units = 12 units. 12 units ÷ 3 = 4 units.

EXERCISE 49

Find the value of the following:

1. 936 ÷ 3.
2. 844 ÷ 2.
3. 666 ÷ 3.
4. 505 ÷ 5.
5. 770 ÷ 7.
6. 488 ÷ 4.
7. 604 ÷ 2.
8. 826 ÷ 2.
9. 963 ÷ 3.

Example 4. Divide 745 by 6.

6)745
124 – 1

Six is contained in 7 hundreds, 1 hundred times and 1 hundred over. The 1 hundred and 4 tens make 14 tens. Six is contained in 14 tens, 2 tens times and 2 tens over. 2 tens and 5 make 25. Six is contained in 25, 4 times and 1 remainder.

43. The process described above is called **Short Division.** It is usually used when the divisor is 12 or less.

EXERCISE 50

Find the value of the following:

1. $84 \div 6$.	2. $840 \div 8$.	3. $748 \div 2$.
4. $512 \div 4$.	5. $972 \div 4$.	6. $735 \div 5$.
7. $880 \div 5$.	8. $864 \div 6$.	9. $833 \div 7$.
10. $8\overline{)944}$	11. $8\overline{)7576}$	12. $8\overline{)111032}$
13. $7\overline{)4732}$	14. $7\overline{)9359}$	15. $9\overline{)8892}$
16. $6\overline{)7338}$	17. $9\overline{)3978}$	18. $8\overline{)29352}$

19. At 6 cents each, how many oranges can be bought for 354 cents?

20. At 2 dollars a day, how many days' work can I hire for 346 dollars?

21. How many pounds of rice at 4 cents a pound can I buy for 3672 cents?

22. In 3 feet there is 1 yard; how many yards are there in 693 feet?

23. If 8 men can dig 768 rods of ditch in 3 weeks, how many rods can 1 man dig in the same time?

24. If 7 yards of cloth cost 637 cents, what will 1 yard cost?

25. If 9 men dig 135 bushels of potatoes in 1 day, how many bushels can 1 man dig in 1 day?

26. When 7 is multiplied by a certain number the product is 861. What is the number?

27. If 6 bins of equal size are exactly filled by 36312 bushels of grain, how much does each bin hold?

28. If 7 men can cut 56 cords of wood in 4 days, how much can 1 man cut in the same time?

EXERCISE 51

Divide :

1. 6532 by 3.
2. 11236 by 9.
3. 57636 by 6.
4. 11485 by 7.
5. 98537 by 8.
6. 345246 by 5.
7. 1680245 by 4.
8. 3432026 by 6.
9. 6216563 by 8.
10. 7295849 by 10.
11. 16779120 by 12.
12. 37000305 by 5.
13. 5767692 by 7.
14. 56464237 by 9.
15. 46626289 by 11.
16. 3523360 by 6.

17. When flour is worth 8 dollars a barrel, how many barrels could be bought for 3456 dollars?

18. If 7 casks of sugar weigh 8792 pounds, what is the average weight of each cask?

19. A father dying left an estate of 37356 dollars to be divided equally among his wife, his two sons and his three daughters; what was the share of each?

20. Five men bought a horse for 160 dollars; they hire him out at 4 dollars a day for 24 days, and sell him for 120 dollars; how much will each one gain?

21. A grocer bought 15 barrels of flour for 100 dollars; he sold it so as to gain 20 dollars; how much did he receive per barrel?

22. How long will it take two boys, starting at the same place, and travelling in opposite directions, to be 29076 rods apart, if one goes 5 and the other 7 rods in a minute?

23. If 66 apples are divided equally among 5 boys, how many does each boy receive?

24. If 4 sacks of coffee weigh 523 pounds, what is the weight of each?

25. If 626 dollars are divided equally among 5 men, what will be the share of each?

26. In one week there are 7 days; how many weeks are there in 365 days?

27. If 9 car-loads of freight weigh 141714 pounds, what is the weight of each car-load?

The process of Division may be also performed as follows:

Example 5. How many times is 7 contained in 952?

Divisor.	*Dividend.*	*Quotient.*
7)	952	(136
	7	
	25	
	21	
	42	
	42	

We write the Divisor at the left, and the Quotient at the right of the Dividend, and begin at the left to divide. 7 is contained in 9 hundreds 1 hundred times. 1 is placed in the quotient, and 7 is multiplied by 1 and the product written under 9 and subtracted from 9. The remainder is 2 hundreds or 20 tens. 20 tens + 5 tens = 25 tens. 25 tens ÷ 7 gives 3 tens and a remainder. The 3 is put in the quotient and 7 is multiplied by it. The product, 21, is placed under 25 and subtracted from it. The remainder is 4 tens or 40 units. 40 units + 2 units = 42 units. 42 units ÷ 7 gives 6. 6 is placed in the quotient and 7 is multiplied by it. The 42 is placed under 42 and subtracted as before.

44. This way of performing division is known as **Long Division.** It is usually used when the divisor is greater than 12, since the pupil does not know the multiplication table beyond 12 times.

Example 6. Divide 28314 by 37.

```
37)28314(765
  259
  241
  222
  194
  185
    9
```

37 is not contained in 28 thousands, but is contained in 283 hundreds, 7 hundreds times. The 7 is put in the quotient as the first figure and 37 is multiplied by it, and the product, 259, is subtracted from 283. The remainder is 24. To this remainder 1, the next figure of the dividend, is annexed, and the result, 241 tens, is divided by 37. The quotient is 6 tens. The 6 is placed in the quotient to the right of 7, and 37 is multiplied by 6, and the product, 222, is subtracted from 241. The remainder is 19. To this remainder 4, the next figure of the dividend, is annexed, and the work continued as before.

EXERCISE 52

Divide :

1. 764 by 31.
2. 367 by 41.
3. 987 by 53.
4. 4567 by 61.
5. 2936 by 74.
6. 38271 by 65.
7. 29781 by 56.
8. 71847 by 76.
9. 67654 by 122.
10. 39298 by 801.
11. 80157 by 346.
12. 466281 by 936.
13. 159750 by 425.
14. 539902 by 239.
15. 999999 by 198.
16. 2802690 by 990.
17. 6008005 by 196.
18. 8991 by 144.
19. 9672 by 156.
20. 6192 by 165.
21. 3515 by 173.
22. 9876 by 197.
23. 24197 by 249.
24. 8231 by 190.
25. 13896 by 297.
26. 16084 by 505.
27. 18356 by 1607
28. 57210 by 786.
29. 34494 by 134.
30. 18061 by 35.
31. 56734 by 785.
32. 18425 by 678.
33. 30008 by 897.
34. 70809 by 908.

EXERCISE 53

1. There are 24 hours in a day. How many days are there in 1032 hours?

2. If a man walks 25 miles in a day, how long will it take him to walk 950 miles?

3. Sound moves 37060 feet in 34 seconds. How far will it move in 1 second?

4. A drover bought 23 head of cattle for $736. What was the price per head?

5. In 1 year there are 52 weeks. How many years are there in 6708 weeks?

6. If 75 shares of bank stock sell for $9225, what is the price per share?

7. A man bought a farm of 524 acres for $24104. What was the average price per acre?

8. How many bales could be made out of 281765 pounds of cotton, allowing 517 pounds to the bale?

9. If a steamship sails 5836 miles in 17 days, what would be the average daily distance sailed?

10. A flour barrel holds 196 pounds of flour. How many barrels would it take to hold 406700 pounds?

11. From Montreal to Vancouver is 2948 miles. How long will it take for a man to walk the distance at 24 miles per day?

ABBREVIATED PROCESS IN DIVISION

I. DIVISION BY FACTORS

Example 1. Divide 564 by 12.

$$12\overline{)564}\quad 47$$

$$3\overline{)564}\quad 4\overline{)188}\quad 47$$

$$2\overline{)564}\quad 6\overline{)282}\quad 47$$

Observe how 564 has been divided by 12.

(*a*) What are the factors of 12?

(*b*) How does the result of dividing by the factors of 12 compare with that of dividing by 12?

(*c*) How does the result of dividing by one set of factors compare with that of dividing by the other set?

Example 2. Divide 8769 by 42.

7)8769
6)1252 (7's) and 5 ones over = 5
208 and 4 (7's) over = 28
Remainder = 33

EXERCISE 54

Using factors, divide:

1. 46827 by 27.
2. 87468 by 64.
3. 97648 by 63.
4. 13853 by 45.
5. 8642396 by 35.
6. 7308216 by 49.
7. 8742 by 25.
8. 66842 by 96.
9. 87648 by 81.
10. 419421 by 99.
11. 339240 by 132.
12. 806345 by 144.

13. In a yard there are 36 inches. How many yards are there in 3888 inches?

14. There are 16 ounces in a pound. How many pounds are there in 1968 ounces?

15. How many pounds of beef at 18 cents a pound can be bought for 540 cents?

16. There are 64 pints in a bushel. How many bushels are there in 2688 pints?

17. A farmer sold 24 horses for $5640. How much did he receive apiece for them?

18. How many bushels of oats at 36 cents a bushel can be bought for 13272 cents?

19. If 48 acres of land produce 2064 bushels of corn, how much will be produced from 1 acre?

20. There are 160 acres of land in a quarter section. How many quarter sections are there in a township containing 23040 acres?

II. DIVISION BY 10, 100, 1000, &c.

EXERCISE 55

1. Divide 80, 35, 50, 207, 500, 6003, each by 10.

45. *It will thus be seen that a number is divided by 10 by cutting off the right-hand figure from the dividend and considering it as the remainder and the part to the left of the right-hand figure as the quotient.*

2. How many tens are there in the following:
87? 925? 1235? 3106?

3. Divide the following numbers by 10:
95, 104, 276, 475, 479,
510, 689, 970, 999, 2708.

4. Divide 400, 300, 500, 2000, 6000 by the factors of 100.

46. *It will thus be seen that a number is divided by 100 by cutting off the two right-hand figures from the dividend and considering them as the remainder and the part to their left as the quotient.*

5. How many hundreds are there in 385, 453, 2165?

6. Divide each of the following numbers by 100:
395, 3724, 5196, 4006,
3903, 41204, 47321, 60000.

7. Read the following numbers as thousands:
72000, 4289, 56094.

8. How is any number divided by 1000?

9. Divide each of the following numbers by 1000:
7089, 51875, 64360, 47385,
293306, 78947, 576849, 741846.

Example 3. Divide 8593 by 700.

$$7,00\overline{)85,93}$$

12 and remainder 193.

$700 = 100 \times 7$. Dividing by 100, the quotient is 85 and remainder 93. Dividing 85 by 7, the quotient is 12 and remainder 100. Hence, the quotient is 12 and the remainder 193.

EXERCISE 56

Divide:

1. 725 by 30.
2. 7642 by 60.
3. 8642 by 700.
4. 97861 by 300.
5. 72369 by 90.
6. 94678 by 80.
7. 3786 by 1700.
8. 21500 by 3600.
9. 378751 by 12300.
10. 984721 by 6400.
11. 1684273 by 2500.
12. 9486279 by 15000.

13. There are 60 minutes in an hour. How many hours are there in 3900 minutes?

14. At 80 cents each, how many books can be bought for 1280 cents?

15. If it take 1 man 360 days to do a piece of work, how long will it take 20 men?

16. If $2590 was paid for 70 acres of land, find the price per acre.

17. A train runs at the average speed of 30 miles per hour. How long will it be in going 2790 miles?

18. It costs 4950 cents to buy the carpet for a room at 110 cents a yard. How many yards were bought?

19. How many farms, each having 200 acres in it, are there in a township containing 27800 acres?

EXERCISE 57

1. The divisor is 8, the dividend 44, and the quotient 5. Find the remainder.

2. Given the divisor, the dividend, and the quotient, how do you find the remainder?

3. The divisor is 12, the quotient 7, and the remainder 5. Find the dividend.

4. Given the divisor, the quotient, and the remainder, how do you find the dividend?

5. The divisor is 9, the dividend 61, and the remainder 7. Find the quotient.

6. Given the divisor, the dividend, and the remainder, how do you find the quotient?

7. The quotient is 9, the dividend 115, and the remainder 7. Find the divisor.

8. Given the quotient, the dividend, and the remainder, how do you find the divisor?

9. The divisor is 85, the quotient 109; there is no remainder. Find the dividend.

10. The divisor is 97, the quotient 203, the remainder the largest possible. Find the dividend.

EXERCISE 58

1. What number divided by 75 will give a quotient of 117 and a remainder of 39?

2. What is the least number that must be taken from 9765 so that it may be exactly divisible by 132?

3. Of what number is 483 both divisor and quotient?

4. What number larger than 216 will divide 75168 without a remainder?

5. What is the least number that must be added to 38472 so that it may be exactly divisible by 379?

6. The answer to a question in multiplication is 1404336; the multiplicand is 5163. What is the multiplier?

7. If the quotient is 5000 when the divisor is 2001 and the remainder 100, what is the dividend?

8. What number divided by 528 will give 36 for quotient and leave 44 as a remainder?

9. The divisor is the difference between 785 and 693, the quotient is their sum, and the remainder is the largest possible. Find the dividend.

10. Find the smallest number which added to 98765 will make it exactly divisible by 579.

EXERCISE 59

1. What number besides 1001 is contained an exact number of times in 271271?

2. Find the smallest number which subtracted from 78964 will make it exactly divisible by 881.

3. The divisor is 1001, the quotient 221, and the remainder the largest possible. Find the dividend.

4. The divisor and quotient are each 795, and the remainder the largest possible. Find the dividend.

5. When 213 is added to the dividend, it is exactly divisible by 383, the quotient being 587. Find the dividend.

6. In a division question the quotient is 5 times and

the divisor is 9 times the remainder. Find the dividend, the remainder being 29.

7. The quotient is 709, the divisor 584, and the remainder one-half of the divisor. Find the dividend.

8. By what number must 76 be multiplied to give the same product as 1444 and 504?

9. The product of three numbers is 93869, and the product of two of them is 1591. Find the third number.

10. When 123 is subtracted from the dividend, it is exactly divisible by 578, and the quotient is 847. Find the dividend.

MISCELLANEOUS PROBLEMS

NOTE.—It is not intended that all these should be worked by every pupil. The teacher should select those to be worked.

EXERCISE 60

1. A carpenter can earn $45 a month; his expenses are at the rate of $24 a month. He wishes to purchase a lot of ground which contains 19 acres, and is held at $42 per acre. In what time may he save enough to make the purchase?

2. A farmer bought land from *A* at $60 an acre, and the same quantity from *B* at $85 an acre. The whole amounted to $53215. How many acres did he buy from each?

3. A merchant sold a piece of cloth containing 45 yards, another piece containing 57 yards, and another containing 63 yards, at $14 a yard. What did the whole amount to?

4. A man left $2535 to each of his four children, but one of them dying, the three remaining children divided

the money equally among them. How much did each receive?

5. A farmer has 24 cows and 93 sheep, worth $1521; if the sheep are worth $5 each, how much is each cow worth?

6. If 28 men earn 7980 cents in a day, and 25 boys earn 5450 cents in a day, how much more does one man earn in a day than one boy?

7. How many barrels of flour at $6 a barrel are equal in value to 1100 tons of coal at $9 a ton?

8. A clerk's sal. ry is $1200 a year; he pays $5 a week for board, $2 a month for car fare, and his other expenses amount to $1 a day. How much can he save in a year?

9. Mr. Jones bought a farm of 100 acres at $75 an acre, $2200 to be paid down, and the remainder in five equal yearly instalments. What must he pay each year?

10. A man has 13 piles of wood, each containing 25 cords, and each cord 128 cubic feet. How many cubic feet of wood has he?

EXERCISE 61

1. If 3 pounds of coffee cost 30 cents, what will 8 pounds cost?

The cost of 3 pounds of coffee = 30 cents.
" 1 pound " $= \frac{30}{3} = 10$ cents.
" 8 pounds " $= 8 \times 10$ cents $= 80$ cents.

2. What will 15 slates cost, if five slates cost 80 cents?

3. If 4 trees cost 72 cents, what will 3 trees cost?

4. If 6 barrels of flour cost $48, what will 7 barrels cost?

5. What will be the cost of 16 cords of wood, if 4 cords cost $24?

6. If 7 pounds of beef cost 56 cents, what will 5 pounds cost?

7. If 12 men can earn $36 in a day, how much can 4 men earn in the same time?

8. In 52 years there are 18980 days. How many days are there in 65 years?

9. Twenty-five barrels of flour weigh 4900 pounds. What is the weight of 36 barrels?

10. If you can buy 765 yards of cloth for $51, how many yards can you get for $376?

EXERCISE 62

1. If 7 men do a piece of work in 36 days, in how many days can 28 men do it?

Time for 7 men to do the work = 36 days.
" 1 man " " $= 7 \times 36$ days.
" 28 men " " $= \frac{1 \times 36}{28} = 9$ days.

2. If 15 workmen can do a piece of work in 25 days, in what time can 25 men do the same?

3. A field can be mowed by 40 men in 9 days. In how many days would it be finished by 30 men?

4. If 16 men can build a house in 20 days, how long would it take 10 men to build it?

5. If 19 men can finish a work in 437 days, how long will it take 23 men to do the same work?

6. If 18 horses can cart away the earth from a cellar in 75 days, in how many days would 27 horses do this work?

7. Ten men engage to build a house in 63 days, but 3 of them being taken sick, how long will it take the rest to build the house?

8. If 6 carpenters can build a house in 72 days, how long would it take 9 carpenters to build the same?

9. How long will it take 40 men to build a wall, if 12 men can do it in 20 days?

10. How long will it take 9 men to do the same amount of work that 6 men can do in 15 days?

EXERCISE 63

1. If 4 men can dig a garden in 7 days, how many men would be required to dig it in 1 day?

2. If 28 men can mow a field of grass in 15 days, how many men will be required to mow it in 4 days?

3. If 7 men can reap a field of wheat in 18 days, how many men would be required to do the same work in 6 days?

4. A piece of work was to have been performed by 144 men in 36 days, but a number of them having been discharged, the work was performed in 48 days. How many men worked?

5. How many men, in 26 days, can perform the same amount of work that 39 men can do in 76 days?

6. A drain is dug by 49 men in 96 days. How many men would have been required to dig it in 84 days?

7. A gentleman met a number of beggars, and relieved 9 of them by giving 25 cents to each one. How many would he have relieved for the same sum had he given them only 15 cents apiece?

8. A merchant balancing his accounts found that he had on hand merchandise worth $475, and cash amounting to $2570; he had lost by bad debts $250, and owed $525. If his original capital was $2000, what had he gained?

9. A cistern containing 13500 gallons is filled by two pipes, one discharging 250 gallons an hour and the other

300 gallons; but, by a leak in one of the pipes, 100 gallons are lost in an hour. If the cistern is empty, how long will it take to fill it?

10. There are 160 acres of land in a quarter section. How many quarter sections are there in a township containing 23040 acres?

11. The Province of Quebec has 65 members in the Dominion Parliament. The population of Quebec in 1901 was 1648898. Find the average population per member.

ORAL EXERCISE

1. Find the result of $8 \times 7 \div 4$.

2. Simplify $7 + 8 \times 9$ and $7 \times 6 - 3 \times 8$.

3. If a boat sails 8 miles per hour, how far will it go in 6 hours?

4. A farmer sold 7 sheep at \$5 each, and 8 pigs at \$6 each. How much did he receive in all?

5. At \$3 per yard, how many yards of cloth can be bought for \$54?

6. When \$12 is paid for 2 barrels of flour, how many barrels can be bought for \$66?

7. Simplify $12 \div 6 \times 9 + 23$.

8. The sum of the product of two numbers and 8 is 36; one of the numbers is 4. Find the other.

9. What number subtracted five times from 263 leaves 3 for remainder?

10. The remainder is 4, the quotient 7, and the divisor 9. Find the dividend.

11. If it takes 8 men 9 days to do a work, how many days will it take 3 men to do it?

12. From 7 times 12 take 8 times 7, and add 17 to the remainder.

CHAPTER VI

SIMPLE FRACTIONS

47. If an object, for example a line, or an apple, be divided into two equal parts, each part is called a half and is written $\frac{1}{2}$. If the object be divided into three equal parts, each part is called a third and is written $\frac{1}{3}$; two of the parts taken together are called two-thirds, being written $\frac{2}{3}$.

48. The parts of the whole $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, are called **fractions.**

A **fraction** is, therefore, one or more of the equal parts into which a whole is divided.

Any one thing is called a **unit.**

A fraction is always written by means of two numbers, one above and the other below a line, thus, $\frac{2}{3}$ meaning two-thirds, $\frac{3}{4}$ meaning three-fourths.

49. The **Denominator** or **name-giver** is the number below the line and shows into how many equal parts the whole is divided.

50. The **Numerator** or **numberer** is the number above the line and shows how many of the equal parts named by the denominator are to be taken.

The numerator and denominator are called the **terms** of a fraction.

1. What are the terms of each of the following fractions and what does each term indicate : $\frac{3}{5}$, $\frac{4}{5}$, $\frac{1}{5}$, $\frac{3}{4}$, $\frac{5}{8}$?

2. Find the following : $\frac{1}{3}$ of 12 inches ; $\frac{3}{4}$ of 8 inches ; $\frac{2}{5}$ of 10 cents.

3. Draw a line AD three inches long

Divide it into three equal parts at the points B and C.

$AB = \frac{1}{3}$, ; $BC = \frac{1}{3}$; $CD = \frac{1}{3}$; $AC = \frac{2}{3}$; $BD = \frac{2}{3}$.

Divide AB, BC, CD equally at points E, F, G. The line is now divided into 6 equal parts.

$AE = \frac{1}{6}$, $AB = \frac{2}{6}$, $AF = \frac{3}{6}$, $AC = \frac{4}{6}$, $AG = \frac{5}{6}$, $AD = \frac{6}{6}$ of the line.

4. Why is the whole line equal to $\frac{6}{6}$?

How long are the following: AB? BC? CD? AE? AF? AG?

$AF = 1$ inch + $\frac{1}{2}$ an inch, written $1\frac{1}{2}$ inches; $AG = 2\frac{1}{2}$ inches.

51. When a number consists of a whole number and a fraction, as $1\frac{1}{2}$, $2\frac{1}{3}$, it is called a **mixed number.**

EXERCISE 64

Read:

1. $\frac{4}{7}$ 2. $\frac{5}{8}$ 3. $\frac{3}{5}$ 4. $\frac{1}{9}$.

Write in figures:

5. Three-eighths. 6. Four-sevenths. 7. Five-eighths.

8. Find the value of the following:

$\frac{1}{2} + \frac{1}{2}$; $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$; $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$; $\frac{1}{4} + \frac{3}{4}$.

9. How many halves are there in 1? in 2? in $2\frac{1}{2}$?

10. How many thirds are there in 1? in 2? in $4\frac{2}{3}$?

11. How many fourths are there in 1? in 2? in $2\frac{3}{4}$?

12. (*a*) Draw a line 2 inches long and divide it into halves and then into quarters.

(*b*) How many quarters are equal to one-half?

13. (*a*) Draw a line 3 inches long and divide it into 6 equal parts.

(*b*) How many sixths are there in one-half the line?

(*c*) How many sixths are there in one-third of the line?

(*d*) How many sixths are there in one-half and one-third together?

14. Find the value of the following:

$\frac{1}{2} + \frac{1}{4}$ $\quad$ $\frac{1}{2} + \frac{3}{4}$ $\quad$ $1\frac{1}{2} + 2$

$2\frac{1}{2} + 1\frac{1}{4}$ $\quad$ $2\frac{1}{4} + 3\frac{2}{4}$. $\quad$ $2\frac{1}{2} + \frac{1}{2}$

EXERCISE 65

1. Find the value of the following:

$\frac{1}{2} - \frac{1}{4}$ $\quad$ $1 - \frac{3}{4}$ $\quad$ $2\frac{1}{2} - \frac{3}{4}$

$\frac{1}{2} - \frac{1}{3}$ $\quad$ $1 - \frac{2}{3}$ $\quad$ $2 - \frac{2}{3}$

2. How many inches are there in 2 half-inches? in 4 half-inches? in 8 half-inches? in 9 half-inches?

3. How many feet are there in the following: 3-thirds of a foot? 6-thirds of a foot? 9-thirds of a foot? 8-thirds of a foot?

4. Change the following to whole numbers:

$\frac{2}{2}$, $\frac{3}{3}$, $\frac{12}{4}$, $\frac{24}{3}$, $\frac{12}{6}$.

5. Multiply each of the following fractions by 4:

$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{2}{6}$.

6. How many halves are there in $\frac{2}{2}$? in $\frac{4}{2}$? in $\frac{8}{2}$? in $\frac{12}{2}$? in $\frac{12}{4}$? in $\frac{20}{4}$?

7. Find the amount of the following bill:

$7\frac{1}{2}$ pounds sugar at 6 cents.
$6\frac{1}{4}$ yards linen at 60 cents.
$12\frac{1}{2}$ pounds coffee at 32 cents.
$21\frac{3}{8}$ pounds cheese at 16 cents.

8. Simplify $\frac{1}{2}$ of 50 cents + $\frac{1}{3}$ of 36 cents + $\frac{1}{4}$ of 100 cents + $\frac{1}{5}$ of 40 cents.

9. Add $\frac{1}{2}$ and $\frac{1}{3}$; $\frac{3}{4}$ and $\frac{3}{8}$; $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$.

10. Reduce $4\frac{1}{2}$ to thirds and $5\frac{3}{4}$ to quarters.

11. Simplify $\frac{1+1+1}{2} + \frac{11-3}{4}$.

12. Find the sum of $\frac{1}{2}$ of \$60, $\frac{1}{4}$ of \$64, and $\frac{1}{6}$ of \$36.

13. From $\frac{1}{2}$ of \$100 take $\frac{1}{4}$ of \$32 and find $\frac{1}{4}$ of the remainder.

14. Find the difference in length between $\frac{1}{2}$ of 2 feet and $\frac{1}{4}$ of 3 feet.

ORAL EXERCISE

1. Find $\frac{1}{2}$ of \$12 and compare it with $\frac{1}{4}$ of \$12.

2. Add together one-third of 60 and two-thirds of 18.

3. Give the length of the following fractions of a foot: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$.

4. Find the value of 5 yards of cloth at \$1$\frac{1}{2}$ a yard.

5. How many fifths are there in $5\frac{1}{5}$? in $7\frac{2}{5}$?

6. Of what number is 12 the $\frac{1}{2}$?

7. One fifth of a number is 7. Find the number.

8. How many quarters are there in $5\frac{1}{4}$?

9. A horse cost \$100 and a sleigh $\frac{1}{5}$ as much. Find the cost of the sleigh.

10. Explain how to find $\frac{1}{5}$ of any unit.

11. A man owned 42 acres of land. He sold $\frac{1}{7}$ of his farm. How many acres did he sell?

12. Find $\frac{1}{3}$ of 15 and $\frac{1}{7}$ of 21.

13. From $\frac{1}{8}$ of 24 take $\frac{1}{3}$ of 15.

14. How many units are there in 18-thirds?

15. How many thirds are there in $12\frac{1}{3}$?

CHAPTER VII

DENOMINATE NUMBERS

I. DEFINITIONS AND TABLES

52. Concrete Numbers (Art. 31) are of two kinds:

(1) Those which specify objects, as 3 apples, 10 men, 50 stars.

(2) Those which express that a definite measure of some kind is repeated, as 3 acres, 10 hours, 50 pounds.

53. The Unit. The object specified or the measure repeated is called a **unit**, as 1 apple, 1 man, 1 acre, 1 hour.

Different units may be used to express the same quantity. For example, the length of a table may be 2 yards or 6 feet, since there are 3 feet in 1 yard.

54. Denominate Numbers. Those concrete numbers which express that a definite measure is repeated are called **denominate numbers.**

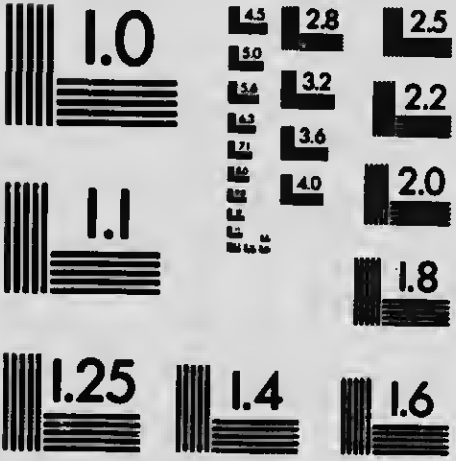
55. Simple Quantity. When a denominate number is expressed in terms of one unit, it is called a **simple quantity**, as 4 feet, 3 yards, 5 hours.

56. Compound Quantity. When a denominate number is expressed in terms of two or more different units, it is called a **compound quantity**, as 2 feet 6 inches; 5 acres 25 square yards, 4 dollars 25 cents.

57. In ordinary commercial transactions it is necessary to have certain constant measuring units. The following tables give the more commonly used of these measures and indicate their use:

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

I. CANADIAN MONEY

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

10 mills = 1 cent.
100 cents = $1.

NOTE 1. The present 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.

NOTE 2. The *mill* is not coined. When the final result of a business computation contains mills, if 5 or more, they are reckoned 1 cent, and if less than 5 they are rejected.

NOTE 3. This table of money is also used in the United States.

EXERCISE 66

1. How many cents are there in $2? in $3? in $5?
2. How many cents are there in $3.16? in $4.25?
3. How many cents are equal to a five-dollar bill?
4. How many cents are there in one dollar and a half?
5. How many dollars are there in 400 cents?
6. How many dollars and cents are there in 375 cents?
7. How many ten-cent pieces are there in $4?
8. What is the difference in value between $2 and 200 cents? between 425 cents and $4.25? between 40 five-cent pieces and $2?

58. In the foregoing examples it will be observed that the same quantity (Art. 53) is expressed in terms of different units, viz., dollars and cents, etc.

The process of changing a number denoting a quantity from one measuring unit to a number denoting the same quantity in another measuring unit, is called **Reduction.**

There are two kinds of Reduction :

(*a*) Reduction when the unit is changed to one of a *lower value.* This is **Reduction Descending.**

(*b*) Reduction when the unit is changed to one of a *higher value.* This is **Reduction Ascending.**

EXERCISE 67

Reduce to cents :

1. \$5.
2. \$29.18.
3. \$7.36.
4. \$141.36.
5. \$17.04.
6. \$200.09.

Reduce to dollars and cents :

7. 368 cents.
8. 3641 cents.
9. 700 cents.
10. 7008 cents.
11. 1236 cents.
12. 910988 cents.
13. From 7169 cents subtract \$37.93.
14. From 5 times 78 cents subtract $\frac{1}{4}$ of \$12.16.
15. Express in cents the following parts of a dollar: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$, and $\frac{1}{3}$.
16. Add the following without using columns :
    (*a*) \$9.41, \$26.35, \$164.78, \$47, \$7.69.
    (*b*) \$19, \$49.78, \$63.27, \$812.35, \$24.
    (*c*) \$36.75, \$40.16, \$365, \$79.25, \$64.82.

II. MEASURE OF LENGTH

12 inches (in.)	make	1 foot,	or	1 ft.
3 feet, or 36 inches	"	1 yard,	"	1 yd.
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	"	1 rod,	"	1 rd.
40 rods, or 220 yards	"	1 furlong,	"	1 fur.
8 furlongs, or 320 rods, or 1760 yards	"	1 mile,	"	1 mi.
100 links	"	1 chain	"	1 ch.
22 yards, or 66 feet	"	1 chain	"	1 ch.
80 chains, or 5280 feet	"	1 mile	"	1 mi.
6 feet	"	1 fathom.		

NOTE 1. The mile used in this table is called a *Statute Mile*. The geographical or nautical mile, also called a *knot*, is equal to 1.15 statute miles. The knot is used in estimating the speed of vessels.

NOTE 2. Gunter's chain is used in measuring land. It is 22 yards in length, and is divided into 100 links, each link being 7.92 inches long.

NOTE 3. The Hand, the breadth of the hand and thumb, is 4 in., and is used in measuring the height of horses at the shoulder.

Ex. 1. How many feet are there in 12 rd. 3 yd. 2 ft. ?

rd.	yd.	ft.
12	3	2
$5\frac{1}{2}$		
66		
3		
69 yd.		
3		
209 ft.		

1 rd. $= 5\frac{1}{2}$ yd.; 12 rd. = 12 times $5\frac{1}{2}$ yd. or 66 yd.
66 yd. + 3 yd = 69 yd.; 1 yd = 3 ft.
69 yd = 69 times 3 ft. = 207 feet.
207 ft. + 2 ft. = 209 ft.

Ans. 209 ft.

Ex. 2. How many rods are there in 209 ft.?

feet	
3)209	
$5\frac{1}{2}$)69 yd	....2 ft.
2	2
11)138	
12	..6 half yd. = 3 yd.

Ans. 12 rd. 3 yd. 2 ft.

3 ft. make 1 yd.; hence, in 209 ft. there are as many yards as the number of times 3 is contained in 209.

$209 \div 3 = 69$ and 2 over. This 2 is 2 ft.

$5\frac{1}{2}$ yd. = 1 rod; hence, in 69 yd. there are as many rods as the number of times $5\frac{1}{2}$ is contained in 69.

$69 \div 5\frac{1}{2} = 12$ and 3 over. This 3 is 3 yd.

EXERCISE 68

Reduce :

1. 2 mi. 45 rd. to rods.
2. 84 yd. 1 ft. to inches.
3. 12 fath. 1 ft. to feet.
4. 17 hands 2 in. to feet.
5. 4562 rd. to miles.
6. 7689 in. to chains.
7. 145 yd. 1 ft. 6 in. to inches.

Add the following :

8. yd.	ft.	in.	9. mi.	fur.	rd.	10. mi.	yd.	ft.
7	2	9	7	5	16	8	960	2
8	1	7	3	4	19	7	450	1
6	0	5	4	6	35	5	365	1
3	2	0	6	2	20	4	856	2

11. From 25 yd. take 19 yd. 2 ft. 5 in.

12. From 6 times 3 mi. 24 rd. subtract 10 mi. 19 rd.

13. Divide 74 yd. 1 ft. 4 in. by 8.

14. From 10 miles take $\frac{1}{3}$ of 7 mi. 3 fur. 15 rd.

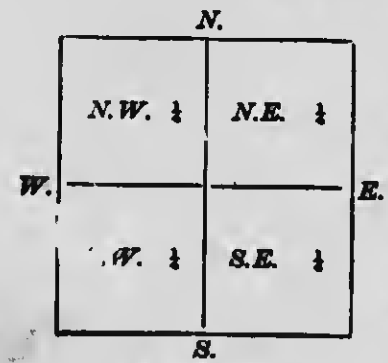
15. In walking a boy steps 2 feet 3 in. How many steps does he take in going 3 miles ?

16. A field is 10 ch. long and there are 440 furrows in it. How many miles did the man walk in ploughing the field ?

III. SURFACE OR SQUARE MEASURE

144 square inches (sq. in.)	make	1 square foot,	or	1 sq. ft.
9 square feet	"	1 square yard,	"	1 sq. yd.
$30\frac{1}{4}$ square yards . . .	"	1 square rod,	"	1 sq. rd.
160 square rods	"	1 acre, . . .	"	1 a.
640 acres	"	1 square mile,	"	1 sq. mi.

NOTE 1. 10,000 square links = 1 square chain.
10 square chains = 4840 sq. yd. = 1 acre.



A SECTION

NOTE 2. A section of land is a tract 320 rods, or 1 mile square, and hence contains 640 acres. It is usually divided into half-sections which are designated North, East, South, or West halves, and into quarter-sections which are known as N.E., S.E., S.W. and N.W. quarters.

NOTE 3. A township is a tract of land six miles square and hence contains 36 sections, which are numbered as follows:

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

A TOWNSHIP

EXERCISE 69

1. How many square inches in 2 sq. ft.? in 5 sq. ft.?
2. How many square feet in 12 sq. yd.? in 9 sq. yd.?
3. How many square yards in 93 sq. ft.? in 117 sq. ft.?
4. How many square rods are there in 5 sq. chains?
5. How many acres are in a section and a half of land?

Reduce:

6. 8 sq. yd. to square inches.
7. 9 sq. yd. 10 sq. ft. to square inches.
8. 17856 sq. in. to square feet.
9. 5 a. 40 rd. to square rods.
10. 7845 sq. rd. to acres.
11. 70 sq. ch. to square rods.
12. 4800 sq. rd. to square chains.
13. 17 sq. yd. 97 sq. in. to square inches.
14. 7645 sq. rd. to acres.
15. 2 quarter-sections to square rods.
16. From 69 a. 10 sq. yd. 3 sq. ft. take 10 a. 15 sq. yd. 7 sq. ft.

17. From 11 times 6 a. 28 sq. rd. 22 sq. yd. take 20 a. 120 sq. rd. 25 sq. yd.

18. Divide 17 a. into 6 equal parts.

19. A piece of land measuring 9 a. was laid out into village lots, each measuring 1320 sq. yd. How many lots were there?

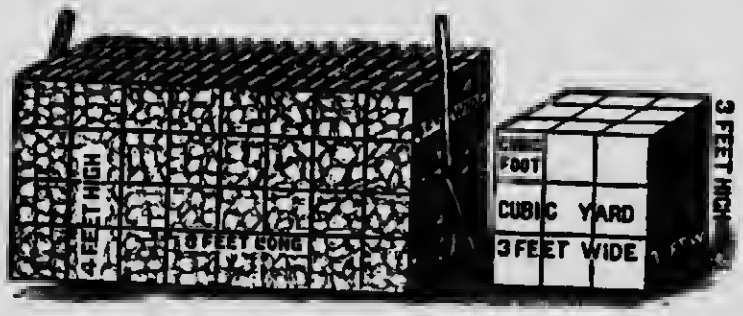
IV. CUBIC OR SOLID MEASURE

1728 cubic inches (cu. in.) make 1 cubic foot, or 1 cu. ft.
27 cubic feet . . . . " 1 cubic yard, " 1 cu. yd.
128 cubic feet . . . . " 1 cord . . " 1 cd.

NOTE 1. A cord is a pile of wood or stone, equal to the volume of a rectangular solid 4 ft. wide, 4 ft. high, and 8 ft. long.

NOTE 2. Firewood and rough stone are measured by the cord.

NOTE 3. 16 cubic feet = 1 cord ft.



EXERCISE 70

1. How many cubic feet in 3 cu. yd.? in 5 cu. yd.?
2. How many cubic feet in 3 cord ft. 12 cu. ft.?
3. How many cubic yards in 54 cu. ft? in 108 cu. ft.?

Reduce:

4. 8469 cu. in. to cubic feet.
5. 78 cu. ft. 640 cu. in. to cubic inches.

6. 7 cords 108 cu. ft. to cubic feet.

7. 9764 cu. ft. to cord feet.

8. 27 cords 6 cord ft. to cubic feet.

9. 9774 cu. ft. to cords, cord feet, etc.

10. 637684 cu. in. to cubic yards.

11. 27 cords 6 cu. ft. to cubic feet.

12. 6414596 cu. in. to cubic feet.

13. 6 cd. ft. 12 cu. ft. to cubic inches.

14. A pile of wood contains 130 cords. From this pile 29 cd. 112 cu. ft. are taken. How much remains?

15. A farmer has five piles of wood, each one containing 12 cd. 96 cu. ft. How much wood has he?

16. How often can 64 cu. in. be subtracted from 80 cu. ft.?

V. AVOIRDUPOIS WEIGHT

16 drams (dr.)	make 1 ounce	or 1 oz.
16 ounces	" 1 pound	" 1 lb.
100 pounds	" 1 hundred-weight, 1 cental	" 1 cwt.
20 hnndred-weight	" 1 ton	" 1 t.

NOTE 1. Avoirdupois Weight is used for weighing everything except jewels, precious metals, and medicines when dispensed.

NOTE 2. The Dominion standard unit of weight is the pound.

NOTE 3. In Great Britain 112 lb. make a hundred-weight, and 2240 lb. make a ton, called the long ton.

NOTE 4. 7000 grains (gr.) = 1 lb. avoirdupois.
437½ grains = 1 oz. avoirdupois.
14 lb. = 1 stone (st.)

EXERCISE 71

1. How many drams in 2 oz.? in 3 oz.?

2. How many ounces in 2 lb.? in 3 lb. 4 oz.? in 4 lb.

3. What part of a pound is 4 oz.? is 8 oz.? is 12 oz.?

4. How many tons in 58 cwt.? in 112 cwt.? in 200 cwt.?

5. How many hundred-weight in 300 lb.? in 575 lb.?

6. How many pounds in 1 t. 1 cwt. 8 lb.? in 2 t. 3 cwt.?

7. Find the cost of 1 lb. 8 oz. of cloves at 5c. per ounce.

Reduce:

8. 2 t. 81 lb. to ounces.

9. 5 lb. 6 oz. to ounces.

10. 21645 oz. to cwt., etc.

11. 7846 dr. to cwt.

12. 1 t. 18 lb. to drams.

13. 76385 oz. to tons, etc.

14. 3 cwt. 8 lb. 5 oz. to ounces.

15. 365 lb. to stones.

16. 42 st. 8 oz. to drams.

17. Find the sum of 19 t. 14 cwt. 15 lb., 15 t. 19 lb. 10 oz., 18 cwt. 14 lb. 7 oz., and 25 t. 9 oz.

18. From 25 t. 7 cwt. 5 lb. take 9 t. 12 cwt. 10 lb. 12 oz.

19. From 6 times 7 t. 3 cwt. 18 lb. take 24 t. 16 lb. 7 oz.

20. From $\frac{1}{2}$ of 19 cwt. subtract 9 times 14 lb. 6 oz.

21. Find the value of 18 t. 15 cwt. of hay at 55c. per hundred-weight.

22. A number of loads of hay weigh together 11t. 17 cwt. If each load weighs 1 t. 19 cwt. 50 lb., how many loads are there?

VI. MEASURE OF CAPACITY

2 pints (pt.)	. . . .	make 1 quart,	or 1 qt.
4 quarts	. . . . .	" 1 gallon,	" 1 gal.
2 gallons	. . . . .	" 1 peck,	" 1 pk.
4 pecks	. . . . .	" 1 bushel,	" 1 bu.

NOTE 1. A gallon, containing 10 pounds of distilled water, is the standard measure of capacity. Its capacity is 277.274 cubic inches. A cubic foot of water weighs 1000 oz. and contains 6¼ gal.

NOTE 2. The measure of capacity is used in measuring water, milk, oil, alcohol, molasses and other liquids, and grain, fruit, salt, lime, and roots.

NOTE 3. In measuring *liquids* the peck and bushel are not used. These are used in measuring *dry articles*, as grain.

NOTE 4. 8 bushels make 1 quarter in Great Britain.

NOTE 5. The following table shows the weight of a bushel of the article named :

Lime . . . . 80 lb.	Parsnips . . 60 lb.	Buckwheat . . 48 lb.
Bituminous coal 70 lb.	Beets . . . 60 lb.	Timothy Seed . 48 lb.
Beans . . . 60 lb.	Wheat . . 60 lb.	Hemp Seed . 44 lb.
Clover Seed . . 60 lb.	Indian Corn . 56 lb.	Castor Beans . 40 lb.
Peas . . . . 60 lb.	Rye . . . 56 lb.	Malt . . . . 36 lb.
Potatoes . . 60 lb.	Flax Seed . 56 lb.	Oats . . . . 34 lb.
Turnips . . . 60 lb.	Onions . . 50 lb.	Blue Grass Seed 14 lb.
Carrots . . . 60 lb.	Barley . . 48 lb.	

NOTE 6. In measuring the capacity of cisterns and reservoirs, the barrel containing 31½ gallons, or the hogshead containing 63 gallons, is used.

NOTE 7. The *wine gallon* contains 231 cubic inches.

NOTE 8. 6 wine gal. = 5 standard gal.

EXERCISE 72

1. How many pints in 4 qt. 1 pt. ?
2. How many bushels in 20 pk. ? in 29 pk. ?
3. How many pk. in 8 bu. 2 pk.? in 12 bu.? in 15 bu.?
4. How many pounds in 2 bu. of wheat? in 3 bu. of oats?
5. Which is heavier, 5 bu. of peas or 8 bu. of castor beans?
6. In 25 pt. of milk, how many gallons are there ?

Reduce :

7. 7684 pt. to bushels.
8. 84 gal. 3 qt. to pints.
9. 36 bu. 3 qt. 1 pt. to pints.
10. 2695 pt. to gallons.
11. 17 qr. 3 bu. to pecks.
12. 3685 lb. of wheat to bushels.

Reduce :

13. 7849 qt. to quarters.

14. 968 lb. of pure water to gallons.

15. 7860 lb. of onions to bushels.

16. 17 bu. 15 lb. of wheat to pounds.

17. A farmer came to town with 25 bu. of potatoes. He sold 5 bu. 1 pk. 1 gal. to one man, 6 bu. 3 pk. to a second, 7 bu. 1 gal. to a third, and 4 bu. 1 pk. 1 gal. to a fourth. What quantity had he left?

18. A farmer sold a load of 24 bags of wheat, each containing 2 bu. 15 lb. How much did he sell?

19. Find the value of the following :

4320 lb. wheat at 67c. per bushel.
624 lb. timothy seed at $3.75 per bushel.
2184 lb. rye at 48c. per bush
2482 lb. oats at 35c. per bushel.

VII. MEASURE OF TIME

60 seconds (sec.)	make	1 minute,	or 1 min.
60 minutes	"	1 hour,	" 1 hr.
24 hours	"	1 day,	" 1 da.
7 days	"	1 week	" 1 wk.
12 calendar months or 365 days	"	1 year	" 1 yr.
366 days	"	1 leap year.	

NOTE 1. The number of days in each month may be remembered by means of the following lines :

Thirty days have September,
April, June, and November :
February has twenty-eight alone—
All the rest have thirty-one ;
But leap year coming once in four
February then has one day more.

NOTE 2. The leap years are those that can be divided by 4 without a remainder: as 1904, 1908, 1912, etc. But of the even hundreds, only those that can be divided by 400 are leap years. The year 1900 was not a leap year, but 2000 will be.

NOTE 3. The civil day begins and ends at 12 o'clock midnight.

NOTE 4. A.M. denotes time before noon; M. denotes noon; and P.M. denotes time after noon.

EXERCISE 73

1. How many hours in 3 days? in 4 days 4 hrs.?
2. How many weeks in 84 days? in 45 days?
3. How many days from 25th Jan. to 17th Feb.?
4. How many minutes in 430 sec.? in 560 sec.?
5. How many minutes in 8 hr.? in 7 hr. 14 min.?

Reduce:

6. 17 hr. 15 min. to seconds.
7. 2 da. 16 hr. to sec.
8. 36841 sec. to days.
9. 3 weeks to seconds.
10. 1 leap year to hours.
11. 425 hr. to weeks.
12. 55555 min. to days.
13. 1 wk. 1 hr. to sec.
14. 168456 sec. to weeks.
15. 1 day 15 min. to seconds.

16. Find the sum of 1 wk. 2 da. 13 hr. 40 min. 30 sec.; 2 wk. 6 da. 10 hr. 8 min. 3 sec.; 5 da. 22 hr. 55 min. 45 sec.; 4 hr. 1 min. 15 sec.; and 1 wk. 2 da. 4 hr. 5 min.

17. How long will it take to count a million coins at the rate of 100 per minute?

18. A speaker began a speech at 9 hr. 28 min. 40 sec. after noon and ended 11 hr. 4 min. 25 sec. after noon. How long did he speak?

19. A watch gains 1 min. 17 sec. in a day. How much will it gain in 14 days?

20. TIME SHEET

MEN	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Hrs. at 20c.	Wages
Thos. Brown.	9	9½	10	8	8½	9		
A. Jones.....	10	10	8	9½	9½	0		
H. James....	8½	9	10	0	9½	8½		
W. Smith....	0	8½	9½	9	10	8½		
J. Porter ...	10	9½	10	9½	10	9½		
W. Brady ...	9½	10	9½	9½	10	9½		

The above is the weekly time sheet of these six men.

(*a*) What are the wages of each man?

(*b*) How much more did Porter earn than Jones?

(*c*) How much did the six men earn in the week?

VIII. CIRCULAR OR ANGULAR MEASURE

60 seconds (″) . . . make 1 minute, or 1′.
60 minutes . . . . " 1 degree, " 1°.
90 degrees . . . . " 1 quadrant, or right angle.
360 degrees . . . . " 1 circumference, or 1 C.

NOTE 1. *Circular or Angular Measure* is used to measure arcs of circles, angles, and in determining latitude, longitude, direction, the position of vessels at sea, etc.

NOTE 2. A degree of the circumference of the earth at the equator contains 60 geographical miles, or 69.16 statute miles.

EXERCISE 74

1. How many minutes in 7°? in 9° 42′?
2. How many minutes in 300′? in 450′?
3. How many degrees in 420′? in 500′?
4. How many quadrants in 360°? in 180°?

5. How many degrees in 2 quad. 36°? in 3 quad. 45°?

6. How much is 4° larger than 225′?

Reduce:

7. 568′ 19″ to seconds.
8. 768′ to degrees.
9. 76895″ to degrees.
10. 5° 17′ 18″ to seconds.
11. 2 C. 34° to seconds.
12. 1 C. 1° 1′ to seconds.
13. 456° 48″ to seconds.
14. 75687′ to quadrants.
15. 3 quad. 42° to minutes.
16. 784567″ to C., etc.

17. Using the protractor make the following angles: 30°, 45°, 60°, 90°, 120°.

18. The angles of a triangle contain 180°. One angle measures 36° 14′ 56″ and another 80° 56′. Find the third angle.

19. Add

27°	16′	45′
36°	24′	42″
47°	36′	28″

20. Multiply 15° 25′ 27″ by 9.

21. From 90° take one-sixth of 47° 25′.

22. How many angles each containing 5° 24′ are there in 360°?

IX. MISCELLANEOUS TABLE

12 units	. . . .	make 1 dozen,	or 1 doz.
12 dozen	. . . .	" 1 gross,	" 1 gro.
12 gross	. . . .	" 1 great gross.	
20 units	. . . .	" 1 score,	or 1 sco.
24 sheets	. . . .	" 1 quire,	" 1 qr.
20 quires	. . . .	" 1 ream,	" 1 rm.
196 lb. flour	. . .	" 1 barrel,	" 1 bbl.
200 lb. pork	. . .	" 1 barrel,	" 1 bbl.

EXERCISE 75

1. How many units in 2 score? in 5 score?
2. How many units in 1 gross? in 3 gross?
3. How many sheets of paper in 2 quires? in 3 quires?
4. How many sheets in 1 ream? in 5 reams?
5. How many quires in 48 sheets? in 120 sheets?
6. How many score in 100 units? in 180 units?
7. How many dozen in 3 score? in 5 score?
8. How many sheets in 1 ream 5 quires?

Reduce:

9. 5768 lb. flour to bbls.
10. 3 rm. 7 qr. to sheets.
11. 6847 lb. pork to bbls.
12. 75 sco. to dozen.
13. 7684 to great gross, etc.
14. 3 bbl. 95 lb. flour to lb.
15. 7869 sheets to rm., etc.
16. 5 rm. 7 qr. to sheets.

17. At a certain examination there were 180 candidates; each used on an average 12 sheets of paper for each subject; there were 15 subjects to be examined on. How many reams of paper were used?

18. A storekeeper buys writing paper at 45c. a quire and sells it at 3c. a sheet. How much does he gain on a ream?

EXERCISE 76 (REVIEW)

1. How many vessels, each holding 2 gal. 3 qt. 1 pt., can be filled out of a cask containing 106 gal. 1 qt. 1 pt.?

2. A merchant receives an order for 10 t. 16 cwt. of flour. He has 100 bbl. on hand. How much must he purchase to fill the order?

3. Find the cost of feeding 30 horses for 20 weeks, when hay is $10 per ton and oats 30c. a bushel, if a horse eats 20 lb. of hay and 8 quarts of oats each day.

4. If *A* walks 3 yd. 2 ft. per minute faster than *B*, in what time will he be 1 mi. ahead of *B*?

5. How many dozen bottles will be required to hold 84 gal. 2 qt. of beer, counting 6 bottles to the gallon?

6. The great bell at Moscow is said to weigh 443772 lb. How much heavier is it than St. Paul's, which weighs 5 t. 14 cwt. 74 lb.?

7. A train 480 ft. long runs past a post in 12 seconds. How many miles an hour is it running?

8. If it takes 5 yd. 2 ft. 3 in. of cloth for a coat, how many coats can be made from 100 yd. of cloth, and how much will remain?

9. A drove of cattle ate 6t. 19 cwt. 87 lb. of hay in a week. How long will 34 t. 19 cwt. 35 lb. last them?

10. How many seconds are there from 4.20 a.m. on Wednesday to 2.10 p.m. on the same day?

11. Find the value of 3120 pt. of molasses at 50c. per gallon.

12. How many chains are there in 8 mi. 418 yd.?

13. How many seconds are there from 12 m. May 28 to 12 m. June 15th?

14. Find the cost of 5 mi. of wire at 2c. per foot.

15. When was it exactly 450000 sec. past noon on January 1st, 1907?

16. A merchant bought 148 bu. of potatoes at 54c. a bushel and retailed them at 25c. per peck. How much did he gain?

17. A tub of butter weighed 40 lb. 12 oz. The tub alone weighed 4 lb. 3 oz. What was the butter worth at 32c. per pound?

18. Silver is $10\frac{1}{2}$ times as heavy as water. Find the weight in tons of 28 c. ft. of silver.

II. GENERAL REVIEW

EXERCISE 77

1. Write in words 7700007 and 75600056.

2. Express 1908 in Roman numerals.

3. Express the product of CMIV and MCIX in Arabic numerals.

4. The sum of six addends in 879624 : the sum of the first two is 123756 ; the third is 84785 ; the fifth is 92368. Find the sum of the fourth and sixth.

5. The remainder is 240635 ; the minuend is 720009. Find the subtrahend.

6. Find the continued product of 16, 24, 22 and 42.

7. The product is 826751 ; the multiplier is 2693. Find the multiplicand.

8. The subtrahend is 34203 ; the remainder is 9645. Find the minuend.

9. The divisor is 803 ; the quotient 759 ; and the remainder 802. Find the dividend.

10. Simplify $876 - 364 - 285 + 7 \times 8 \times 9$.

11. To the third of 609 add $\frac{3}{4}$ of 804.

12. Find the sum of $\frac{1}{2}$ of \$48, $\frac{1}{3}$ of \$69, and $\frac{2}{3}$ of \$120.

13. How much is $\frac{2}{5}$ of \$125 greater than $\frac{3}{4}$ of \$56?

14. In what number is 356 contained 45 times?

15. In an orchard there are 25 rows of trees. If there are 1750 trees in all, how many trees are there in a row?

16. How many times will a cart-wheel 15 feet in circumference, revolve in going 3 miles?

17. The daily sales of a newspaper for 6 days were 25784 copies. If the papers were sold for 2 cents each, how much was received for them?

18. A spool of barbed wire contains 1500 ft. How much does this length of wire weigh, if 12 ft. weigh 1 lb.?

19. At $1.54 per rod, what will it cost to fence a field which is 180 rd. long and 176 yd. wide?

20. Find the number of days from Feb. 22, 1908, to Sept. 10 of the same year.

21. Reduce 72000 seconds to hours.

22. Find the value of 10 doz. eggs at the rate of 3 eggs for five cents.

23. Find the number of square feet in $\frac{1}{2}$ an acre.

24. How many steel rails 30 ft. long are required for a piece of railway track 10 mi. long?

25. How many seconds are there from 12 m. March 3 to 12 m. April 15?

26. If April the first be on Friday, on what day of the week will Empire Day fall? Dominion Day? Christmas Day? New Year's Day?

27. Find the weight in tons of 40 bu. wheat, 56 bu. oats, 25 bu. buckwheat, and 50 bu. turnips.

28. Find the following dates:

(*a*) 60 days after March 7.

(*b*) 90 days after June 10.

29. Find the cost of the following:

7200 lb. wheat at 83c. per bushel.
4200 lb. beans at $1.05 "
3920 lb. rye at 75c. "
and 2880 lb. timothy at $4.75 "

30. A man earns $1500 per year. His expenses are $860. In what time will he save enough to buy a quarter-section of land at $20 an acre?

CHAPTER VIII

PROBLEMS INVOLVING THE PREVIOUS RULES

I. BILLS

TORONTO, August 25, 1908.

James Brown, Esq.

Bought of C. Meredith.

1908			$	c.
Jan. . .	17	15 lb. Coffee at 32c.	4	80
"	23	16 " Lard at 15c.	2	40
Feb. . .	3	25 " Sugar at 13c.	3	25
" . .	20	16 " Ham at 16c.	2	56
" . .	25	25 " Sugar	1	00
" . .	25	2 " Tea at 45c.		90
			$14	91

1. Examine this bill of goods.

(*a*) Where did the transactions take place?

(*b*) At what time did they take place?

(*c*) Who bought the goods?

(*d*) Who sold the goods?

(*e*) When was a bill of the goods sent to the buyer?

(*f*) What quantities of goods were bought and at what prices?

(*g*) What did the whole cost?

59. A bill of goods is called an account, and when sent to the buyer is said to be an account rendered.

TORONTO, August 30, 1908.

William Jones, Esq.

Bought of H. Madill.

1908		$	c.
Jan. 21....	10 yd. Cloth at $1.15	11	50
" 27....	12 yd. Silk at 75c.	9	00
Feb. 10....	6 Hats at $1.75	10	50
		$31	00

Sept. 4th, 1908. Received Payment,

H. Madill.

2. (*a*) Point out points of resemblance between these two bills.

(*b*) In what other respects do they differ than in the time and nature of the transactions?

60. The second bill represents the form of a **receipted account.**

In business, Jones, the purchaser, is usually called the **Debtor.**

TORONTO, Sept. 3, 1908.

John Smith, Dr.

To George Brown.

1908					$	c.
Jan...	1	To 75 lb. of Sugar at $0.12. ..	$9	00		
Feb...	2	" 47 yd. of Cloth at $3.25	152	75		
					161	75
		Cr.				
Jan...	7	By 75 bu. of Corn at $0.78....	$58	50		
Feb...	2	" 43 bu. of Apples at $1.25..	53	75		
					112	25
		Balance due.....			$49	50

Sept. 15th, 1908. Received Payment,

George Brown.

3. Examine this bill and point out wherein these three bills agree.

4. Point out other differences than in the parties, times, and nature of the transactions.

61. The third bill shows that the goods bought by Smith have been paid for in full.

62. A bill should show the place and time of each transaction; the buyer and the seller; the quantity, price, and cost of each article; the total cost, and any payments made.

63. A **bill** is thus a written statement of goods sold or services rendered and payments, if any, made.

64. The purchaser, or person who receives money, goods or services from another, is **a Debtor.**

65. The seller, or person who parts with money, goods, or services to another, is **a Creditor.**

EXERCISE 78

Make out bills for the following accounts, supplying dates and places:

1. Mr. J. Jones bought of R. Walker 10 yd. silk at $2.50; 12 yd. flannel at 40c.; 10 yd. calico at 15c.

2. David Montgomery bought of F. F. McArthur 20 yd. cotton at 11c.; 15 yd. print at 16c.; 12 yd. braid at 6c.; 3 pair gloves at 27c.; 26 yd. dress goods at 63c.; 1 hat at $5.25

3. Robert Davey bought of Murdoch Bros. 18 bags salt at 75c.; 4 bbl. plaster at 98c.; 10 lb. coffee at 35c.; 1 chest tea, 18 lb., at 65c.; 48 grain bags at $3.60 a doz.

4. Levi Van Camp sold Wm. Burns & Co. 257 bu. wheat at 73c.; 475 bu. oats at 36c.; 45 bu. corn at 76c.; 175 bu. peas at 92c.; 367 bu. barley at 69c.

5. Peter Adams bought from Edward Mills the following: 34 lb. sugar at 5½c.; 12 lb. coffee at 30c.; 30 lb. raisins at 11c.; 37 lb. biscuits at 12c.; 13 lb. butter at 23c.; 15 lb. cheese at 17c.; 15 doz. eggs at 18c. Mills bought from Adams 12000 ft. of lumber at $18 per thousand. The balance was settled by cash. Make out a receipted bill.

II. AGGREGATES AND AVERAGES

66. The Aggregate of several quantities of the same kind is their sum. Thus, 31 is the aggregate of 4, 7, 9, 11.

67. The Average of several quantities is that quantity which substituted for each of them will produce an aggregate equal to that of the given quantities. Thus, the average of 8, 0, 9, 11 is 7.

EXERCISE 79

Find the average of:

1. 16, 18, 26, 30, 36, 42, 50, and 56.

2. 17, 0, 20, 30, 70, 100, 27, 9, and 17.

3. 120, 340, 560, 780, 320, and 840.

4. Five pupils obtained the following marks at an examination: 60, 36, 75, 21, and 80 respectively. What was their average mark?

5. There were 45 pupils at school on Monday; 43 on Tuesday; 47 on Wednesday; 45 on Thursday; and 40 on Friday. What was the average attendance for the week?

6. A man trolling caught four fish; the first weighed 12 lb. 8 oz.; the second, 4 lb. 10 oz.; the third, 7 lb. 3 oz.; and the fourth, 9 lb. 7 oz. Find their average weight.

7. The scores of a side at cricket were the following: 22, 14, 0, 16, 4, 3, 0, 18, 17, 5, and 11. Find the aggregate score and the average per man.

8. In a store, for a week, the sales were the following: $355, $450, $440, $370, $285, and $722. Find the average sale each day.

9. A farmer sold 4 loads of wheat from a 10-acre field; the first weighed 54 bu. 16 lb.; the second, 57 bu. 37 lb.; the third, 56 bu. 25 lb.; and the fourth, 53 bu. 18 lb. What was the average weight of each load, and the average yield per acre?

EXERCISE 80

1. The average weight of seven salmon was 9 lb. 5 oz. Find their aggregate weight.

2. The average rate of a train for five hours was 27 mi. 43 rd. Find the distance travelled during the five hours.

3. A grocer sold 5 lb. of tea at 75c. per pound and 2 lb. at 50c. per pound. What was the average price per pound?

4. *A* mixes 25 gal. of water with 125 gal. of vinegar, which cost him 40c. per gallon. How much must he charge per gallon so as to make a gain of $10?

5. I bought 300 bu. of wheat, part at 78c. per bushel and the rest at 72c. per bushel. The average cost was 76c. per bushel. How many bushels of each kind did I buy?

6. The aggregate weight of seven tubs of butter is 185 lb., and of eleven it is 286 lb. Find the average weight of the four tubs.

7. In a factory the foreman receives $15 per week; of the workmen each of three receives $12.50; each of five $10.50, and each of eleven $9. What is the average weekly wage per man?

III. SHARING

EXERCISE 81

Example 1. Divide 100 cents between John and James, so that John may have 16 cents more than James.

Extra for John . . . = 16c.
Sum to be shared equally = (100 − 16)c. = 84c.
James's share . . . = ½ of 84c. = 42c.
John's share . . . . = 42c. + 16c. = 58c.

1. Divide $7.25 between two boys, so that one may have 25c. more than the other.

2. Divide 113 marbles between two boys, so that one may have 9 more than the other.

3. Two boys together weigh 122 lb. 1 oz., and one is 7 lb. 7 oz. heavier than the other. Find the weight of each.

4. Two farms contain together 226 a. 297 yd., and one is 1 a. 232 yd. larger than the other. Find the size of each farm.

5. Divide $2.07 among *A*, *B*, and *C*, so that *B* may have 4c. more than *C*, who will have 34c. more than *A*.

6. Divide 72 marbles among *A*, *B*, and *C*, so that *B* may have 7 more than *A* and 10 less than *C*.

7. Three times the sum of two numbers is 2997, and one is 43 more than the other. Find the numbers.

8. Three men together chopped 112 cords of wood; B chopped 9 cd. 103 c. ft. more than A, and 126 c. ft. less than C. How much did each chop?

EXERCISE 82

1. Divide 150 marbles between two boys, so that one may have 4 times as many as the other.

2. Divide \$200 between A and B, so that for every \$3 that A gets, B shall get \$2.

3. Divide \$1260 between two men, so that when the first receives \$5 the second may receive \$4.

4. Divide \$500 among A, B, and C, so that when A gets \$5, B may get \$6, and C \$9.

5. Divide 63c. among A, B, and C, so that B may have twice as much, and C, 6 times as much as A.

6. Divide \$1.15 between A and B, so that B may have 15c. more than three times as much as A.

7. \$3.90 is made up of twice as many 5-cent pieces and three times as many 10-cent pieces as 25-cent pieces. How many are there of each?

8. A box contains 350 marbles, red, blue, and green. There are 212 red and blue and 250 blue and green. How many of each kind are there?

IV. SIMPLE MEASUREMENTS

(a) THE RECTANGLE

68. A Rectangle is a figure bounded by four straight lines with each of its angles a right angle.

69. There are two kinds of rectangles:

(1) A rectangle which is longer than wide is an **oblong.**

(2) A rectangle with all its sides equal is a **square.**

EXERCISE 83

1. Draw a rectangle 6 in. by 5 in. and find its perimeter.

2. Find the perimeter of a table 4 ft. 6 in. long by 3 ft. 4 in. wide.

3. How many boards, each 12 ft. long, will it take to make a fence 4 boards high round a lot 40 yd. long and 28 yd. wide?

4. How much will it cost to fence a rectangular farm 240 rd. long and 80 rd. wide, at $1.75 per rod?

5. How much will it cost to enclose a mile square of land with wire at 2c. per yd., the fence being seven wires high?

6. A box is 2 ft. long, 1 ft. 6 in. wide, and 1 ft. deep. Find the total length of the edges of the box.

7. A rectangular floor is twice as long as wide, and is 60 ft. in perimeter. Find its dimensions.

8. A rectangular room is 18 ft. long, 13 ft. 6 in. wide, and 12 ft. high. Find the total length of all the edges of the room.

EXERCISE 84

Find the area of the rectangles having the following dimensions:

1. 8 ft. by 12 ft.
2. 6 ft. 6 in. by 14 ft.
3. 21 ft. by 25 ft.
4. 2 yd. 2 ft. by 7 yd.
5. 17 yd. by 20 yd. 2 ft.
6. 19 ft. 7 in. by 24 ft.

7. What will it cost to plaster a room 18 ft. long, 14 ft. wide, and 9 ft. high, at 17c. a square yard?

8. Find the surface of a pane of glass measuring 37½ in. long and 23 in. wide.

9. How many square inches are there in the surface of a box 2 ft. 3 in. long, 1 ft. 9 in. wide, and 1 ft. 3 in. deep?

EXERCISE 85

1. A rectangle 16 ft. long contains 168 sq. ft. Find its width.

2. The top of a table 2 ft. 3 in. wide contains 6 sq. ft. 108 sq. in. Find its length.

3. A rectangular surface contains 10 sq. ft. If it is 6 ft. long, find its width.

4. Find the perimeter of a rectangular plot 27 yd. long which contains 240 sq. yd.

5. A rectangular room is 13 ft. 6 in. wide and its floor contains 24 sq. yd. Find its length.

6. It costs $43.75 to cover a floor with linoleum at $1.25 per square yard. The room is 21 ft. long. How wide is it?

7. A box 3 ft. long and 2 ft. 4 in. wide has 27 sq. ft. 48 sq. in. in its surface. How deep is the box?

8. The walls of a room contain 84 sq. yd. The room is 12 ft. nigh. Find the perimeter of the room.

9. A room 12 ft. high is 5 ft. longer than wide; its walls contain 96 sq. yd. Find its dimensions.

10. There are 1056 sq. ft. in the walls of a rectangular room 28 ft. long and 16 ft. wide. How high is it?

EXERCISE 86

1. Draw an oblong 8 in. long and 6 in. broad. Find its area. Draw a diagonal. Find the area of each of the triangles formed.

2. Draw oblongs of any size. Join the opposite corners. Compare the area of a triangle with that of an oblong.

3. Find the area of the following right-angled triangles:

(*a*) Base 16 ft., perpendicular 20 ft.

(*b*) Base 24 ft., perpendicular 18 ft.

4. A right-angled triangle contains 24 sq. in. It is 12 in. in perpendicular height. Find its base.

5. The base of a triangle is 10 in. and the perpendicular height is 8 in. Find the area of the triangle.

6. A triangle with a base of 12 ft. is equal in area to a square with a side of 8 ft. Find the height of the triangle.

8. Fill in the following blanks:

Base.	Perpendicular.	Area of right-angled triangle.
8 ft.	10 in.	?
?	4 ft.	360 sq in.
$5\frac{1}{2}$ ft.	?	$30\frac{1}{4}$ sq. ft.

(*b*) CARPETING

70. (*a*) Examine a room that is carpeted. Observe how the carpet is made. Notice in what direction the strips run, from end to end, or from side to side.

(*b*) A room is 15 ft. wide. How many strips of carpet running lengthwise will cover the floor if the carpet is a yard wide? Show this by a diagram.

(*c*) If a room is 13 ft. 6. in. wide, how many strips of carpet 27 in. wide, running lengthwise, will cover the room ?

(*d*) If a room is 15 ft. wide, how many strips of carpet 27 in. wide, running lengthwise, will be required?

In computing how much carpet is required for a room there are two modes of procedure: (1) *the mathematical*, when the quantity of carpet equal to the floor space is found, and (2) *the practical*, when the number of strips of carpet required is first found, an allowance being made for matching the pattern and for turning under a part at the side in case the width of the carpet exceeds the width of the room.

EXERCISE 87

1. How many yards of carpet 27 in. wide will be required for rooms whose dimensions are:

(*a*) 27 ft. by 21 ft. ? (*c*) 18 ft. by 24 ft. ?

(*b*) 15 ft. by 12 ft. ? (*d*) 26 ft. by 36 ft. ?

Find the cost of carpeting rooms whose dimensions are:

2. 18 ft. by 20 ft., with carpet 3 ft. wide, at $1.20 a yd.

3. 20 ft. by 24 ft., with carpet 30 in. wide, at 90c. a yd.

4. 15 ft. by 17 ft. 6 in., with carpet 3 ft. wide, at $1 a yd.

5. How many strips of carpet 27 in. wide are needed for a square room 18 ft. long ?

6. Fill in the blanks in the following:

	Length of room.	Breadth.	Width of carpet.	Length in yards.	Price per yard.	Total price.
(*a*)	24 ft.	18 ft.	27 in.	?	$1.10	?
(*b*)	27 ft.	?	3 ft.	54	$1.25	?
(*c*)	32 ft.	?	27 in.	?	$1.25	$160

7

(*c*) PLASTERING

71. Observe a plastered room. Note the base-board. Notice the other parts not plastered.

(*a*) What is saved if there are doors and windows?

(*b*) What is lost by reason of the doors and windows?

In reckoning the area to be plastered there are two methods of procedure: (1) *the mathematical*, where the exact number of square yards to be plastered is found by deducting the area of all the doors and windows from the total area of the walls; and (2) *the practical* method, where only half the area of the doors and windows is taken from the total area of the walls. The nearest whole number of square yards in the remainder is the area for which the plasterer is to be paid.

EXERCISE 88

1. How many square yards of plastering are there in the ceiling of a rectangular room 18 ft. by 16 ft.?

2. How many square yards of plastering are there in the walls and ceiling of a rectangular room 22 ft. by 18 ft. and 12 ft. high?

3. Find the cost of plastering the walls of a rectangular room 30 ft. by 24 ft. and 15 ft. high, at 21c. per sq. yd.

4. It costs $11.44 to plaster the ceiling of a rectangular room 24 ft. long, at 33c. per sq. yd. Find the width of the room.

5. At 25c. per sq. yd. find the cost of plastering the walls and ceiling of a rectangular room 24 ft. by 21 ft. and 12 ft. high, making no allowance for deductions.

6. How much would the cost of plastering the room in the last example be reduced if there are 3 doors 8 ft. by 4 ft. and 3 windows 7 ft. by 4 ft.?

(*d*) PAPERING

72. Examine the walls of a room that is papered. How do the strips run? How wide are they? Observe how the paper is matched, so that the pattern is preserved.

In Canada and the United States, wall paper is usually made into rolls 8 yd. long, or double rolls 16 yd. long and 18 in. wide. In Great Britain the usual width of wall paper is 21 in.

Example 1. How many yards of paper 16 in. wide will be required for a room 18 ft. long, 14 ft. wide, and 8 ft. high, which contains one door 7 ft. high by $3\frac{1}{2}$ ft. wide, and 3 windows, each 5 ft. high by $2\frac{1}{2}$ ft. wide?

Length of surface to be covered $= (18+14+18+14)$ ft. $= 64$ ft.
Area of entire walls . . . $= (8 \times 64)$ sq. ft. $= 512$ sq. ft.
Area of door . . . . . $= \left(\frac{42 \times 7}{12}\right)$ sq. ft. $= 24\frac{1}{2}$ sq. ft.
Area of 3 windows . . . $= \left(\frac{3 \times 30 \times 5}{12}\right)$ sq. ft. $= 37\frac{1}{2}$ sq. ft.
Area of door and windows . $= (24\frac{1}{2}+37\frac{1}{2})$ sq. ft. $= 62$ sq. ft.
Area to be papered . . . $= (512-62)$ sq. ft. $= 450$ sq. ft.
450 square feet . . . . . $= (450 \times 144)$ sq. in.;
$\therefore$ length of paper required . $= \frac{450 \times 144}{16} = 4050$ in.
$= 112\frac{1}{2}$ yards.

EXERCISE 89

1. How many yards of paper 20 in. wide will be required for a room 20 ft. long, 15 ft. wide, and 9 ft. high?

2. How many yards of paper 30 in. wide will it require to cover the walls of a room 15 ft. by 12 ft. by 8 ft.

3. How many yards of paper 21 in. wide are needed to paper the walls of a room 37 ft. by 26 ft. by 12 ft.

4. A room 24 ft. long, 20 ft. wide, and 10 ft. high contains 2 doors, each 7 ft. by 4 ft., and 6 windows, each $5\frac{1}{2}$ ft. by 4 ft. Find how many yards of paper 2 ft. wide will be required to paper it.

(e) MEASUREMENT OF LUMBER

73. Lumber is measured by **the board foot,** which is a square foot of board 1 in. thick. Lumber less than an inch thick is reckoned as if it were 1 in. thick. Thus, a board 16 ft. long, 1 ft. wide, and $\frac{1}{2}$-inch thick is sold for 16 ft. board measure.

Lumber more than an inch thick is sold by the number of feet, board measure, to which it is equivalent. Thus, a plank 16 ft. long, 1 ft. wide, and 2 in. thick, contains 32 ft. board measure.

EXERCISE 90

Find the number of board feet in the following:

1. A board 12 ft. long, 10 in. wide, and 1 in. thick.
2. A board 18 ft. long, 9 in. wide, and 1 in. thick.
3. A board 16 ft. long, 10 in. wide, and 3 in. thick.
4. How many feet, board measure, are there in 100 scantlings 18 ft. long, 4 in. wide, and 4 in. thick?
5. How much lumber will be required to fence a rectangular lot 66 ft. by 120 ft. with a close board fence 6 ft. high?
6. How many thousand (M) feet are there in the following:

(a) 250 boards 12 ft. × 10 in. × $\frac{3}{4}$ in.?
(b) 360 " 16 ft. × 12 in. × 2 in.?
(c) 275 joists 21 ft. × 4 in. × 4 in.?
(d) 300 planks 18 ft. × 12 in. × 3 in.?

(*f*) ROOFING

74. (*a*) Observe the roof of a house covered with shingles or slates. Describe how the shingles are laid. How many rows of shingles are there usually in the lowest course?

(*b*) If possible, measure the length of shingle exposed to the weather.

(*c*) Observe a bunch of shingles. How are they packed together? How many layers are there on each end?

(*d*) Measure the width of a bunch of shingles.

(*e*) If a shingle is 4 in. wide, how many shingles are there in one row? in 25 rows? in 50 rows? in the bunch?

75. Shingles are considered to average 4 in. in width, and are generally laid 4 in., $4\frac{1}{2}$ in., or 5 in. to the weather. For convenience they are put up in bunches consisting of 25 layers on each side, 20 in. wide. Thus, there are 5 shingles in a layer and 250 in a bunch.

EXERCISE 91

Find the number of shingles to cover the following:

1. A rectangular surface 24 ft. by 12 ft., the shingles being laid 4 in. to the weather.

2. A rectangular surface 36 ft. by 15 ft., the shingles being laid 5 in. to the weather.

3. The two sides of the gable roof of a barn 40 ft. long, and each slope being 16 ft. 8 in. wide, the shingles being laid 5 in. to the weather.

4. It requires 96 bunches of shingles to cover a gable roof 64 ft. long. How wide is each slope, the shingles being laid 4 in. to the weather?

5. At 15c. per square foot, what will a tin roof for a building 36 ft. long and 19 ft. 6 in. wide cost?

(*g*) RECTANGULAR SOLIDS

76. The length, width, and depth of a box or brick are its **Dimensions.**

77. A body having three dimensions is a **solid.** The space it occupies is its **volume.**

78. A solid bounded by six rectangular faces is a **Rectangular Solid.**

Example 1. Find the number of cubic feet in a room 16 ft. long, 14 ft. wide, and 9 ft. high.

No. of cu. ft. which can be placed on length = 16 cu. ft.
" " " " upper surface = (14 × 16) cu. ft.
Whole number of cubic feet in room = (9 × 14 × 16) cu. ft.
= 2016 cu. ft.

EXERCISE 92

Find the cubic content of the rectangular solids whose dimensions are :

1. 8 ft., 6 ft., 5 ft.

2. 2 ft. 6 in., 5 ft. 4 in., 7 ft.

3. 3 ft., 7 ft. 6 in., 8 ft. 4 in.

4. 2 ft., 3 ft. 6 in., 5 ft.

5. How many bricks will be required to build a wall 45 ft. long, 20 ft. high, and 15 in. thick, each brick being 8 in. long, 4 in. wide, and 3 in. thick ?

6. What will it cost to put a stone foundation under a barn 36 feet long by 24 ft. wide, at $2 a cubic yard, the wall being 7 ft. high and 2 ft. thick ?

7. The breadth and thickness of a beam are 20 in. and 15 in., respectively. Find the length of a piece which contains 10 cu. ft.

8. How many cords of wood are there in a pile 50 ft. long, 16 ft. high and 5 ft. wide?

9. How many cubic feet are there in a tank 9 ft. 6 in. long, 5 ft. 3 in. wide, and 3 ft. 4 in. deep?

ORAL EXERCISE

1. Find the cost of 15 oranges, when 3 cost 11 cents.

2. John has 3 times as much money as James; both have 64c. How much has each?

3. A newsboy saves 112c. in 8 days. How much will he save in 30 days at this rate?

4. Multiply 50 by 4, subtract 75, add 15, divide by 5, and multiply by 3. What is the result?

5. The divisor is 7, the quotient 9, and the remainder 3. Find the dividend.

6. If it takes $2\frac{1}{2}$ min. to walk a furlong, how long will it require to walk a mile?

7. How many square feet are there in an oblong 8 ft. by $4\frac{1}{2}$ ft.?

8. How many minutes are there between 9 in the morning and 20 min. to 12?

9. At 75c. a bushel, how many bushels of wheat must be given for 5 barrels of flour at $6 a barrel?

10. The sum of the product of two numbers and 9 is 37; one of the numbers being 4, find the other.

11. If 3 boxes of strawberries cost 25c., find the cost of $1\frac{1}{2}$ dozen boxes.

12. Find the cost of sending a telegram of 17 words, at 25c. for 10 words and 1c. for each additional word.

V. GENERAL REVIEW

EXERCISE 93

1. A room is 18 ft. long, 15 ft. wide, and 9 ft. high. Find: (*a*) The area of the four walls.

(*b*) The area of the floor and ceiling.

2. Find the average length of four boards which are 10 ft. 6 in., 12 ft., 12 ft. 6 in., and 16 ft. long.

3. How many yards of carpet 27 in. wide are required for a room 27 ft. by 18 ft.?

4. A wheel 12 ft. in circumference turns round 99 times in going from one side of a field to the other. How wide was the field in rods?

5. A farmer has 36 bags of wheat on his load. If each bag holds $2\frac{1}{4}$ bu., find the weight of his load.

6. In a six-roomed school, the number of children present on Monday was 54, 36, 48, 52, 34, 42. Find the average per room.

7. A merchant owed a debt of £250. He paid at one time £85 17s. 6d. and at another £76 13s. 4d. How much did he still owe?

8. A garden is 66 ft. wide and 99 ft. deep.

(*a*) Find its perimeter in chains.

(*b*) Find its area in square rods.

9. The divisor and quotient are each 207 and the remainder is the largest possible. Find the dividend.

10. How many cords of wood are there in a pile 36 ft. long, 16 ft. wide, and 12 ft. high?

11. After 304 was subtracted 19 times from a number, the remainder was 540. Find the number.

12. How many bnshels of oats will weigh as much as 170 bnshels of potatoes?

13. The snbtrahend is 25307, and the remainder is 7847. Find the minuend.

14. To the snm of MDIV and CMXLIX add the prodnct of XCVIII and CXXIX.

15. How many fathoms deep is the sea where it is 5796 ft. deep?

16. A rectangular room is 25 ft. long and 18 ft. wide. Find the cost of covering it with oilcloth at $1.16 per square yard.

17. If sound travels at the rate of 1120 ft. per second, in what time will the sonnd of a cannon shot 7 mi. off be heard?

18. *A* walks 3 yd. 2 ft. per minute faster than *B*; in what time will he have walked 2½ miles farther than *B*?

EXERCISE 94

1. A farmer gave $43.50 for sheep, at the rate of $7.25 for 3 sheep. How many did he buy?

2. If 18 chickens cost $4.20, how much will 3 chickens cost?

3. A merchant bonght 9 pieces of cloth, each containing 50 yd., for which he paid $2317.50. What was the cost of a single yard?

4. I owe $276 and paid $17.25 on it. How many times must I pay such a sum to cancel the debt?

5. I retail envelopes at 12c. a pack, gaining 3c. on each pack of 24. What did they cost me per thousand?

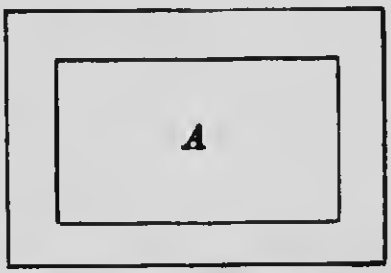
6. A grocer sold 9760 lb. of flour at $1.25 per 100 lb. What was the amonnt of the sale?

7. Messrs. Smith & Co. burn in their store, in a year, 62560 cu. ft. of gas. What is their gas bill for a year, at $1.50 per 1000 cu. ft.?

8. The charge of sending a telegram to a certain place is 40c. for 10 words and 5c. for each additional word. What would a despatch of 24 words cost me?

9. There are 3072 cu. ft. of masonry in a stone wall under a barn 60 ft. long. The wall being 8 ft. high and 2 ft. thick, how wide is the barn?

10. This is the plan of a hall, scale $\frac{1}{4}$ in. to 24 ft. *A* is a carpet. Find the following:



(*a*) The cost of flooring it at $120 per thousand.

(*b*) The cost of the carpet at $2.00 per square yard.

(*c*) The cost of oiling and polishing the uncovered part of the floor at 45c. per square yard.

11. At an election there were three candidates, *A*, *B*, and *C*; the total number of votes polled was 7734. The successful candidate, *A*, got 203 votes more than *C*, who got 107 votes less than one-third of the total vote polled. What was *A*'s majority over *B*?

12. If the continued product of 275, 376, 484, and 196, be divided by $77 \times 28 \times 47 \times 55$, what will be the quotient?

13. If 80 men have sufficient provisions for 75 days, and 20 men go away, how long will they last the rest?

14. *A* bought 600 bu. of wheat, part at 80c. per bushel, and the rest at 75c. The average price was 77c. How many bushels of each kind did he buy?

CHAPTER IX

FACTORS, CANCELLATION, MEASURES, MULTIPLES

I. FACTORS

79. Even Numbers are those which are exactly divisible by 2, as 2, 4, 6, 8.

80. Odd Numbers are those which are not exactly divisible by 2, as 3, 5, 7, 9.

81. A Composite Number is one which can be formed by multiplying together two or more numbers, each greater than one, as 4, 6, 15, 21.

82. A Prime Number is one which has no other factors than one and the number itself, as 5, 7, 11.

83. The **Prime Factors** of a number are the prime numbers which, when multiplied together, will produce it; thus, 2, 2, and 3 are the prime factors of 12.

EXERCISE 66

1. Write seven even numbers.
2. Write seven odd numbers.
3. Write the composite numbers less than 50.
4. Write the prime numbers less than 50.
5. Which of the following numbers are exactly divisible by 2: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50?
6. In what figures do numbers that are exactly divisible by 2 end?
7. Which of the above numbers are exactly divisible by 5?

8. In what figures do numbers that are exactly divisible by 5 end?

9. (*a*) Which of the following numbers are exactly divisible by 3 : 112, 126, 312, 415, 414, 537, 442?

(*b*) Divide the sum of the digits of these numbers by 3.

84. *It will be seen that a number is exactly divisible by 3 when the sum of its digits is so divisible.*

(*c*) Which of these numbers are exactly divisible by 9?

85. *It will be seen that a number is exactly divisible by 9 when the sum of its digits is so divisible.*

10. What are the prime factors of 21, 25, 35, 27?

11. What prime factor is found in both 6 and 9?

12. What prime factor is found in both 20 and 26?

13. What prime factors are common to 12 and 30?

14. What prime factor is common to 35 and 50? to 14 and 70? to 33 and 99? to 42 and 48? to 26 and 39?

86. To resolve a number into its prime factors.

Example 1. Find the prime factors of 105.

$$\begin{array}{r} 3)105 \\ 5)35 \\ 7 \end{array}$$

Dividing 105 by 3, a prime factor, we have 35; dividing 35 by 5, a prime factor, we have 7, a prime number, therefore the prime factors of 105 are 3, 5, 7.

EXERCISE 96

Find the prime factors of :

1. 48.	5. 175.	9. 429.	13. 313.
2. 72.	6. 270.	10. 276.	14. 336.
3. 81.	7. 160.	11. 800.	15. 855.
4. 108.	8. 325.	12. 180.	16. 1155.

EXERCISE 97

What prime factors are common to :

1. 50 and 70 ?
2. 81 and 96 ?
3. 40 and 54 ?
4. 27 and 72 ?
5. 72 and 112 ?
6. 140 and 176 ?
7. 63 and 147 ?
8. 220 and 600 ?
9. 315 and 525 ?
10. 500 and 600 ?
11. 360 and 480 ?
12. 540 and 864 ?

EXERCISE 98

1. Write the numbers less than 50 of which 7 is a factor.

2. Write the numbers between 200 and 300 of which 13 is a factor.

3. Write down all numbers less than 144 of which 11 is a factor.

4. Find the largest factor other than the number itself of each of the following numbers : 18, 42, 729, 579, 913.

5. Resolve the following numbers into as many pairs of factors as possible : 64, 84, 96, 100, 120, 500.

6. Write down all the divisors of 84 ; of 96 ; of 100.

7. Find three prime numbers that will divide each of the following : 42, 66, 105, 165, 1001.

II. CANCELLATION

87. On page 54 it was shown that division can be performed by dividing by the factors of the divisor in succession.

Thus, $\frac{24}{6} = \frac{24}{2 \times 3} = \frac{12}{3} = 4.$

We may also factor both divisor and dividend and obtain the result by dropping the factors common to both.

Thus, $\frac{24}{6} = \frac{2 \times 3 \times 4}{2 \times 3} = 4.$

88. The process of shortening operations in division by rejecting or *cancelling* equal factors common to both dividend and divisor, is **Cancellation.**

Example 1. Divide $18 \times 36 \times 48$ by $24 \times 54 \times 12$.

$$\frac{\overset{1}{\cancel{18}} \times \overset{3}{\cancel{36}} \times \overset{2}{\cancel{48}}}{\underset{1}{\cancel{24}} \times \underset{3}{\cancel{54}} \times \underset{1}{\cancel{12}}} = \frac{1 \times \cancel{3} \times 2}{1 \times \cancel{3} \times 1} = \frac{1 \times 1 \times 2}{1 \times 1 \times 1} = 2.$$

EXERCISE 99

1. Divide $16 \times 4 \times 5$ by $8 \times 2 \times 10$.
2. Divide $7 \times 16 \times 6$ by $14 \times 3 \times 8$.
3. Divide $9 \times 7 \times 16 \times 16$ by $21 \times 32 \times 2$.
4. Divide $27 \times 12 \times 14$ by $9 \times 4 \times 7$.
5. Divide $72 \times 45 \times 140$ by $18 \times 24 \times 35$.
6. Divide $24 \times 32 \times 36 \times 144$ by $64 \times 108 \times 8$.
7. How many yards of muslin, worth 12c. a yard, may be bought for 16 lb. of butter, worth 15c. a pound?
8. How many bushels of potatoes at 75c. a bushel must a farmer give for 36 yd. of carpet worth $1.50 a yard?
9. A tailor bought 12 pieces of cloth, each containing 22 yd., worth $2.25 a yard; he made 27 suits of clothes. How much must he get per suit so as not to lose?
10. If a farmer exchange 75 bu. of wheat at 72c. a bushel for cloth at 40c. a yard, how many yards does he get?

III. HIGHEST COMMON FACTOR

89. Whether two or more numbers have a common factor or not, can at once be determined by resolving them into prime factors.

EXERCISE 100

Name a common factor:

1. Of 6 and 9.
2. Of 12 and 10.
3. Of 27 and 24.
4. Of 16 and 20.

What is the highest common factor:

5. Of 12 and 10?
6. Of 20 and 15?
7. Of 25 and 50?
8. Of 24 and 72?

90. A number which will exactly divide each of two or more numbers is a **Common Factor** of these numbers.

91. The largest number which will exactly divide each of two or more numbers is called the **Highest Common Factor (H. C. F.)** of these numbers.

92. Numbers which have no common factor are said to be **prime to one another.**

Example 1. Find the H. C. F. of 12 and 16.

$12 = 2 \times 2 \times 3$
$16 = 2 \times 2 \times 2 \times 2$

The common factors are 2 and 2. Hence 4, the product of the common factors, is the H. C. F.

93. The H. C. F. is conveniently found as follows:

Example 2. Find the H. C. F. of 24, 36, and 54.

$$\begin{array}{r|rrr} 2 & 24, & 36, & 54 \\ \hline \cancel{2} & 12, & 18, & 27 \\ \hline \cancel{2} & 6, & 9, & 27 \\ \hline 3 & 3, & 3, & 27 \\ \hline & 1, & 3, & 9 \end{array}$$

$24 = 2 \times 2 \times 2 \times 3.$

By trial, 2 and 3 are found to be factors of the other numbers; $\cancel{2}$ and $\cancel{2}$ are not common factors, and so are crossed out.

EXERCISE 101

Find the H.C.F. of:

1. 24 and 90.
2. 36 and 84.
3. 48 and 128.
4. 65 and 143.
5. 42 and 189.
6. 15, 20, 30.
7. 16, 20, 24.
8. 24, 96, 80.
9. 28, 56, 42.
10. 30, 50, 60.
11. 84, 126, 210.
12. 120, 240, 72.
13. 44, 110, 77.
14. 75, 300, 450.
15. 144, 576, 720.
16. 216, 360, 405.

94. In examples with **concrete** numbers, a common factor is called a **common measure** and the H.C.F. is called the **Greatest Common Measure (G.C.M.)** Thus, a rod 3 feet long can be used to measure exactly distances of 9 ft. and 12 ft., because 3 is a common factor of 9 and 12.

EXERCISE 102

1. A man has two logs which he wishes to cut into boards of equal length; one is 24 ft. and the other is 16 ft. long. What is the greatest length into which the boards can be cut?

2. What is the greatest equal length into which two trees can be cut, one being 105 ft. in length and the other 84 ft.?

3. Three pieces of carpet, of 48 ft., 64 ft., and 80 ft., respectively, if cut into the longest possible equal lengths, will exactly fit a parlor floor, each piece being the length of the parlor. How long is the parlor?

4. When two numbers prime to each other are multiplied by the same number, they become 589 and 779. Find the multiplier and also the other numbers.

5. Jack has 475 lb. of sugar and Tom has 817 lb. to put up into parcels of the same weight. Find the fewest number of parcels each must put up.

6. Find the largest number that will divide 661, 876, and 1004, leaving as remainders 10, 15, and 17, respectively.

7. Two cisterns are of 4672 gal. and 5088 gal., respectively. Find the largest barrel capable of measuring both cisterns.

IV. LEAST COMMON MULTIPLE

95. A number which is one or more times another number is called a **Multiple** of that number.

Thus, 12 is a multiple of 3; 15 is a multiple of 5.

96. Any number is a factor of its multiple and will, therefore, be contained in it exactly. Hence, the *multiple* of a number is a number which will *contain it exactly.*

(1) Write 4 multiples of 5.

(2) Find a number that is a multiple of both 4 and 5.

97. A number into which each of two or more numbers will exactly divide, is **a Common Multiple** of these numbers.

Thus, 36 is a common multiple of 4 and 6, because it is exactly divisible by both 4 and 6.

98. The least number into which each of two or more numbers will exactly divide, is **the Least Common Multiple (L. C. M.)** of these numbers.

Example 1. Find the least common multiple of 24, 20, and 33.

$24 = 2 \times 2 \times 2 \times 3$

$20 = 2 \times 2 \times 5$

$33 = 3 \times 11$

L. C. M. $= 2 \times 2 \times 2 \times 3 \times 5 \times 11 = 1320.$

The L. C. M. of the given numbers must contain the factors 2, 2, 2 and 3, to be divisible by 24; it must contain the factors 2, 2 and 5, to be divisible by 20; it must contain the factors 3 and 11, to be divisible by 33. Since the number 1320 contains all these factors and no others, it is the least common multiple of 24, 20, and 33.

EXERCISE 103

Find the L. C. M.:

1. Of 15, 10 and 5.
2. Of 20, 10 and 30.
3. Of 9, 12 and 18.
4. Of 10, 25 and 30.
5. Of 24, 30 and 36.
6. Of 5, 9, 12 and 15.
7. Of 12, 15, 18 and 24.
8. Of 22, 55, 77 and 110.
9. Of 15, 30, 42 and 72.
10. Of 21, 54, 56 and 84.
11. Of 5, 7, 16, 28, 48 and 21.
12. Of 16, 12, 14, 32, 50 and 75.
13. Of 15, 18, 24, 40, 50, 60 and 90.
14. Of the even numbers from 14 to 28, inclusive.
15. Of the odd numbers from 13 to 25, inclusive.

EXERCISE 104

1. What is the least number which, divided by 8, by 12, or by 14, gives in each case the remainder 5?

2. What is the least sum of money for which I can purchase sheep at $6, or cows at $28, or horses at $150 a head?

3. What is the least number of bushels of wheat that would make an exact number of full loads for three drays hauling, respectively, 24 bu., 30 bu., or 36 bu. a load?

4. What is the least number of cents with which you could buy an exact number of lemons at 6c. each, or oranges at 8c., or bananas at 10c., or pineapples at 16c.?

5. What must be the capacity of a cask which can be emptied exactly by measures of 3 pt., 1 qt., 2 qt. 1 pt., 3 qt. 1 pt., and 1 gal.?

6. Three boys run round a circular track. The first can make the circuit in 12 min., the second in 15 min., and the third in 18 min. After what time will all three be at the starting point together?

7. What is the least size of a farm that may be divided into 13-acre lots, 14-acre lots, or 21-acre lots?

8. Find the least capacity of a cistern so that it could be filled in an exact number of minutes by each of three pipes which supply 42 gal., 63 gal., or 147 gal. per minute.

EXERCISE 105 (REVIEW)

1. How do you determine whether a given number is prime or composite? Which of the following numbers are prime and which composite: 611, 643, 707, 757, 991, 1089?

2. Divide the continued product of 6, 15, 16, 24, 12, 21, and 17 by the continued product of 2, 10, 9, 8, 36, 7, and 51.

3. What is the least number of dollars that will purchase an exact number of cows at $24 each, sheep at $6 each, or horses at $127 each?

4. What is the least number which, divided by 18, 21, or 30, gives 13 for remainder in each case?

5. A man owns 3 tracts of land containing 525, 725, and 875 acres, respectively. He wishes to divide each tract into lots that will contain the same number of acres,

and this the largest number possible. Of how many acres must his lots consist?

6. Define Highest Common Factor and Prime Factor, and explain when a number is Odd and when Even.

7. What is the quotient of $144 \times 75 \times 15 \times 32 \times 23$, divided by $432 \times 25 \times 8 \times 30$?

8. What is the least number of marbles that can be divided equally among 16, 21, 24, or 30 boys?

9. The product of four consecutive numbers is 840. Find the numbers.

10. What is the least number of acres in a farm that can be exactly divided into lots of 12 a., 15 a., 18 a., or 25 a. each?

11. The prime factors of a number are 2, 3, 5, 7, and 11. Find the number.

12. Find the prime factors of 1800.

13. The product of two numbers is 24157 and 7 times one of them 833. Find the numbers.

14. Divide the continued product of 40, 27, 32, and 3 by the continued product of 5, 8, 12, 8, and 27.

15. A farmer exchanged 9 tubs of butter, each containing 56 lb., worth 25c. per pound, for 4 chests of tea, each containing 42 lb. What was the tea worth per pound?

ORAL EXERCISE

1. Which of the following numbers are prime and which composite: 27, 29, 37, 39, 55, 57?

2. Find common multiples of 3 and 4; of 4 and 6.

3. Name the prime factors of 44; of 56; of 68.

4. Find the H.C.F. of 24, 30, and 42.

5. Find the L.C.M. of 4, 6, 8, and 12.

6. Find the least number that, divided by 5 and 7, leaves 3 for remainder in each case.

7. The prime factors of a number are 3, 7, and 11. Find the number.

8. Simplify $(7 \times 5 - 4 \times 7 + 6 \times 8) \div 11$.

9. What is the least number of cents with which I can buy apples at 2c., lemons at 3c., or oranges at 5c.?

10. What is the smallest number which, added to 56, will make it a multiple of 13?

V. GENERAL REVIEW

EXERCISE 106

1. Write 730006070305 in words, and sixty-four billion, sixty-five thousand in figures.

2. When the subtrahend is subtracted twice from 7082 the remainder is 368. Find the subtrahend.

3. If 117 t. of coal are worth $702, how much are 234 t. worth?

4. The perimeter of a room is 80 ft. and it is 8 ft. longer than it is wide. Find its length.

5. When full, a bin holds 12 t. of coal; three loads of 2 t. 17 cwt., 2 t. 14 cwt., and 2 t. 10 cwt., have been put into it. How much more will it hold?

6. How often can $\frac{3}{4}$ of a foot be taken from $2\frac{1}{4}$ ft.?

7. A milk-dealer delivers 26 gal. 1 qt. of milk each day. If each customer takes on the average 1 qt. 1 pt. from him, how many customers has he?

8. One log is 3 times as long as another and the length of both together is 43 ft. 8 in. Find the length of each log.

9. Add together $\frac{3}{4}$ of 144 and $\frac{1}{4}$ of 250.

10. How many cords are there in a pile of wood 480 ft. long, 22 ft. wide and 18 ft. high?

11. If a boy runs 15 ft. in a second, how far will he run in 10 min. at this rate?

12. A quilt is 2 yd. 1 ft. 6 in. long, and 2 yd. broad. It is made from 3-in. squares. How many squares are there?

13. A grocer bought sugar at 6c. per pound and sold it at 8c. and thereby gained $15.80. How many pounds of sugar did he buy?

14. Without dividing, determine which of the following numbers contain 3 an exact number of times: 111, 233, 343, 426, 536, 1234, 3234, and 3145.

15. Find the value of $\frac{1}{2}$ of $360 + $\frac{2}{3}$ of $90 + $\frac{3}{5}$ of $75.

16. A horse was sold for $130 which was a quarter more than it cost. Find the cost.

17. A train goes at the rate of 45 mi. an hour. How many feet does it go per second?

18. Make out the following account, render it on June 3, and receipt it on June 6: James Smith bought of Edward Ryan 75 cords of hardwood at $4.50, 10 t. coal at $7.25, 25 cd. pine at $3.75. He paid cash $175.

19. In a certain shop 8 men receive $10 per week, 16 receive $8 per week, and 26 receive $6 per week. Find the total wages paid per week.

20. Find the prime factors of 2520.

21. How many thousand feet of lumber are there in 1500 boards, each 16 ft. long, 9 in. wide and 3 in. thick?

22. How many tons of wheat at 65c. a bushel will pay for a binder costing $130?

CHAPTER X

VULGAR FRACTIONS

I. PROPER FRACTIONS, IMPROPER FRACTIONS

EXERCISE 107

1. (*a*) Name the unit in each of the following :

$\frac{1}{3}$, $\frac{2}{3}$ ft., $\frac{5}{7}$ lb., $\frac{3}{4}$ apple.

(*b*) How does the value of each fraction compare with that of the unit?

(*c*) How does the numerator of each fraction compare with the denominator as to magnitude?

99. Fractions in which the numerator is less than the denominator are **Proper Fractions.**

2. Name the proper fractions with the following denominators : 3, 4, 5, 6, and 8.

3. (*a*) Name the units in each of the following : $\frac{2}{3}$, $\frac{3}{5}$, $\frac{1}{4}$ apple, $\$\frac{4}{5}$.

(*b*) How does each fraction compare in value with its unit?

(*c*) Compare the numerator of each fraction with its denominator.

4. (*a*) Compare the value of the following fractions with that of the unit : $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{3}$, $\frac{4}{4}$ ft., $\$\frac{6}{5}$.

(*b*) Compare the numerator of each with its denominator.

100. Fractions in which the numerator is equal to or greater than the denominator are **Improper Fractions.**

5. Name three improper fractions having 4 for denominator; having 5 for denominator; having 8 for denominator.

II. REDUCTION OF FRACTIONS

(a) REDUCTION OF WHOLE OR MIXED NUMBERS TO IMPROPER FRACTIONS

EXERCISE 108

1. (*a*) How many pints are there in 3 quarts 1 pt.?
   (*b*) How many half-feet are there in 3 ft. and $\frac{1}{2}$ a ft.?
2. (*a*) How many quarts are there in 5 gal. 3 qt.?
   (*b*) How many quarters are there in $\$6\frac{3}{4}$?
3. (*a*) How many inches are there in 5 ft. 8 in.?
   (*b*) How many twelfths are there in $5\frac{8}{12}$?

Example 1. Reduce $12\frac{3}{4}$ to fourths.

$1 = 4$ fourths,
$12 = 48$ fourths,
$12 + \frac{3}{4} = 48$ fourths $+ 3$ fourths $= \frac{51}{4}$.

EXERCISE 109

Reduce to improper fractions:

1. $4\frac{1}{2}$.	5. $4\frac{5}{9}$.	9. $16\frac{1}{8}$.
2. $5\frac{1}{4}$.	6. $7\frac{3}{8}$.	10. $24\frac{3}{5}$.
3. $7\frac{3}{4}$.	7. $8\frac{3}{10}$.	11. $18\frac{1}{7}$.
4. $7\frac{5}{6}$.	8. $5\frac{7}{12}$.	12. $20\frac{7}{12}$.

13. How are mixed numbers reduced to improper fractions?

14. A man divided $\$8\frac{3}{4}$ equally among 5 boys. How many quarter dollars did each receive?

15. How many lots, each containing $\frac{1}{8}$ a., would $7\frac{1}{4}$ a. make?

(*b*) REDUCTION OF IMPROPER FRACTIONS TO WHOLE OR MIXED NUMBERS

EXERCISE 110

1. How many yards are there in 6 ft.? in 15 ft.?

2. How many feet are there in $\frac{2}{3}$ ft.? in $\frac{14}{3}$ ft.?

3. How many integral units are there in $\frac{8}{4}$? in $\frac{12}{3}$? in $\frac{12}{2}$?

Example 1. Reduce $\frac{125}{8}$ to a mixed number.

$\frac{125}{8} = 125 \div 8 = 15\frac{5}{8}$. Since 8 eighths = 1, 125 eighths are equal to as many units as the number of times 125 eighths contain 8 eighths, or $15\frac{5}{8}$ units.

4. How many dollars are there in $\$\frac{210}{4}$? in $\$\frac{320}{4}$? in $\$\frac{41}{4}$?

5. How many integral units are there in $\frac{45}{5}$? in $\frac{17}{3}$? in $\frac{20}{3}$?

6. How many dollars will be needed to give each of 25 boys $\$\frac{1}{4}$?

Reduce the following fractions to whole or mixed numbers:

7. $\frac{10}{5}$.	11. $\frac{20}{3}$.	15. $\frac{103}{7}$.	19. $\frac{205}{15}$.
8. $\frac{31}{6}$.	12. $\frac{102}{6}$.	16. $\frac{117}{9}$.	20. $\frac{442}{11}$.
9. $\frac{45}{7}$.	13. $\frac{70}{6}$.	17. $\frac{432}{10}$.	21. $\frac{237}{13}$.
10. $\frac{75}{10}$.	14. $\frac{110}{8}$.	18. $\frac{245}{16}$.	22. $\frac{270}{9}$.

(*c*) REDUCTION TO LOWEST TERMS

EXERCISE 111

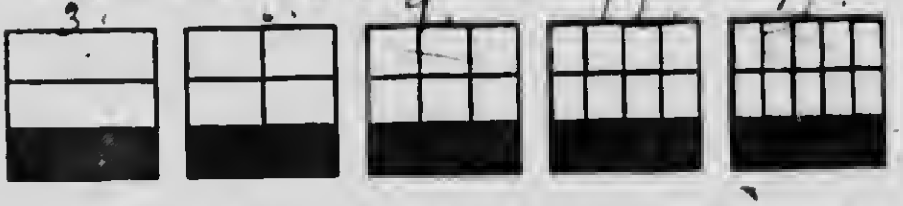
Draw a line 8 in. long and divide it into fourths.

1. How many inches are there in each quarter of the line?

2. By shorter cross lines, divide the line into eighths.

3. How many inches are there in each eighth of the line?

Examine these diagrams to determine the following:



4. How many ninths are there in one-third? in two-thirds?

5. How many twelfths are there in one-third? in two-thirds?

6. How many twelfths are there in one-sixth? in two-sixths? in three-sixths? in four-sixths?

7. How many fifteenths are there in one-third? in two-thirds?

8. Show that 5-fifteenths are equal to 1-third; that 4-twelfths are equal to 1-third.

9. Prove $\frac{1}{6} = \frac{2}{12}$; $\frac{2}{3} = \frac{10}{15}$; $\frac{2}{9} = \frac{6}{27}$.

10. Compare $\frac{1}{4}$ with $\frac{2}{8}$; $\frac{1}{2}$ with $\frac{3}{6}$; $\frac{1}{3}$ with $\frac{4}{6}$; $\frac{1}{3}$ with $\frac{3}{9}$.

11. To what fraction, with 1 for numerator, is each of the following equal:

$\frac{2}{4}$? $\frac{2}{6}$? $\frac{3}{6}$? $\frac{3}{12}$? $\frac{4}{12}$? $\frac{6}{12}$? $\frac{3}{9}$?

12. What has been done to both numerator and denominator of $\frac{2}{4}$ to produce $\frac{1}{2}$? of $\frac{2}{6}$ to produce $\frac{1}{3}$? of $\frac{3}{6}$ to produce $\frac{1}{2}$? of $\frac{3}{12}$ to produce $\frac{1}{4}$?

13. What is the effect upon the value of a fraction of dividing both terms by the same number?

101. *Hence, the value of a fraction is not changed by multiplying or dividing both its terms by the same number.* This is the fundamental principle of fractions.

14. Insert numerators in the following:

$\frac{1}{2} = \frac{\ }{12}$; $\frac{2}{3} = \frac{\ }{15}$; $\frac{3}{4} = \frac{\ }{16}$; $\frac{5}{8} = \frac{\ }{24}$.

15. Insert denominators in the following:

$\frac{1}{4} = \frac{2}{\ }$; $\frac{2}{3} = \frac{10}{\ }$; $\frac{5}{6} = \frac{20}{\ }$; $\frac{2}{5} = \frac{8}{\ }$.

16. Insert denominators in the following:

$1\frac{1}{2} = 1$; $1\frac{2}{5} = 2$; $\frac{14}{21} = 2$; $\frac{3}{8} = 1$; $\frac{10}{15} = 2$.

17. Insert numerators in the following:

$\frac{4}{6} = 3$; $\frac{12}{16} = 4$; $\frac{12}{20} = 4$; $\frac{6}{8} = 4$; $\frac{12}{28} = 7$.

18. Reduce $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ each to twelfths, and $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{8}$ each to twenty-fourths.

19. Reduce $1\frac{3}{2}$, $2\frac{5}{10}$, and $\frac{21}{28}$ each to fourths, and $\frac{3}{9}$, $1\frac{4}{12}$, and $1\frac{6}{18}$ each to thirds.

EXERCISE 112

1. What integral factor greater than 1 is common to the numerator and denominator of the following:

$\frac{5}{6}$, $1\frac{9}{16}$, $\frac{5}{9}$, $1\frac{3}{15}$, $\frac{20}{25}$, $1\frac{4}{15}$, $\frac{20}{24}$, $\frac{15}{28}$?

102. A fraction, such as $1\frac{5}{16}$, $\frac{3}{9}$, $1\frac{4}{15}$, or $\frac{15}{28}$, whose numerator and denominator are prime to each other, is in its **lowest terms.**

2. Which of the following fractions are in their lowest terms: $\frac{3}{9}$, $1\frac{8}{12}$, $\frac{12}{28}$, $\frac{9}{14}$, $1\frac{9}{18}$, $\frac{12}{18}$, $\frac{12}{16}$, $\frac{21}{28}$?

Reduce the following fractions to their lowest terms:

3. $\frac{4}{6}$.
4. $\frac{12}{18}$.
5. $1\frac{8}{12}$.
6. $1\frac{9}{12}$.
7. $3\frac{6}{30}$.
8. $1\frac{10}{15}$.
9. $\frac{21}{28}$.
10. $\frac{14}{21}$.
11. $\frac{18}{20}$.
12. $\frac{24}{30}$.
13. $\frac{21}{24}$.
14. $\frac{24}{40}$.

(*d*) REDUCTION TO COMMON DENOMINATOR

EXERCISE 113

1. Which is the greater, and by how much, 6 gal. or 23 qt.? 4 yd. or 13 ft.? 2 lb. or 35 oz.?

2. Before quantities can be compared, in what unit must they be expressed?

103. Fractions which have the *same number for denominator*, are said to have a **common denominator**, and the fractions are said to be **similar**.

3. Write four fractions with 9 for a common denominator; three with 10 for a common denominator.

Example 2. Reduce $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$ to equivalent fractions with least common denominator.

L. C. M. of 4, 6, 8 = 24.

$$\frac{3}{4}=\frac{6\times3}{6\times4}=\frac{18}{24}$$
$$\frac{5}{6}=\frac{4\times5}{4\times6}=\frac{20}{24}$$
$$\frac{7}{8}=\frac{3\times7}{3\times8}=\frac{21}{24}$$

The L. C. M. of the denominators is 24, hence 24 is the least common denominator. Dividing 24 by 4, the denominator of $\frac{3}{4}$, we find we must multiply 4 by 6 to produce 24, similarly with the other fractions.

EXERCISE 114

Reduce to equivalent fractions having the least common denominator:

1. $\frac{3}{4}$, $\frac{5}{12}$.
2. $\frac{4}{5}$, $\frac{7}{15}$.
3. $\frac{7}{8}$, $\frac{5}{16}$.
4. $\frac{2}{3}$, $\frac{3}{4}$.
5. $\frac{2}{3}$, $\frac{3}{4}$.
6. $\frac{3}{4}$, $\frac{5}{6}$.
7. $\frac{7}{8}$, $\frac{5}{12}$.
8. $\frac{7}{10}$, $\frac{3}{4}$.
9. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.
10. $\frac{2}{3}$, $\frac{5}{6}$, $\frac{3}{8}$.
11. $\frac{1}{2}$, $\frac{7}{8}$, $\frac{5}{6}$.
12. $\frac{5}{6}$, $\frac{1}{3}$, $\frac{7}{12}$.

13. Arrange the following groups of fractions in ascending order of magnitude: $\frac{2}{3}$, $\frac{1}{2}$, $\frac{5}{6}$, $\frac{3}{4}$; $\frac{1}{2}$, $\frac{1}{3}$, $\frac{3}{4}$, $\frac{5}{6}$; $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{5}{6}$.

III. ADDITION OF FRACTIONS

EXERCISE 115

1. What is the sum of 2-elevenths, 3-elevenths, and 5-elevenths?

2. How many ninths are $\frac{2}{9}$, $\frac{4}{9}$, $\frac{1}{9}$, and $\frac{7}{9}$?

3. James paid $\$\frac{1}{5}$ for a slate, $\$\frac{2}{5}$ for a Reader, and $\$\frac{4}{5}$ for an Arithmetic. How much did he pay for all?

4. Mary paid $\$\frac{4}{6}$ for some ribbon, and $\$\frac{5}{9}$ for a pair of gloves. How much did she pay for both?

5. Jane bought $\frac{3}{4}$ of a yard of ribbon at one time and $\frac{7}{8}$ of a yard at another time. How much did she buy at both times? (Reduce $\frac{3}{4}$ and $\frac{7}{8}$ to a common denominator.)

6. A farmer sold $\frac{1}{5}$ of his grain to one man, and $\frac{1}{3}$ of it to another. How much did he sell altogether?

$$\tfrac{1}{5}=\tfrac{6}{30}, \text{ and } \tfrac{1}{6}=\tfrac{5}{30}; \quad \therefore \tfrac{1}{5}+\tfrac{1}{6}=\tfrac{6}{30}+\tfrac{5}{30}=\tfrac{11}{30}.$$

7. If I pay $\frac{1}{4}$ of a dollar for butter, $\frac{3}{5}$ of a dollar for eggs, and $\frac{1}{2}$ a dollar for cheese, how much do I pay for all?

8. Find the sum of $\$2\frac{1}{2}$ and $\$3\frac{1}{3}$.

$$\$2\tfrac{1}{2}+\$3\tfrac{1}{3}=\$(2+\tfrac{1}{2}+3+\tfrac{1}{3})=\$(2+3+\tfrac{1}{2}=\tfrac{1}{3})$$
$$=\$(5+\tfrac{5}{6})=\$5\tfrac{5}{6}.$$

9. How much is $4\frac{1}{4}$ bu. $+3\frac{1}{2}$ bu.? $5\frac{1}{3}$ yd. $+4\frac{1}{2}$ yd.?

EXERCISE 116

Add together the following fractions:

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

Simplify the following:

13. $2\frac{1}{2}+3\frac{1}{3}+4\frac{5}{6}$.

14. $5\frac{2}{3}+3\frac{3}{4}+5\frac{7}{12}$.

15. $4\frac{5}{6}+3\frac{1}{3}+7\frac{1}{12}$.

16. $2\frac{1}{4}+3\frac{5}{6}+7\frac{5}{12}$.

EXERCISE 117

1. Simplify $\frac{3}{8}+2\frac{1}{4}+3\frac{1}{2}$.

2. If A spends $\frac{1}{3}$ of his money on Monday, and $\frac{2}{5}$ of it on Tuesday, what part of it does he spend in the two days?

3. Mr. Smith bought three loads of coal. The first weighed $1\frac{1}{2}$ t., the second $1\frac{1}{4}$ t., and the third $1\frac{5}{12}$ t. How much coal did he buy?

4. John rode $15\frac{1}{2}$ mi. on Monday, $12\frac{3}{8}$ mi. on Tuesday, and $14\frac{1}{4}$ mi. on Wednesday. How far did he ride during the three days?

5. How far is it round a rectangular field $42\frac{1}{4}$ rd. long and $28\frac{3}{8}$ rd. wide?

6. A woman sold $12\frac{1}{2}$ lb. of butter on Monday, $15\frac{1}{4}$ lb. on Tuesday, $13\frac{1}{3}$ lb. on Wednesday, and $15\frac{3}{4}$ lb. on Thursday. How much did she sell during these four days?

IV. SUBTRACTION OF FRACTIONS

EXERCISE 118

1. John has 7 marbles, James has 4. How many marbles has John more than James?

2. John has $\frac{7}{12}$ of a dollar, James has $\frac{4}{12}$ of a dollar. How much has John more than James?

3. How much less is $\frac{3}{8}$ than $\frac{7}{8}$? $\frac{3}{8}$ than $\frac{5}{8}$? $\frac{3}{8}$ than $\frac{4}{8}$?

4. John has $\frac{1}{3}$ of an apple, James has $\frac{1}{4}$ of an apple. How much has John more than James?

$\frac{1}{3}=\frac{4}{12}$, and $\frac{1}{4}=\frac{3}{12}$; $\therefore \frac{1}{3}-\frac{1}{4}=\frac{4}{12}-\frac{3}{12}=\frac{1}{12}$.

5. What is the difference between $\frac{2}{3}$ and $\frac{4}{12}$?

6. How much change will a person receive out of a ten-dollar bill after paying for an article which cost $\$4\frac{3}{5}$?

7. After spending $\frac{3}{7}$ of his money on a suit of clothes, A has \$24 left. How much money had he at first?

8. How much do $7\frac{1}{2}$ in. exceed $4\frac{1}{3}$ in.?

9. $7\frac{1}{3}$ in. and how many inches make 1 ft.?

EXERCISE 119

Find the difference between:

1. $\frac{1}{2}$ and $\frac{1}{3}$.
2. $\frac{3}{4}$ and $\frac{2}{3}$.
3. $\frac{2}{7}$ and $\frac{3}{5}$.
4. $\frac{3}{7}$ and $\frac{3}{4}$.
5. $\frac{5}{6}$ and $\frac{7}{12}$.
6. $\frac{5}{8}$ and $\frac{7}{12}$.
7. $\frac{4}{9}$ and $\frac{5}{12}$.
8. $\frac{5}{9}$ and $\frac{2}{3}$.
9. $\frac{3}{8}$ and $\frac{5}{12}$.

EXERCISE 120

1. Simplify $\frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{8} + \frac{5}{12}$.

2. William earned $\$12\frac{3}{8}$. This was $\$2\frac{3}{4}$ more than John earned. How much did John earn? How much did both earn?

3. From a bin containing $96\frac{3}{4}$ bu. of wheat, $59\frac{3}{5}$ bu. were sold. How many bushels remained in the bin?

4. A rectangular lot is $36\frac{5}{8}$ rd. long and $24\frac{1}{2}$ rd. wide. How much longer than wide is the lot?

5. By how much does the sum of $1\frac{1}{2}$, $2\frac{1}{3}$, and $3\frac{1}{4}$ differ from the sum of $2\frac{1}{4}$, $3\frac{1}{3}$, and $4\frac{7}{8}$?

6. From two piles of wood containing $36\frac{3}{5}$ and $24\frac{5}{8}$ cords, respectively, $27\frac{1}{2}$ cords were sold. How many cords were not sold?

7. From a web of cloth containing 80 yd., $7\frac{1}{2}$ yd. were sold to one woman, $8\frac{1}{4}$ yd. to a second, and $12\frac{2}{3}$ yd. to a third. How many yards remained?

V. MULTIPLICATION AND DIVISION OF FRACTIONS

(a) To Multiply a Fraction by a Whole Number

EXERCISE 121

1. If 3 sevenths are multiplied by 5, what is the product?

3 sevenths ($\frac{3}{7}$) multiplied by $5 = 15$ sevenths ($\frac{15}{7} = 2\frac{1}{7}$).

2. If it requires $\frac{3}{4}$ of a yd. of cloth to make a vest, how many yards will it require to make 8 vests?

3. If 1 yd. of muslin costs $\$\frac{4}{8}$, find the cost of 4 yd.

4. If a barrel of flour cost $\$8\frac{3}{4}$, what will 5 barrels cost?

(Multiply the fractional and integral parts separately, and add the products.)

5. How much is 10 times $1\frac{3}{10}$? $2\frac{3}{4}$? $6\frac{1}{8}$? $3\frac{5}{12}$?

Example 1. Multiply $\frac{3}{10}$ by 5.

3 tenths ($\frac{3}{10}$) multiplied by $5 = 15$ tenths ($\frac{15}{10}$);

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

104. Hence, *a fraction is multiplied by a whole number either by multiplying the numerator by the whole number or by dividing the denominator by the whole number.*

EXERCISE 122

Multiply:

1. $\frac{7}{12}$ by 9.	4. $1\frac{1}{2}$ by 6.	7. $2\frac{1}{2}$ by 11.
2. $\frac{5}{12}$ by 3.	5. $2\frac{1}{4}$ by 5.	8. $3\frac{1}{4}$ by 6.
3. $\frac{9}{14}$ by 7.	6. $3\frac{1}{8}$ by 7.	9. $5\frac{1}{3}$ by 9.

10. Find the cost of 5 gal. of molasses at $37\frac{1}{2}$c. per gal.

11. At $\$1\frac{1}{4}$ a day, how much does a man earn in 4 weeks of 6 days each?

(*b*) TO DIVIDE A FRACTION BY A WHOLE NUMBER

EXERCISE 123

1. If 8 ninths are divided by 4, what is the quotient?

2. Divide $\frac{8}{9}$ by 2; $\frac{6}{11}$ by 3; $\frac{4}{7}$ by 8.

3. If 3 caps cost $\$\frac{9}{10}$, how much will 1 cap cost?

4. A man shares $\frac{8}{9}$ of a ton of coal among 5 persons. How much does each get?

$$\text{Share of 5 persons} = \frac{8}{9} \text{ ton} = \frac{5 \times 8}{5 \times 9} \text{ ton};$$

$$\text{“ 1 person} = \frac{1}{5} \text{ of } \frac{5 \times 8}{5 \times 9} \text{ ton} = \frac{8}{45} \text{ ton.}$$

105. Hence, *a fraction is divided by a whole number either by dividing the numerator of the fraction by the whole number or by multiplying the denominator by the whole number.*

5. If 8 men can do $\frac{4}{5}$ of a piece of work, how much can 1 man do in the same time?

6. Divide $\frac{8}{9}$ by 2; by 3; by 5; and by 7.

7. If 4 yd. of cloth cost $\$\frac{2}{3}$, how much will 1 yd. cost?

EXERCISE 124

Divide:

1. $\frac{4}{15}$ by 3.
2. $\frac{3}{11}$ by 4.
3. $\frac{9}{10}$ by 3.
2. $2\frac{2}{3}$ by 2.
5. $8\frac{1}{2}$ by 4.
6. $9\frac{4}{7}$ by 3.
7. $12\frac{2}{3}$ by 4.
8. $16\frac{2}{3}$ by 8.
9. $15\frac{2}{3}$ by 5.

10. If a man can reap $22\frac{2}{4}$ a. of wheat in 7 da., how much could he reap in 1 da.?

11. If a man can cut $15\frac{3}{4}$ cords of wood in 7 da., how many cords could he cut in 1 da.?

12. If a man walks $38\frac{1}{2}$ mi. in 10 hr., how far does he walk in 1 hour?

(c) To Multiply a Whole Number or a Fraction by a Fraction

EXERCISE 125

1. If a house cost $800 and a barn $\frac{3}{4}$ as much, how much does the barn cost?

2. *A* rode $4\frac{2}{3}$ hr. on his wheel at the rate of 9 mi. per hour. How far did he ride?

3. Find the cost of $7\frac{1}{2}$ lb. of raisins at 16c. per pound.

4. If a yard of cloth cost $3, find the cost of $8\frac{2}{3}$ yd.

5. Find how far a train will go in $3\frac{1}{4}$ hr. at the rate of 25 mi. per hour.

6. How many seconds are there in $7\frac{1}{3}$ min.?

EXERCISE 126

1. How many inches are there in $\frac{3}{4}$ of a foot?

2. How many inches are there in $\frac{1}{4}$ of 3 ft.?

3. Compare $\frac{3}{4}$ of 1 ft. with $\frac{1}{4}$ of 3 ft.

4. Compare $\frac{2}{3}$ of $1 with $\frac{1}{3}$ of $3.

5. In finding $\frac{1}{3}$, or $\frac{1}{4}$, or $\frac{1}{7}$ of a number, what operation is necessary?

106. Hence, *we may define a fraction as a simple manner of indicating that its numerator is to be divided by its denominator.*

Example 1. Multiply $\frac{3}{5}$ by $\frac{4}{7}$.

$$\frac{4}{7} = 4 \div 7. \quad \frac{3}{5} \times 4 = \frac{12}{5}.$$

$$\frac{12}{5} \div 7 = \frac{12}{35} = \frac{3 \times 4}{5 \times 7} = \frac{\text{the product of the numerators}}{\text{the product of the denominators}}.$$

Multiply:

6. $\frac{3}{5}$ by $\frac{1}{6}$.
7. $\frac{3}{4}$ by $\frac{5}{8}$.
8. $\frac{5}{6}$ by $\frac{7}{8}$.
9. $\frac{3}{4}$ by $\frac{8}{9}$.
10. $\frac{11}{12}$ by $\frac{6}{7}$.
11. $\frac{5}{12}$ by $\frac{3}{4}$.
12. $\frac{1}{3}$ by $\frac{1}{6}$.
13. $\frac{1}{3}$ by $\frac{3}{10}$.
14. $\frac{1}{3}$ by $\frac{1}{8}$.

EXERCISE 127

Example 2. Multiply $2\frac{1}{4}$ by $3\frac{1}{3}$.

$2\frac{1}{4} = \frac{9}{4}$ and $3\frac{1}{3} = \frac{10}{3}$.

$$2\frac{1}{4} \times 3\frac{1}{3} = \frac{9}{4} \times \frac{10}{3} = \frac{9 \times 10}{4 \times 3} = \frac{15}{2} = 7\frac{1}{2}.$$

Multiply:

1. $2\frac{1}{3} \times 4\frac{1}{2}$.
2. $1\frac{3}{4} \times 2\frac{1}{3}$.
3. $3\frac{1}{2} \times 2\frac{1}{4}$.
4. $3\frac{1}{3} \times 5\frac{1}{4}$.
5. $2\frac{1}{4} \times 3\frac{1}{2}$.
6. $3\frac{1}{3} \times 2\frac{3}{4}$.
7. $4\frac{1}{3} \times 2\frac{1}{2}$.
8. $3\frac{1}{3} \times 1\frac{3}{5}$.
9. $3\frac{1}{2} \times 2\frac{3}{5}$.
10. Find the cost of $7\frac{1}{4}$ cords of wood, at $\$2\frac{3}{4}$ per cord.
11. If a cord of wood costs $\$4\frac{1}{4}$, what will $3\frac{1}{2}$ cords cost?
12. If a pound of sugar is worth $9\frac{1}{2}$c., what will $4\frac{1}{2}$ lb. cost?

(*d*) TO DIVIDE A WHOLE NUMBER OR A FRACTION BY A FRACTION.

EXERCISE 128

1. How often is 4 ninths ($\frac{4}{9}$) contained in 8 ninths ($\frac{8}{9}$)?
2. How often is 2-fifths ($\frac{2}{5}$) contained in 12-fifteenths ($\frac{12}{15}$)? (Reduce the fractions to equivalent ones having a common denominator.)
3. How often is $\frac{3}{10}$ contained in $\frac{1}{3}$?
4. At $\$\frac{3}{10}$, how many caps can I buy for $\$\frac{1}{3}$?
5. If a pound of coffee costs $\$\frac{1}{4}$, how much can be bought for $\$1\frac{1}{4}$?
6. When apples are worth $\$\frac{3}{4}$ a bushel, how many bushels can be bought for $\$2\frac{1}{2}$?

EXERCISE 129

1. What is the effect upon the quotient of multiplying both dividend and divisor by the same number?

2. Divide 7 by 1; 10 by 1; $8\frac{1}{4}$ by 1; $1\frac{3}{5}$ by 1; $4\frac{1}{2}$ by 1.

3. If any number is divided by 1, what is the quotient?

4. (*a*) Find the product of the following: $\frac{1}{2}$ multiplied by $\frac{3}{1}$; $\frac{1}{3}$ multiplied by $\frac{5}{1}$; $\frac{2}{3}$ multiplied by $\frac{3}{2}$; $\frac{3}{4}$ multiplied by $\frac{4}{3}$.

(*b*) How are the terms of the multiplier, in each case, derived from those of the multiplicand?

Example 1. Divide $\frac{3}{5}$ by $\frac{5}{7}$.

$$\frac{3}{5} \div \frac{5}{7} = (\frac{3}{5} \times \frac{7}{5}) \div (\frac{5}{7} \times \frac{7}{5})$$
$$= (\frac{3}{5} \times \frac{7}{5}) \div 1$$
$$= \frac{21}{25} = \text{dividend multiplied by divisor inverted.}$$

Multiplying both dividend and divisor by $\frac{7}{5}$, the terms of the divisor inverted, makes the divisor 1 and does not alter the quotient.

Divide:

5. 10 by $\frac{3}{5}$.
6. 12 by $\frac{3}{4}$.
7. 15 by $\frac{5}{7}$.
8. $\frac{3}{4}$ by $\frac{5}{8}$.
9. $\frac{3}{5}$ by $\frac{5}{6}$.
10. $\frac{5}{7}$ by $\frac{3}{4}$.
11. $2\frac{1}{2}$ by $3\frac{1}{3}$.
12. $3\frac{1}{4}$ by $4\frac{1}{2}$.
13. $2\frac{3}{5}$ by 4.

EXERCISE 130

1. If $\frac{3}{4}$ of a yard of cloth cost 24c., what would a whole yard cost?

2. At $\$1\frac{1}{5}$ per bushel, how many bushels of wheat can be bought for $\$42\frac{3}{5}$?

3. If a ton of coal is worth $\$6\frac{3}{4}$, how many tons can be bought for $\$89\frac{1}{20}$?

4. If a bushel of apples cost $\$2\frac{1}{4}$, how many bushels could be bought for $\$60\frac{3}{4}$?

5. If a man earns $\$7\frac{1}{2}$ in a week, how long will it require him to earn $\$20\frac{3}{4}$?

6. A man divided $30\frac{1}{2}$ lb. of flour among the poor, giving to each $2\frac{1}{2}$ lb. How many poor persons were there?

7. If $21\frac{3}{4}$ lb. of tea cost $\$18\frac{3}{10}$, what will 1 lb. cost?

8. A man raised $93\frac{3}{4}$ bu. of wheat on $8\frac{1}{3}$ a. of land. How many bushels per acre was that?

9. The product of two numbers is 27, and one of them is $2\frac{1}{4}$. What is the other?

EXERCISE 131 (REVIEW)

1. Reduce $\frac{5}{6}$ to eighteenths and $\frac{1}{7}$ to twenty-firsts.

2. In one village lot there is $\frac{7}{8}$ a. and in another $1\frac{1}{4}$ a.

(*a*) How much land is there in the two lots?

(*b*) How much is one larger than the other?

3. The sum of two numbers is $8\frac{1}{4}$; one of the numbers is $3\frac{3}{5}$; find the other.

4. The subtrahend is $\frac{4}{7}$ and the remainder $\frac{7}{15}$. Find the minuend.

5. What must be added to $22\frac{3}{4}$ to produce $35\frac{1}{2}$?

6. James had $\$10\frac{1}{2}$; Jane had as much, lacking $\$1\frac{3}{4}$. How much money had they together?

7. Find the cost of $2\frac{3}{4}$ yd. of cloth at $\$1\frac{1}{3}$ per yard.

8. If a horse eats $\frac{3}{4}$ bu. of oats in a day, how many bushels will 10 horses eat in 7 days?

9. How often is $\frac{1}{4}$ contained in $2\frac{1}{2}$?

10. If $\frac{3}{4}$ yd. of cloth costs $\$1.20$, find the cost of $10\frac{3}{8}$ yd.

11. If $\frac{3}{4}$ of a bushel of wheat costs 63 cents, what will $\frac{5}{6}$ of a bushel cost?

12. At the rate of $3\frac{2}{3}$ mi. an hour, how long shall I take to walk 15 mi.? 22 mi.?

13. The divisor is $\frac{2}{5}$, the quotient $4\frac{2}{9}$. Find the dividend.

14. Find $\frac{3}{4}$ of £13 18s. 6d.

15. Change the following to fifths: $\frac{2}{10}$, $\frac{8}{10}$, $\frac{9}{15}$, $\frac{20}{25}$, $\frac{24}{40}$.

16. A box of soap weighed $87\frac{1}{2}$ lb. The box alone weighed $3\frac{3}{8}$ lb. How much did the soap weigh?

17. Find the number of feet in $\frac{1}{8}$ of a rod.

18. When hay is worth $\$20\frac{3}{4}$ per ton, how much will $\frac{7}{12}$ t. cost.

19. A man owns $\frac{5}{6}$ of a mill. He sells $\frac{3}{4}$ of his share. What part of the mill did he sell?

20. Change $\frac{5}{6}$, $\frac{3}{10}$, and $\frac{11}{12}$ each to sixtieths.

21. Supply numerators in $\frac{5}{8} = \frac{\quad}{40}$; $\frac{75}{100} = \frac{\quad}{4}$; $\frac{77}{132} = \frac{\quad}{12}$.

22. Arrange $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{4}{9}$ in ascending order of magnitude.

23. Reduce each of the following to its lowest terms:

$$\frac{36}{40},\ \frac{72}{88},\ \frac{45}{63},\ \frac{80}{120},\ \text{and}\ \frac{32}{108}.$$

24. A grocer bought three tubs of butter containing $18\frac{1}{2}$ lb., $21\frac{3}{4}$, and $24\frac{2}{5}$ at 24c. a pound and sold it at 30c. a pound. How much did he make?

25. A house and lot cost \$8750; the house cost $2\frac{1}{2}$ times as much as the lot. Find the cost of each.

ORAL EXERCISE

1. Simplify $\frac{3}{4}$ of $24 + \frac{2}{3}$ of 18.

2. From $\frac{2}{5}$ of \$40 take $\frac{3}{4}$ of \$16.

3. If $\$\frac{3}{4}$ is $\frac{1}{8}$ of what my vest cost, find its cost.

4. A man walked for 3 hours at $3\frac{1}{2}$ mi. per hour. How far did he go?

5. Simplify $4\frac{1}{2} + 5\frac{3}{4} - 2\frac{1}{8}$.

6. Simplify $2\frac{3}{4} \times 5 - 16\frac{1}{2} \div 11$.

7. What number added to $\frac{2}{3}$ of 21 will make 30?

8. To $\frac{3}{5} \times \frac{1}{3}$ add $\frac{1}{2} \times \frac{2}{5}$.

9. $7 \times 2\frac{1}{2}$ is $\frac{1}{4}$ of what number?

10. Three tons of coal cost $\$22\frac{1}{2}$. Find the cost of 4 t.

VI. GENERAL REVIEW

EXERCISE 182

1. The prime factors of a number are 3, 5, 13, and 19. Find the number.

2. Resolve each of the numbers 770, 1386, 1078 into prime factors, and from these determine the H.C.F. of the numbers.

3. The greater of two numbers is 3482 and their difference is 1122. Find their product.

4. Find the cost of 2575 ft. of lumber at $40 per M.

5. Find the L.C.M. of 16, 24, 32, and 40.

6. The aggregate attendance at a public school during the month of May was (21 school days) 4221. Find the daily average attendance.

7. A manufacturer sold 54 pieces of cassimere, each containing 48 yd., at $\$1.12\frac{1}{2}$ per yard. How much did he receive for the cloth?

8. If your pulse beats 4320 times in a hour, how many times will it beat from 8 a.m. on Monday till 2 p.m. on Tuesday?

9. Divide $55 \times 36 \times 27 \times 42$ by $12 \times 25 \times 35 \times 33$.

10. If a cubic foot of dynamite weighs $103\frac{1}{3}$ lb., find the weight of a box whose contents measure 4 ft. by 3 ft. by $2\frac{1}{2}$ ft.

11. Find the sum of $4\frac{1}{3}$, $5\frac{1}{2}$, and $9\frac{3}{4}$.

12. A ton of egg coal occupies about 35 cu ft. How much coal will a bin $7\frac{1}{2}$ ft. by $6\frac{2}{3}$ ft. by 5 ft. hold?

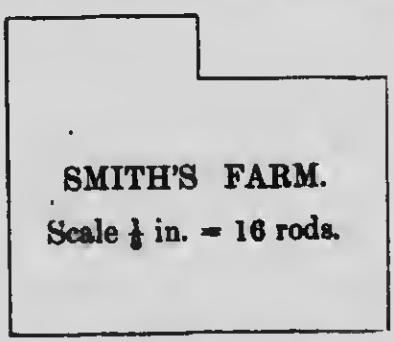
13. A special train ran from Strathcona to Calgary, a distance of 192 mi., in 3 hrs., 12 min. At what rate per hour did the "special" run?

14. Theodore Roosevelt was born Oct. 27, 1858, and became President of the United States on Sept. 14, 1901. How old was he at the time?

15. The 11 men of a football team weigh together 1 ton 57 lb. Find the average weight of the men.

16. Find the cost of 125 ft. of garden hose at $7\frac{1}{2}$c. per foot.

17. Divide \$10 between John and James so that John may have 75 cents more than 4 times as much as James.



18. This is a plan of Smith's farm.

(*a*) Find its perimeter.

(*b*) Find its area.

(*c*) How many fence posts set half a rod apart will be required to fence the farm?

(*d*) If it is enclosed by a standard Page Wire Fence having 20 rods in a roll at \$2.55 per roll, find the number of rolls used and the cost of the fencing.

CHAPTER XI

DECIMALS

I. DEFINITIONS

EXERCISE 133

1. Draw a line and find one-tenth of it.

107. One-tenth is written .1 ; .1 is called a **decimal.**

2. Find $\frac{3}{10}$ or .2 of a line 10 in. long.

3. Find $\frac{7}{10}$ or .7 of a line 5 in. long.

4. In the number 1.1, name the 1 at the left ; at the right.

5. How many tenths are there in 1.1 ? in 2.4 ?

6. Write in decimal form $\frac{3}{10}$, $\frac{6}{10}$, $4\frac{3}{10}$, $9\frac{7}{10}$.

7. Read 7.3, 2.8, 5.7, 21.6.

8. Write in figures : Three-tenths ; four, and six-tenths.

9. Draw a line and find $\frac{1}{10}$ of $\frac{1}{10}$ of it.

108. One-tenth of $\frac{1}{10}$ is $\frac{1}{100}$ and is written .01 in decimals.

10. Find $\frac{5}{100}$ or .05 of a line 10 in. long.

11. How many hundredths are there in one-tenth ?

12. Fill in numerators for the following :

$$.1 = \frac{\quad}{100} ; \quad .3 = \frac{\quad}{100} ; \quad .7 = \frac{\quad}{100}.$$

13. Write as decimals : $\frac{4}{100}$, $\frac{19}{100}$, $\frac{75}{100}$.

14. In the number 111.11 name the places from left to right.

15. How many hundredths are equivalent to one-tenth? how many tenths to one unit? how many units to one ten? how many tens to one hundred?

16. One hundred is equal to how many tens? one ten to how many units? one unit to how many tenths? one tenth to how many hundredths?

17. Read the following:

3.07, 25.17, 100.09, 45.75, 101.11.

18. Write in figures:

Seven hundredths; two, and nine hundredths; forty-three hundredths; seven units, seven-tenths and seven hundredths.

109. One-tenth of $\frac{1}{100}$ is $\frac{1}{1000}$ and is written .001 in decimals.

110. A fraction that expresses tenths, hundredths, or thousandths, etc., is called a **Decimal Fraction** or a **Decimal.**

111. The following table shows the relation of the places to the right and left of the units' places. Thus the place of tens is first to the left of the units, the place of tenths is first to the right of units; the place of hundredths is second to the right of units, etc.

4 Thousands.	3 Hundreds.	2 Tens.	1 Units.	*Decimal Point.*	2 Tenths.	3 Hundredths.	4 Thousandths.
4	3	2	1	.	2	3	4

EXERCISE 134

1. Read or write in words .7, .07, .007, 7.7.
2. Read or write in words .45, .37, .71.

3. Read or write in words .234, .457, .575.

4. Express decimally 9 tenths, 5 tenths, 17 hundredths, 9 hundredths, 7 thousandths, 453 thousandths.

5. Write in figures nine tenths, seven tenths, twenty-five hundredths, seventy-nine thousandths, three hundred and forty-five thousandths.

6. Write in words 57.5, 500.05, 2000.02, 174.85.

7. Express 9 as tenths, as hundredths, as thousandths.

8. How many hundredths are there in five tenths? in four units? in forty units?

9. Write in figures seven, and seven tenths; forty-five, and fifty-three hundredths; six hundred, and six hundredths; one hundred and one, and one thousandth.

10. Read the following:

(*a*)	.08	.18	.175
(*b*)	7.17	18.36	25.376
(*c*)	27.306	175.008	207.207

11. Write the following in figures:

(*a*) 7 tenths; 57 hundredths; 83 tenths.

(*b*) 24 thousandths; 9 thousandths; 137 thousandths.

(*c*) 5, and 7 hundredths; 27, and 4 thousandths.

II. ADDITION

Example 1. What is the sum of 3.7, 14.035, 81.64, and .716?

3.7
14.035
81.64
.716
100.091

The addends are placed so that units are under units, tenths under tenths, etc. This is always the case when the points range under one another. The addition is performed as in the case of integers.

EXERCISE 135

Add:

1. 3.4, 7.5, 17.45, 3.84, 5.14.
2. 17.04, 36.7, 7.86, 5.945, 6.005.
3. 34.006, 6.9, 7.089, 8.96, 7.385.
4. 7, 7.7, 7.07, 17.84, 34.07.
5. .006, 7.8, 7, 9.036, 80.4, 70.09.
6. Simplify $36 + 7.8 + 70.84 + .006$.
7. Simplify $7.06 + 36.4 + 42.009 + .07 + .17$.
8. Add seven thousandths; seven, and twenty-nine hundredths; sixty-one, and nine tenths; eight hundred, and eighty thousandths.
9. What is the sum of the following: 3.04, 71.7, 8.006, .75, 1.075, .825, 9?

III. SUBTRACTION

Example 1. From 17.13 take 1.907.

$$\begin{array}{r} 17.13 \\ 1.907 \\ \hline 15.223 \end{array}$$

The subtrahend is written under the minuend so that tenths may be under tenths, etc. The subtraction is performed as in subtraction of whole numbers.

EXERCISE 136

1.	2.	3.
From 7.46	36.56	7.01
Take 2.28	9.78	1.23
4.	**5.**	**6.**
From 9.6	3.07	7.
Take 3.25	1.846	2.456

7. From 8 take 3.45 and from 7.01 take 3.645.

8. Simplify 6 - 2.45 ; 15.1 - .008 ; 3.6 - 2.475.

9. Find the difference between 17.643 and 25.

10. How much does one hundred, and seven tenths exceed ninety-six, and four hundred and five thousandths?

11. From the sum of 7.4 and 9.06 take 8.975.

12. Simplify 7.84 - 2.9 + 8.06 + 37 - 5.756.

13. *A*, who owned 85.7 a. land, sold at one time 13.125 a. and at another 16.004 a. How many acres had he left?

14. Find the difference between the following pairs of numbers: 36 and 24.709 ; 12 and 18.875 ; 50 and 69.78.

15. Find the number which added to the sum of .12, 2.1, .07, and 8 will make 20.

16. Find the value of 9 - 2.75 - 3.5 + 8.006 - 9.67.

17. The average of five numbers is 12.465. Find the difference between their aggregate and 100.

IV. MULTIPLICATION

Example 1. Multiply .7 by 6.

$$\begin{array}{r} .7 \\ \times\ 6 \\ \hline 4.2 \end{array}$$

7 tenths multiplied by 6 gives 42 tenths, or 4.2.

Example 2. Multiply .75 by 5.

$$\begin{array}{r} .75 \\ \times\ 5 \\ \hline 3.75 \end{array}$$

75 hundredths multiplied by 5 gives 375 hundredths, or 3.75.

Example 3. Multiply .9 by .7.

$$\begin{array}{r} .9 \\ \times\ .7 \\ \hline .63 \end{array}$$

Multiplying a number of tenths by a number of tenths produces a number of hundredths.

Example 4. Multiply .83 by .9.

$$\begin{array}{r} .83 \\ .9 \\ \hline .747 \end{array}$$

A number of hundredths multiplied by a number of tenths produces a number of thousandths.

112. *From these examples it will be seen that to multiply decimals, we multiply as in the case of integers and mark off from the right of the product as many decimal places as there are decimals in the multiplier and multiplicand together.*

EXERCISE 137

1. Multiply each of the following numbers by 5 :

.75, 7.5. .75, .075.

2. Multiply each of the following numbers by 7 :

78, 7.8, .78, .078.

3. Multiply each of the following numbers by 19 :

86, 8.6 .86, .086.

4. Multiply each of the following numbers by 10 :

78, 7.8, .78, .078.

5. Give a rule for multiplying a number by 10.

6. Multiply each of the following numbers by 100 :

87, 8.7, .87, .087.

7. Give a rule for multiplying by 100.

8. Find the cost of 79 articles at $3.055 each.

9. To .006 add the difference between .034 and 3.4, and multiply the result by 247.

Multiply :

10. 36 by 3.5.
11. 4.7 by 5.8.
12. 7.5 by 4.7.
13. 785 by 2.07.
14. 36.3 by 5.25.
15. 782 by .009.

V. DIVISION

Example 1. Divide 7.5 by 3.

$3\overline{)7.5}$ Divide as in division of integers.
2.5

Example 2. Divide 7.5 by .3.

$3\overline{)75}$ Multiply the divisor by 10 to make it an integral
25 number. The dividend must be multiplied by 10 so that the quotient may not be altered.

Example 3. Divide 7 by .004.

$4\overline{)7000}$ Multiplying the divisor by 1000 makes it an
1750 integer. The dividend must be multiplied by 1000 so that the quotient may be correct.

Example 4. Divide .007 by .05.

$5\overline{)\ .7}$ Multiplying the divisor by 100 makes it an in-
$.14$ teger. The dividend must be multiplied by 100.

113. *From these examples it will be seen that to divide by a decimal, the divisor and dividend must be multiplied by such a number as will make the divisor an integer, then the division is performed as in division of whole numbers, and the decimal point is placed in the quotient as soon as the tenths figure of the dividend is used in the work.*

EXERCISE 138

Divide :

1.	96 by 4,	.96 by 4,	.096 by 4.
2.	7.55 by 5,	7.055 by 5,	.075 by 5.
3.	32 by 8,	32 by .8,	32 by .08.
4.	6.4 by .8,	3.6 by .9,	.36 by .09.
5.	1.2 by .6,	1.2 by .06,	.12 by .06.
6.	10.5 by .5,	10.5 by .05,	1.05 by .05.

7. 17.5 by .25, 12.6 by .021, 18.006 by .006.

8. 16 by .25, 3.6 by .05, 7 by .08.

9. The product of two numbers is 4.962; one of the numbers is 16.54. Find the other.

10. A man bought 64.5 a. of land for which he paid $1773.75. How much did the land cost per acre?

11. How many cords of wood at $5.625 per cord, can be bought for $1495.125?

12. If a train moves at the rate of 43.3 mi. per hour, how long will it take to go 313.925 mi.?

EXERCISE 139 (REVIEW)

1. Find the cost of 2.6 yd. of cloth at $3.5 per yard.

2. How many bushels of oats, at $.375 per bushel, can be bought for $13.125?

3. Find the cost of 8384 feet of boards at $13.25 per M.

4. Find the freight charges on 3846 lb. at $.875 per hundred.

5. If 9.3 yd. cost $20.925, find the cost of 390.6 yd.

6. If lumber is bought at $11.875 per thousand, and sold at $13.625 per thousand, how much must be bought and sold to gain $12.95?

7. If 4.8 yd. of cloth are required to make a coat, how many coats can be made from 7488 yd.?

8. Find the product of one thousand, and five-tenths multiplied by two hundred and six thousandths.

9. Simplify $(7.35 \cdot 4.71) \div .015$.

10. From a cistern containing 3000 gal., 45.25 bbls. of 31.5 gal. each, are drawn off. How many gallons remain in the cistern?

11. How many cubic feet of firewood are there in a pile 25.6 ft. long, 18.5 ft. wide, and 12.3 ft. high?

12. If 20.5 a. produce 322.875 bu. of wheat, how much will 16.8 a. produce at the same rate?

13. Multiply the sum of eight, and seventeen hundredths and ninety, and sixty-four hundredths by nine tenths.

ORAL EXERCISE

1. Simplify $7.35 + 8 - 9.75$.

2. Find the cost of 4.5 yd. of cloth at $5.

3. If 4 men can do a work in 8.75 days, in what time can 7 men do it?

4. If .8 of John's money is 64c., how much has he?

5. Express .25 as a vulgar fraction.

6. Divide 65 marbles between two boys so that one may have .3 of the other's share.

7. To 3.8 add .7 of 7.5.

8. Find .25 of 72.

9. Divide 7.5 by .5 and 8.4 by .04.

10. Simplify $4 \times 8.5 + 36 \div .4$.

VI. GENERAL REVIEW

EXERCISE 140

1. Find the L.C.M. of 18, 24, 27, and 32.

2. Simplify $55 \times 36 \times 27 \times 42$ divided by $12 \times 25 \times 35 \times 33$.

3. John and James have together 375 marbles. One has $\frac{2}{3}$ as many as the other. How many has each?

4. A lot has a frontage of 66 ft. and a depth of 12 rods. How much lumber will be required to enclose it with a close board fence 5 ft. high?

5. A grocer mixes 26 lb. of tea worth 66c. per pound with 84 lb. worth 44c. per pound. Find the average price per pound of the mixture.

6. A man walks at the rate of 4 mi. per hour. How much is that per minute?

7. Divide $12.60 between James and Mary, so that each time Mary receives 2 cents, James may receive 3 cents.

8. If $\frac{3}{4}$ of a farm is worth $1800, how much is $\frac{5}{12}$ of it worth?

9. A farmer sold a merchant two loads of potatoes, one for $28\frac{3}{4}$, and the other for $25\frac{1}{2}$. If he received $43.75 in cash, how much is still due him?

10. How many rods of wire fencing will be required for a rectangular field 462 ft. long and 330 ft. wide? Find its cost at $1.40 per rod.

11. Find the cost of 7860 ft. of clear pine at $45 per M.

12. A boy rode on his bicycle $46\frac{3}{8}$ mi. on Monday, $54\frac{1}{4}$ mi. on Tuesday, $68\frac{3}{8}$ mi. on Wednesday. How many miles must he ride on Thursday to make 225 miles for the four days?

13. Reduce $\frac{35}{168}$, $\frac{42}{112}$, and $\frac{77}{132}$ each to lowest terms.

14. Complete the following:

$$\frac{1}{2} = \frac{\quad}{10}, \quad \frac{2}{3} = \frac{12}{\quad}, \quad \frac{1}{5} = \frac{\quad}{75}, \quad \frac{5}{7} = \frac{20}{\quad}.$$

15. Find the G. C. M. of 168, 132, and 352.

16. Find the cost of $4\frac{1}{4}$ bbl. of pork at $14\frac{1}{2}$ per barrel.

17. At $6.25 a ton, how many tons of coal can be bought for 180 bu. of potatoes at 75c. per bushel?

18. How much is a pile of sand 42 ft. long, 27 ft. wide, and 20 ft. deep worth at 24c. per cubic yard?

19. Find the cost of $18\frac{1}{2}$ lb. of cheese at $21\frac{1}{2}$c. per pound.

CHAPTER XII

PERCENTAGE

I. DEFINITION

EXERCISE 141

1. Draw a square $2\frac{1}{2}$ in. long, and divide it into 100 small squares.

2. Mark off 10 one-hundredths of the large square; 20 one-hundredths; 25 one-hundredths; 50 one-hundredths.

3. Show .01 of the large square; .03 of it; .07 of it; .10 of it; .25 of it; .50 of it.

114. Another name for *hundredths* is **per cent.** The symbol for per cent. is %.

115. Percentage treats of transactions that involve per cent.

4. Mark 1 per cent. or 1% of the large square; 3 per cent. or 3% of it; 10 per cent. or 10% of it.

5. What per cent. of a number is .01 of it? .05 of it? .09 of it? .10 of it? .25 of it? .4 of it? .5 of it?

6. Express the following as hundredths:

3%; 7%; 10%; 15%; 20%; 25%.

7. Find .02 of \$100; .05 of \$100; .12 of \$100; .12 of \$200.

8. Find 2% of \$100; 5% of \$100; 12% of \$100; 12% of \$200.

9. Find 5% of \$40; 7% of \$300; 6% of \$350; 20% of 65 a.

10. Express the following (1) as common fractions, (2) as decimals:

3 p. c.	17 p. c.	13 p. c.	19 p. c.
10 p. c.	20 p. c.	25 p. c.	50 p. c.
$12\frac{1}{2}$ p. c.	$16\frac{2}{3}$ p. c.	$8\frac{1}{3}$ p. c.	$33\frac{1}{3}$ p. c.

11. What per cent. of a number is equal to each of the following fractional parts of it: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{10}$, $\frac{3}{4}$, $\frac{2}{3}$?

12. Find 25% of each of the following:

$16, 40 a., 116 lb., 25 mi., 18 in., 1 hr., 1 yd., $1.

13. Express the following decimally:

10%.	35%.	$12\frac{1}{2}$%.
25%.	75%.	$37\frac{1}{2}$%.
20%.	125%.	$2\frac{1}{2}$%.

14. Express as common fractions in their lowest terms:

10%.	$12\frac{1}{2}$%.	$37\frac{1}{2}$%.
25%.	$16\frac{2}{3}$%.	$66\frac{2}{3}$%.
20%.	$33\frac{1}{3}$%.	$87\frac{1}{2}$%.

EXERCISE 142

1. Draw a line 12 in. long. Cross off 25% of it; $33\frac{1}{3}$% of it; 50% of it; 75% of it.

2. Describe a circle and mark off 100% of it; 50% of it; $12\frac{1}{2}$% of it.

3. Find 25% of 24 hr.; of 36 men; of $60.

4. Draw a rectangle 5 in. by 2 in. Mark off 20% of it; 40% of it; 50% of it; 60% of it.

5. Express the following in hundredths:

5%, 10%, 25%, 50%, 60%.

6. Express the following as fractions in their lowest terms:

25%, $33\frac{1}{3}$%, 50%, 20%, 40%.

7. A pupil had 20 examples to work and did 100% of of them correctly. How many did he do correctly?

8. A farmer had 450 bu. of wheat and sold 60% of it. How many bushels did he sell?

9. If a dozen apples cost 12c., for how much must they be sold to gain 25%?

10. A man bought a cart for $25 and sold it at a loss of 20%. How much did he get for it?

11. Of what number is 12 ten per cent.? 8 twenty-five per cent.?

12. Find 10% of 60 men; of $200; of 45 a.; of 185 lb.

13. Find the value of:

5% of 68.	12% of $150.
8% of 75.	20% of $400.
10% of 45.	25% of $684.

14. Give the per cent. equivalent to the following:

$\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{25}$, $\frac{1}{50}$.

15. Find 40 per cent. of 800 men and 25 per cent. of 436 miles.

16. A man having a journey to make has gone $\frac{3}{4}$ of the distance. What per cent. of the journey is still to be made?

17. Out of a 5-gallon keg of molasses, 3 gal. have been used. What per cent. of the molasses remains?

18. What per cent. of the months have 30 days?

19. In a school of 250 pupils, 20% were absent. How many were present?

II. APPLICATIONS OF PER CENT.

(a) PROFIT AND LOSS

A buys a house for \$1200 and sells it for \$1500.

Find, (*a*) how much he gained;

(*b*) his gain per cent.

It is evident that he gains \$(1500 – 1200) or \$300; this is called his profit.

The gain on \$1200 is \$300;

the gain on \$100 is $\frac{1}{12}$ of \$300, or \$25.

Hence, the gain per cent. is 25.

116. Profit is the amount by which the selling price exceeds the cost price.

117. Loss is the amount by which the selling price falls short of the cost price.

118. The Rate of profit or loss is usually expressed as a certain percentage of the cost price.

EXERCISE 143

1. Find the profit or the loss on the following:
   (*a*) Cost \$55, selling price \$82.75.
   (*b*) Cost \$136, selling price \$92.60.
   (*c*) Cost \$500, gain 8%.
   (*d*) Cost \$400, loss 10%.
2. Find the selling price of the following:
   (*a*) Cost \$40, gain 15%.
   (*b*) Cost \$75, loss 10%.
3. A grocer bought sugar at 4c. per lb., and sold it at 5c. per lb. What per cent. of his outlay did he gain?

4. A merchant bought cloth at $2.25 per yd., and sold it at $3 per yd. What per cent did he gain on his outlay?

5. A merchant bought wheat at 60c. per bu., and sold it at a gain of 20%. Find the selling price.

6. A drover sold cattle at $27.50 per head, at a gain of 25% on the cost price. Find the cost price.

7. By selling flour at an advance of 20%, $1.10 is gained on each barrel. Find the cost per barrel.

8. By selling a lot for $264, a man lost 12% of its cost. Find its cost.

(*b*) INTEREST

EXERCISE 144

119. If *A* hires a horse from *B*, *A* will have to pay *B* for the use of the horse.

If *A* borrows money from *B*, it is evident that he should pay *B* for the use of the money.

1. How much must you pay for the use of $600 for 1 yr., if you have to pay $5 for the use of each $100 per year, or 5c. for each dollar? If you have to pay $6? $4? $8?

120. The sum paid for the use of money is called **Interest.**

121. The money on which the *interest* is paid is called the **Principal.**

122. The per cent. of the principal paid each year for interest is the **Rate per cent.**

2. I ask a man to lend me some money. He said he would at 6%. What did he mean?

123. When one man borrows money from another, he usually gives him a paper, called a *promissory note*, to show that he has borrowed the money.

124. **Promissory Note**

$100. Toronto, July 2, 1908.

One year from date, I promise to pay to James Ross, or order, one hundred dollars, with interest at 6%. Value received. Abel Jones.

3. Examine this note.

Who borrowed money?

From whom was money borrowed?

How much must be paid by the borrower at the end of the year?

Why is the sum paid back more than the sum borrowed?

EXERCISE 145

Find the interest on the following sums:

1. $600 for 1 yr. at 5%.
2. $550 for 1 yr. at 7%.
3. $840 for 1 yr. at 6¼%.
4. $3152.16 for 1 yr. at 7½%.
5. $3684.15 for 1 yr. at 6⅓%.
6. $4568.75 for 1 yr. at 7⅛%.

7. A man borrowed $7200 for 1 yr., viz., $1250 at 7%; $1340 at 7½%; $2360 at 8%; and the remainder at 8½%. How much interest has he to pay at the end of the year?

8. Four brothers have to divide equally the interest of $25800 at 7%. How much does each receive each year?

ORAL EXERCISE

1. A man had 96 head of cattle. He sold 84. What per cent. had he left?

2. 25 cents is 10% of the money in my pocket. How much money is in my pocket?

8. \$36 is 12% of what sum of money?

4. Find $33\frac{1}{3}\%$ of \$120; of 60 mi.; of 43.5 lb.

5. Seven per cent. of a number is 21. Find it.

6. A drover purchased 375 head of cattle and sold 40% of them. How many remained?

7. From 25% of 76 take $33\frac{1}{3}\%$ of 45.

8. A horse was bought for \$120 and sold at a loss of $12\frac{1}{2}\%$. Find the selling price.

9. Find the interest on \$250 at 8% for 6 mo.

10. A bicycle was sold for \$40 at a loss of 20%. Find the cost.

III. GENERAL REVIEW

EXERCISE 146

1. Write in figures ten million and ten, and ten thousandths.

2. Divide the continued product of 24, 36, and 45 by the continued product of 16, 18, and 32.

3. The divisor is 78, the quotient 57, and the remainder the largest possible. Find the dividend.

4. Divide the L. C. M. of the even numbers less than 15 by the continued product of 3, 5 and 7.

5. If 24 men can do a work in 36 days, how long will it take 32 men to do it?

6. Reduce $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ to equivalent fractions with a common denominator.

7. How many barrels of apples at \$3.75 per barrel can be bought for 18.5 cords of wood at \$5.25 per cord?

8. Find the average of 71, 68.3, 72.4, 80.1, and 75.6.

9. Simplify $\dfrac{.4 \times .6 \times .8 \times 9}{.2 \times .3 \times .4 \times 1.5}$.

10. What number increased by 40% of itself becomes 896?

11. What number diminished by 40% of itself becomes 840?

12. In 1891 the population of a town was 5760. During the decade ending 1901, it increased 30% in population. Find its population in 1901.

13. During the year 1908, *A* added 12½% to his wealth and was worth $7245 at the end of the year. What was he worth at the beginning of 1908?

14. Fill in the blanks in the following:

Cost price.	Selling price.	Profit.	Gain %.
$450	$600	?	?
$6	$7.50	?	?
40 cents	65 cents	?	?
75 cents	?	25 cents	?
?	$2.50	?	25

15. The cost of building a new road 21.7 miles long was $8419.60. Find the cost per mile.

16. John walked 2½ miles in ⅔ of an hour. At this rate, how long would he take to walk 13½ miles?

17. If a gallon of paint will cover 630 sq. ft., how much paint is required to cover both sides of a tight board fence 6 ft. 4 in. high and 380 ft. long?

18. How many bricks are there in a wall 6½ ft. high, 36 ft. long and 18 in. thick, if there are 600 bricks in a cubic yard?

19. Chickens lose 20% of their weight in being dressed for market. How much will 60 lb. of live chickens weigh when dressed?

ANSWERS

Ex. 30. *6.* $10016. *7.* $6135.

Ex. 34. *8.* 4443. *9.* 997514. *10.* 30. *11.* 5575.

Ex. 36. *3.* 853288. *4.* 10534. *5.* $104. *6.* 956. *7.* 814 ft. *8.* 28, 32. *9.* (*a*) 3724456; (*b*) 1278602; (*c*) 23446930; (*d*) 3523550, 248204, 446353, 2757, 3724456. *10.* 68621.

Ex. 37. *1.* 227 a. *2.* 245. *3.* 7 yr. *4.* (*a*) 3847; (*b*) 156516; (*c*) 160363. *5.* 24335. *6.* 76. *7.* 984.

Ex. 45. *10.* 1323000 lb. *11.* 2496 rails. *12.* $12.

Ex. 46. *1.* 785664. *2.* 425455. *3.* 502176. *4.* 305282. *7.* 1625225240. *11.* 772 lb. *12.* 10954.

Ex. 47. *1.* $608. *2.* 162764 men. *3.* 530229 gal. *4.* $2773. *5.* 12652 ct. *6.* $7455; $9940. *7.* 7 horses; $2532. *9.* 18750c. *10.* 116550c. *11.* 457047. *12.* 944 da.

Ex. 51. *20.* $11½. *21.* $101½. *22.* 2423 min.

Ex. 57. *1.* 4. *3.* 89. *5.* 6. *7.* 12. *9.* 8265. *10.* 19787.

Ex. 58. *1.* 8814. *2.* 129. *3.* 233289. *4.* 348. *5.* 186. *6.* 272. *7.* 10005100. *8.* 19052. *9.* 136067. *10.* 244.

Ex. 59. *1.* 271. *2.* 555. *3.* 222221. *4.* 632819. *5.* 224508. *6.* 37874. *7.* 414348. *8.* 9576. *9.* 59. *10.* 489689.

Ex. 60. *1.* 38 mo. *2.* 367 a. *2.* $2310. *4.* $3380. *5.* $44. *6.* 67 ct. *7.* 1650 bbl. *8.* $551. *9.* $1060. *10.* 41600 c. ft.

Ex. 61. *8.* 23725 da. *9.* 7056 lb. *10.* 5640 yd.

Ex. 63. *4.* 108 men. *5.* 114 men. *6.* 56 men. *7.* 15 beggars. *8.* $520. *9.* 30 hr. *10.* 144. *11.* 25367.

Ex. 65. *7.* $11.58. *8.* 70c. *12.* $118. *13.* $12. *14.* 7 in.

Ex. 67. *16.* (*a*) 255.23; (*b*) 868.50; (*c*) 585.98.

Ex. 68. *14.* 8 mi. 4 fur. 5 rd. *15.* 7040 steps. *16.* 55 mi.

Ex. 69. *16.* 58 a. 4835 sq. yd. 5 sq. ft. *17.* 47 a. 35 sq. rd. 5 sq. yd. 2 sq. ft. 36 sq. in. *18.* 2 a. 53 sq. rd. 10 sq. yd. 108 sq. in. *19.* 33.

Ex. 70. *14.* 100 cd. 16 cu. ft. *15.* 63 cd. 96 cu. ft. *16.* 2160.

Ex. 71. *17.* 60 t. 12 cwt. 49 lb. 10 oz. *18.* 15 t. 14 cwt. 94 lb. 4 oz. *19.* 18 t. 18 cwt. 91 lb. 9 oz. *20.* 2 cwt. 50 lb. 10 oz. *21.* $206.25. *22.* 6.

Ex. 72. *17.* 1 bu. 1 pk. 1 gal. *18.* 54 bu. *19.* $141.26.

Ex. 73. *16.* 6 wk. 3 da. 6 hr. 50 min. 33 sec. *17.* 6 da. 22 hr. 40 min. *18.* 1 hr. 35 min. 45 sec. *19.* 17 min. 58 sec.
20. (*a*) $10.80, $9.40, $9.05, $9.10, $11.65, $11.50; (*b*) $2.25; (*c*) $61.50.

Ex. 74. *18.* 62° 49′ 4″. *19.* 111° 17′ 55″. *20.* 138° 49′ 3″. *21.* 82° 5′ 50″. *22.* 66⅔.

Ex. 75. *17.* 67½ rm. *18.* $5.40.

Ex. 76. *1.* 37. *2.* 2000 lb. *3.* $735. *4.* 8 hr. *5.* 507 bottles. *6.* 432298 lb. *7.* $27\frac{3}{11}$ mi. *8.* 17 coats; 2¼ yd. *9.* 5 wk. *10.* 35400 sec. *11.* $195. *12.* 659 cb. *13.* 64800 sec. *14.* $528. *15.* 5 p.m. Jan. 6. *16.* $68.08. *17.* $11.70. *18.* 9 t. 375 lb.

Ex. 77. *1.* Seven million, seven hundred thousand and seven; seventy-five million, six hundred thousand and fifty-six. *2.* MCMVIII. *3.* 1002536. *4.* 578715. *5.* 479374. *6.* 354816. *7.* 307. *8.* 43848. *9.* 610279. *10.* 731. *11.* 806. *12.* $127. *13.* $8. *14.* 16020. *15.* 70 trees. *16.* 1056. *17.* $3094.08. *18.* 125 lb. *19.* $652.96. *20.* 201 da. *21.* 20 hr. *22.* $2. *23.* 21780 sq. ft. *24.* 3520 rails. *25.* 3715200 sec. *26.* Tuesday, Friday, Sunday, Friday. *27.* 4 t. 504 lb. *28.* (*a*) May 6; (*b*) Sept. 8. *29.* $510.60. *30.* 5 yr.

Ex. 78. *1.* $31.30. *2.* $27.76. *3.* $47.02. *4.* $807.04. *5.* $194.55.

Ex. 79. *1.* 34¾. *2.* 32⅞. *3.* 493¾. *4.* 54¾. *5.* 44. *6.* 8 lb. 7 oz. *7.* 110, 10. *8.* $437. *9.* 55 bu. 24 lb.; 22 bu. 9⅞ lb.

Ex. 80. *1.* 65 lb. 3 oz. *2.* 135 mi. 215 rd. *3.* 67½c. *4.* 40c. *5.* 200 bu. at 78c. *6.* 25½ lb. *7.* $10.20.

Ex. 81. *5.* *A*, 45c.; *B*, 83c.; *C*, 79c. *6.* *A*, 16; *B*, 23; *C*, 33. *7.* 478,521. *8.* *A*, 30 cd. 60 c. ft.; *B*, 40 cd. 35 c. ft.; *C*, 41 cd. 33 c. ft.

Ex. 82. *6.* *A*, 25c. *7.* 6 twenty-five-cent pieces. *8.* 100 red, 112 blue, 138 green.

Ex. 83. *3.* 136. *4.* $1120. *5.* $985.60. *6.* 18 ft. *7.* 20 ft. by 10 ft. *8.* 174 ft.

Ex. 84. *7.* $15.64. *8.* 862½ sq. in. *9.* 2574 sq. in.

Ex. 85. *3.* 20 in. *4.* 71⅓ yd. *5.* 16 ft. *6.* 15 ft. *7.* 15 in. *8.* 63 ft. *9.* 20½ ft. by 15½ ft. *10.* 12 ft.

Ex. 86. *4.* 4 in. *6.* 10⅝ ft.

Ex. 87. *2.* $48. *3.* $57.60. *4.* $29½. *5.* 8.

Ex. 88. *2.* 150⅔ sq. yd. *3.* $37.80. *4.* 13 ft. *5.* 44. *6.* $5.

Ex. 89. *1.* 126 yd. *2.* 57⅔ yd. *3.* 288 yd. *4.* 115½.

Ex. 90. *4.* 2400 ft. *5.* 2232 ft. *6.* (*a*) 2500 ft.; (*b*) 11520 ft.; (*c*) 7700 ft.; (*d*) 16200 ft.

Ex. 91. *1.* 2592. *2.* 3888. *3.* 9600. *4.* 20 ft. 10 in. *5.* $105.30.

Ex. 92. *5.* 20250. *6.* $116\frac{4}{17}$. *7.* 4⅓ ft. *8.* 31½ cd. *9.* 166½ c. ft.

Ex. 93. *1.* (*a*) 66 sq. yd.; (*b*) 60 sq. yd. *2.* 12 ft. 9 in. *3.* 72 yd. *4.* 72 rd. *5.* 4860 lb. *6.* 44½. *7.* £87 9s. 2d. *8.* (*a*) 5 ch.; (*b*) 24 sq. rd. *9.* 43055. *10.* 54 cd. *11.* 6316. *12.* 300 bu. *13.* 33154. *14.* 15095. *15.* 966 fath. *16.* $58. *17.* 33 sec. *18.* 20 hr.

Ex. 94. *1.* 18 sheep. *2.* 70c. *3.* $5.15. *4.* 16. *5.* $3.75. *6.* $122. *7.* $93.84. *8.* $1.10. *9.* 40 ft. *10.* (*a*) $414.72; (*b*) $360; (*c*) $91.80. *11.* 85 votes. *12.* 1760. *13.* 100 da. *14.* 240 bu. at 80c.

Ex. 99. *7.* 20 yd. *8.* 72 bu. *9.* $22. *10.* 135 yd.

Ex. 101. *1.* 6. *2.* 12. *3.* 16. *4.* 13. *5.* 21. *6.* 5. *7.* 4. *8.* 8. *9.* 14. *10.* 10. *11.* 42. *12.* 24. *13.* 11. *14.* 75. *15.* 144. *16.* 9.

Ex. 102. *1.* 8 ft. *2.* 21 ft. *3.* 16 ft. *4.* 19, 31, 41. *5.* 25, 43. *6.* 21. *7.* 32 gal.

Ex. 103. *1.* 30. *2.* 60. *3.* 36. *4.* 150. *5.* 360. *6.* 180. *7.* 360. *8.* 770. *9.* 2520. *10.* 1512. *11.* 1680. *12.* 16800. *13.* 1800. *14.* 720720. *15.* 50702925.

Ex. 104. *1.* 173. *2.* $2100. *3.* 360 bu. *4.* 120c. *5.* 105 gal. *6.* 180 min. *7.* 546 a. *8.* 882 gal.

Ex. 105. *2.* 8. *3.* $3048. *4.* 643. *5.* 25 a. *7.* 46. *8.* 1680 marbles. *9.* 4, 5, 6, 7. *10.* 900 a. *11.* 2310. *12.* 2, 2, 2, 3, 3, 5, 5. *13.* 203, 119. *14.* 1. *15.* 75c.

Ex. 106. *1.* Seven hundred and thirty billions, six millions, seventy thousand three hundred and five; 64000065000. *2.* 3357. *3.* $1404. *4.* 24 ft. *5.* 3 t. 19 cwt. *6.* 3 times. *7.* 70. *8.* 10 ft. 11 in.; 32 ft. 9 in. *9.* 208. *10.* 1485 cd. *11.* 9000 ft. *12.* 720 squares. *13.* 790 lb. *15.* $285. *16.* $104. *17.* 36 ft. *18.* $328.75. *19.* $364. *20.* 2, 2, 2, 3, 3, 5, 7. *21.* 54000. *22.* 6 t.

Ex. 109. *14.* $\$\frac{1}{4}$. *15.* 12 lots.

Ex. 114. *13.* $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$; $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{4}$, $\frac{2}{5}$; $\frac{2}{3}$, $\frac{3}{4}$, $\frac{3}{5}$, $\frac{4}{5}$.

Ex. 116. *13.* $10\frac{5}{12}$. *14.* 15. *15.* $15\frac{1}{2}$. *16.* $13\frac{7}{12}$.

Ex. 117. *1.* $5\frac{11}{12}$. *2.* $\frac{11}{12}$. *3.* $4\frac{1}{2}$ t. *4.* $42\frac{7}{80}$ mi. *5.* $141\frac{1}{2}$ rd. *6.* $56\frac{11}{12}$ lb.

Ex. 118. *6.* $5\frac{1}{2}$. *7.* $40. *8.* $3\frac{1}{2}$ in. *9.* $4\frac{1}{2}$.

Ex. 120. *1.* $\frac{11}{12}$. *2.* $9\frac{1}{2}$, $22. *3.* $37\frac{1}{12}$ bu. *4.* $12\frac{1}{2}$ rd. *5.* $3\frac{1}{2}$. *6.* $33\frac{11}{12}$ cd. *7.* $51\frac{7}{12}$ yd.

Ex. 122. *10.* $1.87\frac{1}{2}$. *11.* $30.

Ex. 124. *10.* $3\frac{1}{2}$ a. *11.* $2\frac{1}{2}$ cd. *12.* $3\frac{1}{2}$ mi.

Ex. 127. *10.* $19\frac{1}{2}$. *11.* $14\frac{1}{2}$. *12.* $42\frac{1}{2}$c.

Ex. 130. *1.* 32c. *2.* 24 bu. *3.* 14 t. *4.* 27 bu. *5.* $2\frac{13}{20}$ wk. *6.* 11. *7.* $\$\frac{1}{2}$. *8.* $11\frac{1}{2}$ bu. *9.* $10\frac{1}{2}$.

Ex. 131. *3.* $5\frac{3}{12}$. *4.* $\frac{11}{12}$. *5.* $13\frac{1}{12}$. *6.* $19\frac{1}{2}$. *7.* $4\frac{7}{12}$. *8.* 30 bu. *9.* $2\frac{1}{2}$. *10.* $16.60. *11.* 70c. *12.* $4\frac{1}{12}$ br., 6 hr. *13.* $1\frac{1}{2}$. *14.* £10 8s. $10\frac{1}{2}$d. *16.* $84\frac{1}{2}$ lb. *17.* $14\frac{7}{12}$ ft. *18.* $12\frac{5}{12}$. *19.* $\frac{1}{2}$. *22.* $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$. *24.* 3.89\frac{1}{2}$. *25.* $2500, $6250.

Ex. 132. *1.* 3705. *2.* 154. *3.* 8217520. *4.* $103. *5.* 480. *6.* 201. *7.* $2916. *8.* 129600. *9.* $6\frac{1}{12}$. *10.* $3093\frac{1}{2}$ lb. *11.* $19\frac{1}{2}$. *12.* $7\frac{1}{2}$ t. *13.* 60 mi. *14.* 42 yr. 322 da. *15.* 187 lb. *16.* 9.37\frac{1}{2}$. *17.* $1.85, $8.15. *18.* (*a*) 704 rd.; (*b*) $172\frac{1}{2}$ a; (*c*) 1408 posts; (*d*) $35\frac{1}{2}$ rolls, $89.76.

Ex. 135. *8.* 869.277. *9.* 94.396.

Ex. 136. *10.* 4.295. *13.* 56.571. *15.* 9.71. *17.* 37.675.

Ex. 137. *8.* $241.345. *9.* 832.884.

Ex. 138. *9.* .3. *10.* $27.50. *11.* 265.8 cd. *12.* 7.25 hr.

Ex. 139. *1.* $9.10. *2.* 35 bu. *3.* $111.088. *4.* $33.6525. *5.* $878.85. *6.* 7400 ft. *7.* 1560 coats. *8.* 206.103. *9.* 176. *10.* 1574.625 gal. *11.* 5825.28. *12.* 264.6 bu. *13.* 88.929.

Ex. 140. *1.* 864. *2.* 6.48. *3.* 225, 150. *4.* 2640 ft. *5.* 49.2c. *6.* 352 ft. *7.* $5.04, $7.56. *8.* $1000. *9.* $10.80. *10.* 96 rd., $134.40. *11.* $353.70. *12.* $55\frac{5}{12}$. *15.* 4. *16.* $68.875. *17.* $21\frac{1}{2}$ t. *18.* $201.60. *19.* $3.92\frac{1}{2}$.

Ex. 142. *7.* 20. *8.* 270 bu. *9.* 15c. *10.* $20. *11.* 120, 32. *16.* 25%. *17.* 40%. *18.* $33\frac{1}{3}$%. *19.* 200 pupils.

Ex. 143. *3.* 25%. *4.* $33\frac{1}{3}$%. *5.* 72c. *6.* $22. *7.* $5.50. *8.* $300.

Ex. 145. *7.* $568.05. *8.* $451.50.

Ex. 146. *1.* 10,000,010.010. *2.* 4.21875. *3.* 4523. *4.* 8. *5.* 27 da. *6.* $\frac{4}{15}$, $\frac{4}{15}$, $\frac{4}{15}$, $\frac{4}{15}$. *7.* 25.9 bbl. *8.* 73.48. *9.* 48. *10.* 640. *11.* 1400. *12.* 7488. *13.* $6440. *15.* $388. *16.* 4 hr. *17.* $7\frac{11}{15}$ gal. *18.* 7800 bricks. *19.* 48 lb.