MODERN

BUSINESS

ARITHMETIC

SWEET'S

Modern Business Arithmetic
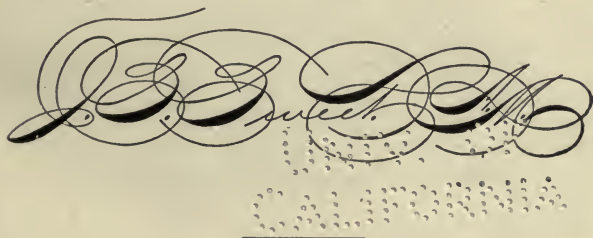
A TREATISE ON

MODERN AND PRACTICAL METHODS

OF

ARITHMETICAL CALCULATIONS

FOR THE USE OF

Business and Commercial Colleges, Business Universities,
Commercial High Schools, Technical Schools, and
Commercial Departments in Other Edu-
cational Institutions

BY

Preface

AFTER thirty years experience as a teacher of mathematics, the author feels that he is able to present the subject of commercial arithmetic to students and instructors in a manner which is not only severely practical and up to date, but attractive and intensely interesting.

No claims are made in regard to the discovery of new facts in the science of arithmetic. While the manner of presenting the topics to the class, the method of illustration, exemplification, and practice have been used by the author for many years, no published work has ever been issued handling the science in this extremely practical manner.

Particular attention is called to the different parts into which the work is divided. ''Class Work,'' ''Home Work,'' ''Test,'' and ''Final Examinations,'' each has its place in the development of every topic. The topics are made largely independent of one another, so that students entering school at different times may take up the work together. This will be found a most excellent feature in business college work. A system of credits is also suggested which will spur the student to do his best at all times.

To the Teacher

The following plan of preparation, recitation, test, credits, and examination is suggested:

I. PREPARATION: Students should be assigned certain definite work to prepare for each recitation. Such preparation should be made before coming to the class room.

II. RECITATION: Students should be required to discuss each topic in class before any blackboard demonstrations are given. Blackboard examples, fully illustrated and discussed, should bring out the principles of each topic. Every student should be required to solve at least one problem in each subject and discuss it from the board before the class.

III. TESTS: Tests may be given at the close of each subject, or may be postponed for two weeks. The latter method is found to be the more satisfactory, as it compels the student to review the subject.

IV. HOME WORK: Twenty-five different exercises for Home Work have been carefully prepared. Each student should be required to hand in a correct solution of these, systematically arranged, as a part of his permanent record.

V. CREDITS: A good plan in recording the work of students is to divide the work into two parts: *Class Work* and *Home Work*. Class Work, including recitations, demonstrations on the blackboard, and criticisms, may be rated on a basis of 100 credits, the credits being actually earned as the subjects are passed. Home work should consist of the papers filed with the teacher, and may be given 100 credits, an average of four credits for each paper. Only accurate, neat, and tastefully arranged work should be given credits. This work should be filed away for future reference.

VI. FINAL EXAMINATIONS: Final examinations may be given, if thought advisable, though experience has taught that with the above system carefully carried out they are hardly necessary.

To the Student

You are about to begin a course of study that is to prepare you for the active duties of business. As you succeed here, so will your teacher and those about you judge of your success in the real battle of business. Here you will win or lose, for your school life is but the epitome of your future.

Resolve, then, to win. Take up each lesson with a determination to master it from start to finish. Every lesson thoroughly learned will make those coming after the easier. Test and examination will then become a pleasure instead of a dread, and you will reap an abundant reward.

Post yourself thoroughly upon your "class work" by studying the definitions and discussions of each topic, and by such preparation upon the examples and problems as will enable you to recite intellegently and correctly.

The "Home Work" should be prepared at home, and should be carefully arranged on your paper so the examiner may note the method of solution and the answer at a glance. Full credits will not be given you unless the above is carefully observed.

Please note the plan of the "system of credits" used by your teacher, and strive to reach the very highest point possible. Success is yours if you work faithfully, methodically, and persistently.

RECORD OF CREDITS:

No.	1	2	3	4	5	6	7	8	9	10	11	12
Cr.												
13	14	15	16	17	18	19	20	21	22	23	24	25

NOTE—Should the student so desire, he may keep a record of his earned credits on the above form.

CONTENTS

Modern Business Arithmetic

Definitions

1. A ***Unit*** is a single thing; as one, one dollar, one dozen.

2. A ***Number*** is one or more units taken as a whole; as one, five, two cents, fifty feet.

3. An ***Integer*** is a number representing whole things; as six, seven, nine men, twenty dollars.

4. A ***Fraction*** is a number representing parts of things; as one-half, two-thirds, three-fourths of a mile.

5. An ***Even Number*** ends in 0, 2, 4, 6, or 8; as 10, 32, 54, 76, 98.

6. An ***Odd Number*** ends in 1, 3, 5, 7, or 9; as 11, 23, 35, 47, 59.

7. An ***Abstract Number*** is the number itself without reference to things; as 7, 25, 142.

8. A ***Concrete Number*** always refers to some particular thing; as 7 quarts, 25 cents, 14 desks, 50 men.

9. A ***Denominate Number*** is one whose unit is a measure; as 2 hours, 5 yards, 37 pounds.

The unit of these numbers is the hour, yard, and pound.

10. A ***Simple Number*** is a single number; as four, or 4 feet.

11. A ***Compound Number*** is a *concrete number* of two or more denominations; as 5 feet 6 inches, or 2 gallons 3 quarts 1 pint.

12. ***Like Numbers*** refer to the same kind of unit; as 3 and 8, 2 dollars and 30 dollars.

13. *Unlike Numbers* refer to different kinds of units; as 3 dollars, and 80 bushels; 5 hours, and 10 boys.

14. *Arithmetic* is the science of numbers and the art of computation.

Science is the amassed knowledge pertaining to a subject.

Art is the power or skill to use the knowledge embodied in a science.

How to Write and to Read Numbers

15. *Figures* are used to express numbers; the ten characters used in Arabic notation are:

1   2   3   4   5   6   7   8   9   0

One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Naught.

16. A number consisting of only one figure is called ***Units;*** as 5, indicates 5 units.

17. A number consisting of two figures contains ***tens*** and ***units;*** as 45, indicates 4 tens and 5 units, and is read *forty-five*.

"Forty" is a contraction of "four tens."

18. A number consisting of three figures contains ***hundreds, tens,*** and ***units;*** as 345, indicates 3 hundreds, 4 tens, and 5 units, and is read *three hundred forty-five*.

19. If the "0" occurs in a number it is not read as it has no value; thus, 305 is read *three hundred five;* 740 is read *seven hundred forty*.

20. Numbers consisting of more than three figures are separated into periods of three figures each, beginning at the right. Each period is named as follows:

Decillions	Nonillions	Octillions	Septillions	Sextillions	Quintillions	Quadrillions	Trillions	Billions	Millions	Thousands	Units
10,	999,	888,	777,	666,	555,	444,	333,	222,	111,	567,	234.

21. Each period is read as standing alone, then its name is given; as: 421,672,305 is read "four hundred twenty-one *million*, six hundred seventy-two *thousand*, three hundred five.

Since **units** is the name of the last period and always a part of the number read, its name is not used.

22. Copy and read the following:

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

23. Write the following in figures on the blackboard:

1. Eighty-four.
2. Six hundred eighty.
3. Four hundred nine.
4. Two thousand, five hundred ten.
5. Fifty thousand, twenty.
6. Seventy-five million, two thousand, four.
7. Nine hundred trillion, seven billion, two hundred.
8. Two million, two thousand, two hundred two.
9. One hundred billion, ten million, one.
10. Thirty quadrillion, three hundred three million, two hundred three.

NOTE—From the above it will be noticed that the word "and" is omitted when writing or reading whole numbers.

Roman Method of Writing Numbers

24. In **Roman Notation** seven capital letters are used in writing numbers, as follows:

I	V	X	L	C	D	M
One	Five	Ten	Fifty	One Hundred	Five Hundred	One Thousand

25. Principles of Roman notation:

1. Repeating a letter repeats its value, as: II is two, XXX is thirty, CCC is three hundred.

2. A letter placed after one of greater value is added to it; if placed before, is subtracted from it; thus: VI is six, IV is four, MC is eleven hundred, CM is nine hundred.

3. A letter placed between other letters is subtracted from their sum; thus: XIV is fourteen, CIX is one hundred nine.

4. A bar placed over a letter multiplies it by one thousand; a double bar, by one million; thus: $\overline{X}$ is ten thousand, $\overline{\overline{X}}$ is ten million.

NOTE—Four is represented on clock and watch dials by IIII; in all other places by IV.

26. Roman and Arabic notation:

I	1	XI	11	XXI	21·	C	100
II	2	XII	12	XXX	30	CC	200
III	3	XIII	13	XL	40	CCC	300
IV or IIII	4	XIV	14	L	50	CD	400
V	5	XV	15	LX	60	D	500
VI	6	XVI	16	LXI	61	DC	600
VII	7	XVII	17	LXXII	72	M	1000
VIII	8	XVIII	18	LXXX	80	$\overline{V}$	5000
IX	9	XIX	19	LXXXVI	86	$\overline{XV}$	15000
X	10	XX	20	XC	90	$\overline{\overline{L}}$	50,000,000

27. Write in Roman notation:

1.	Four.	Also	28
2.	Nine.	"	74
3.	Thirteen.	"	125
4.	Twenty-two.	"	328
5.	Thirty-eight.	"	972
6.	Forty-seven.	"	1,248
7.	Sixty-four.	"	27,853
8.	One hundred sixty-six.	"	458,207
9.	Seven hundred ninety-nine.	"	2,576,324
10.	Nineteen hundred seven.	"	17,265,842

28. Write in Arabic notation:

1.	LXXXII.	6.	$\overline{\text{VIII}}$CDXII.
2.	XLVII.	7.	$\overline{\text{XXXV}}$DCCCLXXII.
3.	DXII.	8.	$\overline{\text{DCCII}}$DCCCLIV.
4.	DCCCXXIII.	9.	$\overline{\overline{\text{IV}}\text{CC}}$XXXVI̅DCCLII.
5.	CCLXXIX.	10.	$\overline{\overline{\text{XXIV}}\text{DCCCL}}$VICCLXXI.

HOME WORK—No. 1

29. Study carefully the following figures and practice them thirty minutes every evening for two weeks, then hand in a full page of your best work:

/ / / / / / / / / / / / / / / / / / / /
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

---

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2
4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7
9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

Outline for Review

30. *Definitions:*

1. Unit.
2. Number.
3. Integer.
4. Fraction.
5. Even number.
6. Odd number.
7. Abstract number.
8. Concrete number.
9. Denominate number.
10. Simple number.
11. Compound number.
12. Like numbers.
13. Unlike numbers.
14. Arithmetic.
15. Science.
16. Art.

Arabic Notation:

1. Figures.
2. Places in a period.
3. Names of places.
4. Names of periods.
5. How to read a number.
6. How to write numbers.

Roman Notation:

1. Letters used.
2. Value of each.
3. Principles of Roman notation.
4. How to read.
5. How to write.

ADDITION

31. *Addition* is the process of finding the sum of two or more numbers.

32. The *Sum* is the result obtained by addition.

33. The *Sign of Addition* is $+$, and is read *plus*.

34. The *Sign of Equality* is $=$, and is read *equals ;* thus, $4 + 5 = 9$ is read *four plus five equals nine.*

35. PRINCIPLE—*Only like numbers can be added.*

36. The *Sign of Dollars* is $, and is read *dollars*. When dollars and cents are expressed a period separates them ; thus, $23.45 is read *twenty-three dollars and forty-five cents.*

37. The **sign** ℔ when placed *before* a number is read *number*, when placed *after* a number is read *pounds ;* thus, ℔32 is read *number thirty-two ;* 32℔ is read *thirty-two pounds.*

38. *Numbers must always be written so that like units stand in the same column. Add each column separately. If the sum of any column is ten or more, carry the tens to the next column.*

Reading Method of Addition

39. There are but *forty-five* possible combinations of the nine digits taken two at a time. These must be memorized so that when any one of the combinations is seen the sum is instantly known. The combinations are as follows :

40. *Sums Less Than 10:*

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

41. *Sums Greater Than 9:*

42. *To Read at Sight:*

When a student sees the numbers 1 and 3 written side by side, he instantly knows the number to be *thirteen* or *thirty-one*, according to their positions.

The same facility may be acquired in addition; thus: 4 over or under 8 may be read *twelve* as readily as the figures 1 and 2 side by side.

43. Read the sums of two figures at a time.   Never add single figures.   Name the result of the following as rapidly as possible from left to right, from right to left, and then by skipping about:

44. Read the sums of the following grouping the figures by twos; thus, in the left hand column read *fifteen*, *twenty-four;* in the next column, *seven*, *twenty-two*, etc. :

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

45. **To Add by Tens,** *fifteens*, *twenties*, *thirties*, etc., carry the *excess* in the mind as in the following :

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

Many times it is convenient to add the figures that will make even *tens* or *twenties*, etc., keeping in mind the unadded digits until they will unite with another to make *ten* or *twenty;* thus : in the right hand column above read the 4 and 6, 7 and 3, 8 and 2, and 1 and 9 as *tens*, to which add the $3 + 4$; as *ten*, *twenty*, *thirty*, *forty-seven*.

46. When the Columns Are Long, add each column separately, writing the sum beneath, then add results, as follows:

```
4 7 5 3 6 8 6 5
4 3 9 4 5 2 4 7
2 8 7 1 9 4 5 2
9 1 6 3 6 7 2 3
6 2 5 8 4 2 8 6
8 4 1 9 7 6 1 8
2 9 6 2 3 8 5 7
7 4 8 5 4 9 2 5
5 1 5 7 9 3 6 4
4 8 2 6 5 2 8 1
1 9 3 2 7 8 4 2
8 2 7 4 6 5 1 6
6 5 8 9 3 4 5 9
4 7 6 4 8 7 6 7
3 6 5 3 7 6 4 5
2 3 4 1 2 1 2 3
───────────────
            8 0
          6 9
        8 2
      9 1
      7 1
    8 7
  7 9
  7 5
───────────────
8 3 8 5 0 9 9 7 0
```

This method is almost indispensable in bookkeeping, since an error can be detected in one column without the trouble of having to add all the others.

47.   To add two columns at a time, practice on the following by adding the *tens'* column first, and by reading the *units'* column, tell at a glance the number to carry :

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

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

48.   ***To Prove Addition,*** add the second time down, or up, in the opposite direction of the first addition.   In short columns, and several of them, the addition may be proved by casting out the 9's as shown below :

```
2 5 1 8 9 6 5 4 — 4
3 6 9 7 2 1 0 5 — 6
9 4 3 7 5 5 1 7 — 5
1 5 1 5 5 8 1 5 — 4
8 5 3 1 0 6 5 2 — 3
9 5 3 1 5 1 7 5 — 0
3 5 2 3 1 8 9 1 8 — 4
```

Casting out the 9's of the first number, we have an *excess* of 4; of the second, 6 ; of the third, 5 ; and so on ; finally casting out the 9's of these results gives an excess of 4.   Then casting

out the 9's of the *sum*, we have 4, which agrees with the former, indicating the probability of a correct addition.

NOTE—This is not always a sure test; the result might be wrong, and yet prove by this test.

49. Write and add the following :

$	mil	$
4 8 2 . 7 6	6 5 2 9 6	3 5 8 4 . 2 5
2 8 . 4 5	6 1 0 6	6 5 4 2 . 1 0
3 5 1 . 6 0	2 8 5 1 2	3 8 7 . 5 0
9 4 5 . 3 8	3 8 7 5	2 5 . 4 0
6 7 6 . 5 5	2 8 4	6 8 2 . 5 5
3 2 1 . 7 5	4 5 2 5 6	3 2 1 1 . 1 5
9 2 . 3 1	8 4	4 5 6 0 . 7 5
6 7 . 4 8	1 2 4	9 8 7 . 3 0
1 1 5 . 9 4	3 8 7 5 .	2 9 . 0 5
3 8 2 . 6 2	5 6 . 7 4	5 8 6 . 4 5
9 8 8 . 3 7	1 1 6 7 1	3 2 9 8 . 7 5
1 8 . 1 0	3 8 5 2	9 8 9 6 . 3 5
7 5 . 5 0	7 9 6 5	4 7 5 0 . 6 0
1 3 5 . 2 5	1 2 5	1 3 8 . 2 5
4 7 3 . 0 5	4 9 1 5 2	2 4 5 5 . 1 5

ft	#	$
5 2 8 0 0	2 8 7 5 4 6	4 8 7 6 9 . 4 5
9 1 7 8 8	5 8 2 3 8 1	7 7 5 3 8 . 2 5
2 4 3 4 5	1 3 4 5 7 6	5 2 3 8 7 . 6 0
6 2 7 5 8	9 8 2 3 2 5	4 7 5 0 . 0 0
9 4 8 7 6	4 2 7 6 3 8	1 2 3 4 5 . 5 0
3 8 7 9 5	7 5 4 9 8 2	8 7 6 2 4 . 3 5
4 5 1 2 3	3 8 8 7 7 5	7 8 4 . 9 5
6 7 8 4 5	4 4 9 6 5 4	3 2 4 8 . 6 5
1 7 3 9 4	2 7 1 7 8 8	4 2 3 7 6 . 4 0
2 8 7 5 9	3 3 4 5 5 6	2 4 6 8 0 . 9 0
3 5 8 7 1	7 3 8 9 8 9	3 5 7 9 1 . 1 5
2 4 8 8 7	2 5 4 8 2 1	8 4 0 2 5 . 0 0
1 3 8 2 5	3 1 5 6 7 9	5 4 9 6 . 5 5
5 8 7 6 4	4 5 7 7 8 8	2 3 4 5 0
9 3 2 1 5	9 9 2 2 3 8	6 3 7 5 8 . 2 5

PRACTICAL PROBLEMS

50. Find the total resources of each of the following persons:

1. L. C. Bonds: Cash, $11250; Mdse., $28760.50; Real Estate, $65000; Bank Stock, $15240; Chattels, $2185.75; Good Will, $5000; Furniture and Fixtures, $1844.25; Bills Receivable $848.20, Interest on same, $42.20; Accounts Receivable, $31245.85.

2. J. M. Johnson: U. S. Bonds, $40000; Premium on Same; $6800, Interest on Same, $800; Interest in Flour Mills, $21245.50; Mining Stocks, $2730; Cattle Ranch, $8540; Stock: horses, $1180; cattle, $4590; sheep, $2475.50; Cash in bank, $3840.25; Cash, in safe, $573.25.

3. Geo. H. Moore: Cash in bank, $7525.84; Cash on hand, $1125.50; Real Estate, $4200; Factory Equipment, $34237.50; Water Rights, $5000; Raw Material on hand, $52-372.25; Manufactured Goods unsold, $38576.75; Insurance prepaid, $735.60; Chattels, $2630.40; Furniture and Fixtures, $1795.

4. L. E. Roof: Accounts Receivable, per schedule "A," $3196.75; Real Estate, $45000; Machinery, $27000; Mdse., per inventory, $3113.92; Furniture, $457.20; Rebate, $895.91; Silk and Thread, $212; Traveling Expenses, unexpended, $24.34; Cash on hand, $8191.68; Accounts Receivable, per schedule "B," less 50% for bad debts, $592.40 net.

5. First National Bank: Loans and Discounts, $3320-699.50; Overdrafts, $5216; U. S. Bonds, to secure circulation, $152500; U. S. Bonds on hand, $126650; Premiums on U. S. Bonds, $9695; Banking House Furniture, $12625; Due from other banks, $905168; Checks on hand, not charged, $18427; Exchanges for Clearing House on hand, $49895; Bills of other National Banks on hand, $13595; Fractional Currency on hand, $984; Gold Coin on hand, $188402; Gold Treasury Certificates on hand, 121275; Silver Dollars on hand, $4800; Clearing House Certificates on hand, $5000; Silver Treasury Certificates on hand, $53648; Legal Tender Notes on hand, $470417; National Bank notes (our own issue) on hand, $14625; Five percent Redemption Fund with United States Treasurer, $6695.

HOME WORK—No. 2

NOTE—The following examples are to be copied with pen and ink and should represent the student's best work. The totals may be written in red ink. Prove the accuracy of the work by casting out the 9's:

1.	2.	3.	4.	5.
4298	42805	832165	1273361	315072683
8215	93176	385601	9164285	509348716
3156	81524	797615	9273106	816597338
3548	78165	950872	3827495	509483726
2167	83495	271345	3816049	379041748
9245	92750	962876	3150647	981506482
3859	28014	170563	2791586	310743162
5849	50561	508911	3681325	927483015
8429	71659	381276	5182497	482497518
8249	28170	428605	9317653	275109632
1687	80961	428654	1703975	907158720
6305	30712	135790	2468013	975310863
1975	86420	284195	3062591	318098127
4286	75319	812312	5142338	927661219
9214	42085	321174	3859271	498372618
3729	43815	461205	4055842	387267875
5348	27389	843442	7724259	409892159
3115	93376	422789	2227498	872262981

6.	7.	8.	9.	10.
1627	50493	271649	2738113	472916559
2162	94059	837205	1616227	434227051
7131	40371	478156	3158219	208849164
9332	29983	516882	9231586	924716607
3299	58115	932215	3724190	537961967
2272	52725	238744	3724057	224274452
4483	73538	264508	1482472	930882258
4225	55824	166723	5048321	663727754
7416	49883	922344	7380996	434287661
2243	93265	315068	3246821	428650286
4287	42897	489322	2260955	999421682
2766	55944	732915	3629721	192837508
9382	91327	427994	9543276	883459277
3721	59047	742236	3489334	248972214
8294	45893	433997	9327165	973324598
3184	40751	466158	1086838	571983349
2974	58158	274894	1468372	905162792
9383	25941	838832	4398232	384837929

SUBTRACTION

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

52. The *Minuend* is the greater of the two numbers.

53. The *Subtrahend* is the less of the two numbers.

54. The *Difference* is the result obtained by subtraction.

55. The *Sign of Subtraction* is —. It is read *minus*. When placed between two numbers it indicates that the one following it is to be taken from the one before it; thus, 14 — 6 equals 8.

56. The *Sign of Equality* is =. When placed between two numbers or sets of numbers it indicates their equality.

57. The *Parenthesis,* ( ), and *Bar,* ⸻, are used to indicate numbers considered together; thus, (5 + 8) — 7 = 9 — 6 — 3.

58. PRINCIPLE—Only like numbers and like units can be subtracted.

59. PROOF—Add the *subtrahend* to the *difference*. The *sum* should equal the *minuend*.

60. If the subtrahend figure be greater than that of the minuend, take a unit from the next higher order of the minuend, and which contains ten units of the order to be subtracted, adding them to the minuend digit, then subtract as usual.

$$\begin{array}{c} \overset{3\ 10}{8\ \overset{}{4}\ 2} \end{array}$$

Thus: $\underline{3\ 2\ 6}$ The 1 taken from the 4 adds 10 to the 2.

$5\ 1\ 6.$

Reading Method of Subtraction

61. When the *forty-five* combinations treated of in ADDITION are thoroughly memorized, the process of subtraction is a very simple one. This consists in being able to discern at a glance

the number which will combine with the one given to produce
the other. Thus,

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

are given, and the question is : What number will combine with
3 to produce 8, or with 4 to produce 9, etc.? The process is
nearly the same as in addition, only we must furnish one of the
numbers to the combination, the result being known.

62.   Read the differences as rapidly as possible :

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

12	13	14	14	13	13	12	18	16	15	14
5	4	7	6	7	9	8	9	8	9	5

15	16	17	15	16	17	18	19	15	14	13
8	9	8	7	7	9	8	9	6	8	6

24	25	26	28	22	23	23	24	24	23	22
5	9	8	7	8	9	7	6	7	4	5

23	24	25	29	28	27	26	25	27	26	25
6	8	6	9	8	9	7	7	8	9	8

8425	68752	27657	45321
3741	34589	19875	27184
5283	20875	41002	72318
1694	13796	37659	48921

NOTE—To become expert in any art, it is necessary to practice daily.
Addition and subtraction are no exceptions to this rule. The processes
set forth in this work are very simple, but faithful, persistent practice
only will perfect and give value to them.

63. Find the differences of the following :

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

```
 5 1 3 2 5 ft   1 2 4 5 6 ¢   $4 8 7.5 2   $3 2 8 4.5 0
 1 7 8 4 2      7 8 5 7       2 9 3.2 7    1 7 6 5.7 5
```

```
$2 5 8 7 2.6 0   $6 6.2.5 4   $8 7.1 2 5 - $9.2 5
 1 8 2 5 9.3 5   2 7 7.7 7    3 8.3 5      3.6 2 5
```

```
$8 4 5 6 7.2 0   $1 4 3.7 5 5   4 0 0 0 0 ounces
 3 8 2 9 3.1 5   2 8.1 7 5      9 8 9 9      "
```

```
 1 7 2 0 4#   6 7 5 1 mi.   1 7 6 0 0 yds.  $1 5 0 0 0
 1 3 5 9 6    2 8 9 4       9 3 8 5          1 2 5 2 4
```

PRACTICAL PROBLEMS

64. Solve the following :

1. L. Cushman's total assets are $9527.15 ; his liabilities are $3645.85. What is his present worth ?

2. L. Ayers' resources amount to $17826.45 ; his outstanding indebtedness is $8245.50. What is he worth ?

3. E. L. Payne began business with $2500, borrowed money. At the end of two years he was worth $3528.50. What was his gain ?

4. M. Coy lost $785.25 the first year ; gained $255.75 the second year, when his present worth was $5964.50. What was his capital at the beginning ?

5. Brown began business with $1840.25 ; the first year he lost $280.50, the second year he lost $177.25, the third year he gained $960.25, the fourth year he lost $128.40 ; What was his present worth at the end of the fifth year if his last year's gain was as much as his total losses ?

HOME WORK—No. 3

6.　J. S. Taylor & Co.s' statement at the close of the year was as follows :　*Resources :* Mdse. inventory, $3585; Cash, in bank, $2250; Notes on hand, $1275.50; Accounts Receivable, $8960.25; Store and Lot, $4500; Furniture and Fixtures, $1628.75; Horses and Wagons, $785.40.　*Liabilities:* Notes Outstanding, $2147.50; Interest Payable, $74.20; Accounts Payable, $3487.25.　Find the firm's present worth.

7.　The following statement of the College National Bank was given the board of directors :　*Resources :* Subscription, $25000; U. S. Bonds, $20000; Cash on hand, $21859.75; Loans and Discounts, $43260; N. Y. Bank, $6729.50; sundries banks, $335.50.　*Liabilities :* Capital Stock, $50,000; Circulation, $18-000; Deposits, $45064.10; Business College Bank, $482.50; Chemical Bank, $990; College Exchange Bank, $490; Surplus Fund, $396.82; Dividends, unpaid, $500.　What amount should be found in the Undivided Profits Account?

8.　E. P. Heald and F. O. Gardiner became partners in business with the following *resources :*　Cash, $4000; Mdse., $7850; Real Estate, $10000; Bills Receivable, $5250; Accounts Receivable $12320.40; Interest Receivable, $782.50; Furniture and Fixtures, $945; Chattels, $485.75. *Liabilities :*　Bills Payable, $675.25; Interest Payable, $48.35; Unpaid Salaries and Rent, $286.80.　If at the end of the year their present worth is $45-623.25, what is their gain?

9.　A milling company's present worth at the beginning of the year is $400000.　The first quarter they lose $2432.85, the second quarter they gain $8975.26, the third quarter they gain as much as their net gain for the first half year, the last quarter they gain as much as in the second and third quarters ; what is their present worth at the end of the year?

10.　The resourses of the First National Bank are given on page 20.　If the *liabilities* are as follows :　Capital Stock, $500-000; Deposits, $3015485; Surplus Fund, $125000; National Bank Notes Issued, $135485; Due to other National Banks, $1269800; Dividends Unpaid, $1176; United States Deposits with us, $114697; what must be the Undivided Profits?

MULTIPLICATION

65. *Multiplication* is a short method of making additions of the same number. Thus, 5 + 5 + 5 + 5 = 4 times 5 = 20.

66. The **Multiplicand** is the number to be repeated or multiplied; as 5 in the above example.

67. The **Multiplier** is the number which shows how many times the *multiplicand* is taken; as 4 in the above example.

68. The **Product** is the result obtained; as 20 in the above example.

69. The **Sign of Multiplication** is the oblique cross, ×; is read "times" or "multiplied by." Thus 3 times 8 is written 3 × 8, and means that 8 is to be taken or added to itself three times and equals 24.

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

71. An **Abstract Number** is the number itself without reference to things; as 5, 36, 240.

72. A **Concrete Number** always refers to some particular thing or quantity; as 12 hours, 80 miles, 500 horses.

73. The *multiplicand* may be either *abstract* or *concrete;* the *multiplier* is always considered an abstract number; the *product* and *multiplicand* are always *like* numbers. Thus,

5 times 7 = 35; all abstract numbers.
5 times \$7 = \$35; multiplier an abstract number, the multiplicand and product concrete numbers.

NOTE—In computing the square units in a given surface where the length and breadth are given, the product of these two dimensions equals the number of square units in a row multiplied by the number of rows. Thus, instead of 3 feet, the width, times 4 feet, the length, the analysis is 3 times the 4 square feet in a row, or 12 square feet.

74. The following *Multiplication Table* should be thoroughly memorized before proceeding further:

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

75. A *Square* of a number is the product of the number multiplied by itself. Thus, 25 is the square of 5; 49 is the square of 7.

76. *The squares of all numbers up to 30* should also be memorized. They become the basis of further knowledge of numbers. Thus:

$$13 \times 13 = 169 \qquad 19 \times 19 = 361 \qquad 25 \times 25 = 625$$
$$14 \times 14 = 196 \qquad 20 \times 20 = 400 \qquad 26 \times 26 = 676$$
$$15 \times 15 = 225 \qquad 21 \times 21 = 441 \qquad 27 \times 27 = 729$$
$$16 \times 16 = 256 \qquad 22 \times 22 = 484 \qquad 28 \times 28 = 784$$
$$17 \times 17 = 289 \qquad 23 \times 23 = 529 \qquad 29 \times 29 = 841$$
$$18 \times 18 = 324 \qquad 24 \times 24 = 576 \qquad 30 \times 30 = 900$$

77. *Alternating Numbers* are those having, in their regular order, a number between them; as, 5 and 7; 17 and 19; 24 and 26.

78. The **Product** of two *alternating numbers* is always one less than the square of the intermediate number. Thus, 5 times $7 = 6 \times 6$ less 1; 17 times $19 = 18 \times 18$ less 1.

Solve the following:

11×13	15×17	21×23	25×27
12×14	16×18	22×24	26×28
13×15	17×19	23×25	27×29
14×16	19×21	24×26	29×31

NOTE—The product of two numbers having three intermediate numbers between them is equal to the square of the central number less 4. Thus 8 times 12 equals 10 times 10, less 4.

79. *To Multiply a Number Consisting of Two Digits by 11.*

Write the sum of the digits between them; the number thus expressed is the product.

EXAMPLES: 11 times $24 = 264$.   11 times $47 = 517$.
11 times $32 = 352$.   11 times $68 = 748$.

NOTE—When the sum is 10 or more, carry one to the hundred's digit.

Solve the following:

11 times 34	11 times 38	11 times 52	11 times 75
11 times 43	11 times 56	11 times 65	11 times 78
11 times 45	11 times 71	11 times 87	11 times 88
11 times 44	11 times 85	11 times 69	11 times 96
11 times 66	11 times 79	11 times 95	11 times 99

80. *To Multiply any Number by 11.*

Write the units figure, the sum of the units and tens, the sum of the tens and hundreds, etc., also the left hand figure, carrying when necessary.

EXAMPLE: 11 times $12345 = \begin{cases} 5 & = & 5 \\ 4 + 5 = & 9 \\ 3 + 4 = & 7 \\ 2 + 3 = & 5 \\ 1 + 2 = & 3 \\ 1 & = & 1 \end{cases}$
$\overline{135795}$

Solve the following:

1.	11 times 2134	6.	11 times 345281
2.	11 times 4352	7.	11 times 587634
3.	11 times 6217	8.	11 times 879655
4.	11 times 7172	9.	11 times 378967
5.	11 times 8154	10.	11 times 897968

NOTE—**To Multiply by 22, 33, 44, etc.,** multiply by 11 as above, mentally, then by 2, 3, 4, etc., in the same operation.

81. *To Multiply by a Single Digit.*

Multiply the units figure of the multiplicand by the multiplier, then the tens, hundreds, etc. If the product at any time is 10 or more, carry the tens to the next product; thus:

$$
\begin{array}{r}
2\,4\,6\,8\,2 \\
4 \\
\hline
9\,8\,7\,2\,8
\end{array}
$$

OPERATION: Four times 2 = 8. Four times 8 = 32, carry 3. Four times 6 = 24, + 3 = 27, carry 2. Four times 4 = 16, + 2 = 18, carry 1. Four times 2 = 8, + 1 = 9.

Solve the following:

1.	$38751 \times 3 = ?$	6.	$55786 \times 7 = ?$
2.	$25684 \times 2 = ?$	7.	$38972 \times 8 = ?$
3.	$62753 \times 4 = ?$	8.	$45876 \times 9 = ?$
4.	$29759 \times 5 = ?$	9.	$82975 \times 4 = ?$
5.	$34287 \times 6 = ?$	10.	$88753 \times 6 = ?$

82. *To Multiply by any Number.*

Multiply by the units digit as above, then by the tens, then by the hundreds, etc., placing the full product by each digit one place to the left of the one before it, then take the sum of the several products; thus,

$$
\begin{array}{rl}
2\,4\,6\,8\,2 & = \text{multiplicand} \\
2\,3\,5\,4 & = \text{multiplier} \\
\hline
9\,8\,7\,2\,8 & = \text{product by } 4 \\
1\,2\,3\,4\,1\,0 & = \text{product by } 5 \\
7\,4\,0\,4\,6 & = \text{product by } 3 \\
4\,9\,3\,6\,4 & = \text{product by } 2 \\
\hline
5\,8\,1\,0\,1\,4\,2\,8 & = \text{TOTAL PRODUCT.}
\end{array}
$$

NOTE—**To Prove Multiplication** by casting out the 9's:

(1). Cast out the 9's of the multiplicand and also of the multiplier.

(2). Cast out the 9's from the product of the remainders. This remainder should equal the remainder after casting out the 9's of the total product.

Solve the following and prove :

1.	$3845 \times 2625 = ?$		6.	$83214 \times 33654 = ?$
2.	$8227 \times 3144 = ?$		7.	$77558 \times 24875 = ?$
3.	$6782 \times 4372 = ?$		8.	$84923 \times 71684 = ?$
4.	$9247 \times 5428 = ?$		9.	$98059 \times 39563 = ?$
5.	$6782 \times 6534 = ?$		10.	$56789 \times 40387 = ?$

83. To Multiply by any Number between 12 and 20.

Multiply by the units figure only; write the result under the number and one place to the right, then add.

EXAMPLE: 13 times 235 = $\left\{\begin{array}{l} 2\,3\,5 \\ \underline{7\,0\,5} = 3 \text{ times } 235 \\ 3\,0\,5\,5. \end{array}\right.$

Solve the following :

1.	$312 \times 13 = ?$		6.	$14256 \times 14 = ?$
2.	$425 \times 14 = ?$		7.	$26754 \times 16 = ?$
3.	$565 \times 15 = ?$		8.	$30875 \times 17 = ?$
4.	$364 \times 16 = ?$		9.	$59874 \times 18 = ?$
5.	$721 \times 17 = ?$		10.	$78395 \times 19 = ?$

84. To Multiply by 21, 31, 41, 51, etc.

Multiply by the tens figure only, writing the result under the number and one place to the left, then add.

EXAMPLE: 31 times 423 = $\left\{\begin{array}{l} \quad 4\,2\,3 \\ \underline{1\,2\,6\,9} = 3 \text{ times } 423 \\ 1\,3\,1\,1\,3. \end{array}\right.$

Solve the following :

1.	$243 \times 21 = ?$		6.	$724 \times 41 = ?$
2.	$325 \times 31 = ?$		7.	$785 \times 61 = ?$
3.	$472 \times 41 = ?$		8.	$847 \times 71 = ?$
4.	$537 \times 51 = ?$		9.	$875 \times 81 = ?$
5.	$654 \times 61 = ?$		10.	$987 \times 91 = ?$

85. To Multiply by 15.

Anex a cipher to the number and add its half.

EXAMPLE: 15 times 28 = $\left\{\begin{array}{l} 2\,8\,0 \text{ one cipher anexed} \\ \underline{1\,4\,0} = \frac{1}{2} \text{ of } 280 \\ 4\,2\,0. \end{array}\right.$

Solve the following:

1. $24 \times 15 = ?$
2. $36 \times 15 = ?$
3. $44 \times 15 = ?$
4. $54 \times 15 = ?$
5. $85 \times 15 = ?$

6. $274 \times 15 = ?$
7. $482 \times 15 = ?$
8. $925 \times 15 = ?$
9. $896 \times 15 = ?$
10. $987 \times 15 = ?$

87.   To Multiply by 51.

Take one-half the number, write it two places to the left and add.

EXAMPLE: $51 \times 72 = \begin{cases} \quad 7\,2 \\ \dfrac{3\,6}{3\,6\,7\,2} = \frac{1}{2} \text{ of } 72 \end{cases}$

Solve the following:

1. $48 \times 51 = ?$
2. $54 \times 51 = ?$
3. $66 \times 51 = ?$
4. $82 \times 51 = ?$
5. $95 \times 51 = ?$

6. $324 \times 51 = ?$
7. $468 \times 51 = ?$
8. $525 \times 51 = ?$
9. $728 \times 51 = ?$
10. $895 \times 51 = ?$

88.   To Find the Product of Complementary Numbers.

Multiply the tens' digit by one unit greater and annex the product of the units.

NOTE—**Complementary Numbers** are those whose tens' digits are identical and the sum of whose units' digits is 10.

EXAMPLE: 23 times 27 = 621.
$2 \times (2 + 1) = 6$, and annex $3 \times 7 = 621$.

Solve the following:

1. $14 \times 16 = ?$
2. $13 \times 17 = ?$
3. $26 \times 24 = ?$
4. $39 \times 31 = ?$
5. $45 \times 45 = ?$

6. $52 \times 58 = ?$
7. $67 \times 63 = ?$
8. $74 \times 76 = ?$
9. $85 \times 85 = ?$
10. $93 \times 97 = ?$

89.   To Find the Product of Two Numbers whose Units' Digits are 5's.

To the product of the tens add one-half their sum in whole numbers; if the sum be even, annex 25; if odd, annex 75.

EXAMPLE: 25 times $45 = 2 \times 4 + \dfrac{2 + 4}{2} = 11$

Annex 25 = 1125.

EXAMPLE: 35 times $65 = 3 \times 6 + \dfrac{3+6}{2} = 22$

Annex $75 = 2275$.

Solve the following:

1. $25 \times 65 = ?$	6. $35 \times 55 = ?$
2. $35 \times 55 = ?$	7. $25 \times 75 = ?$
3. $45 \times 85 = ?$	8. $45 \times 95 = ?$
4. $65 \times 45 = ?$	9. $55 \times 85 = ?$
5. $75 \times 95 = ?$	10. $75 \times 95 = ?$

90. To Find the Product of Two Numbers having a Repeated Digit in the Multiplicand, in the Multiplier, or in the Tens' or Units' Place.

Thus:

```
  33   alike in            54   alike in
  42 multiplicand          22 multiplier
1386                     1188

  47   alike in            36   alike in
  42 tens' place           56 units' place
1974                     2016
```

Take the product of the units, the product of the like digit times the sum of the unlike digits, and the product of the tens, carrying when necessary.

EXAMPLE: 52 times 44.

4×2 $=$ 8 product of units.
$4 \times (5 + 2) =$ 28 product of the like digit times the sum of the unlike digits.
5×4 $= \underline{20}$ product of the tens.
  2288

EXAMPLE: 45 times 42.

$2 \times 5 =$ 10 product of units.
$4 \times 7 =$ 28 product of like digit times the sum of unlike digits.
$4 \times 4 = \underline{16}$ product of tens.
1890

NOTE—This work should all be mental, answers only to be written.

Solve the following:

1. $22 \times 71 = ?$	6. $82 \times 83 = ?$
2. $45 \times 66 = ?$	7. $78 \times 48 = ?$
3. $34 \times 37 = ?$	8. $63 \times 65 = ?$
4. $55 \times 28 = ?$	9. $49 \times 79 = ?$
5. $46 \times 36 = ?$	10. $85 \times 86 = ?$

91. *To Find the Product of any Two Numbers Consisting of Two Digits.*

Take the product of the units, the sum of each ten times the other number's unit, and the product of the tens, carrying when necessary.

EXAMPLE: 47 times 36.

$$6 \times 7 = \quad 42 \text{ product of units.}$$
$$(6 \times 4) + (3 \times 7) = \quad 45 \text{ sum of products of tens and units}$$
$$4 \times 3 = \underline{\quad 12 \quad} \text{ product of tens.}$$
$$1692$$

Solve the following:

1. $24 \times 35 = ?$	6. $46 \times 39 = ?$
2. $52 \times 46 = ?$	7. $52 \times 47 = ?$
3. $71 \times 84 = ?$	8. $63 \times 81 = ?$
4. $38 \times 57 = ?$	9. $85 \times 92 = ?$
5. $63 \times 49 = ?$	10. $93 \times 47 = ?$

92. *To Multiply by Complements.*

From either number subtract the complement of the other, and annex the product of the complements.

NOTE—A complement of a number is 100, 1000, etc., less the number. Thus, the complement of 97 is 3, of 88 is 12, of 996 is 4, etc.

EXAMPLE: 94 complement 6
94 complement 6
97 complement 3
18 product of complements
91 $= 94 - 3$ or $97 - 6$
9118

EXAMPLE: 998 complement 2
998 complement 2
989 complement 11
022 product of complements
987 $= 998 - 11$ or $989 - 2$
987022

NOTE—When the numbers consist of three digits, the product of the complements requires three places, as 022 above.

Solve the following :

1.	$92 \times 87 = ?$	6.	$996 \times 995 = ?$
2.	$94 \times 75 = ?$	7.	$975 \times 994 = ?$
3.	$99 \times 93 = ?$	8.	$988 \times 997 = ?$
4.	$97 \times 91 = ?$	9.	$994 \times 998 = ?$
5.	$88 \times 95 = ?$	10,	$999 \times 989 = ?$

93.   To Multiply by Excesses. ·

From the sum of the numbers subtract 100 or 1000, as required, and annex the product of the excesses.

NOTE—An excess is the amount greater than 100, 1000, etc.

EXAMPLE :   115 times $104 = 11960.$
$115 + 04 = 119$
To 119 annex 15 times $4 = 60 = 11960.$

EXAMPLE :   1008 times $1007 = 1015056.$
$1008 + 007 = 1015$, annex $056 = 1015056.$

Solve the following :

1.	$1005 \times 1007 = ?$	6.	$1012 \times 1005 = ?$
2.	$1004 \times 1008 = ?$	7.	$1015 \times 1004 = ?$
3.	$1003 \times 1009 = ?$	8.	$1025 \times 1002 = ?$
4.	$1002 \times 1004 = ?$	9.	$1035 \times 1006 = ?$
5.	$1007 \times 1009 = ?$	10.	$1012 \times 1025 = ?$

NOTE—This principle may be carried to numbers a little over 200, 300, 400, 2000, 3000, etc.

94.   To Find the Product of Two Numbers, one of which is More and the other Less than 100, 1000, etc.

From the sum of the numbers subtract 100 or 1000, as required, annex two ciphers and subtract the product of the excess and complement.

EXAMPLE :   108 excess 8
98 comp. 2
10600
        16 = product of excess and comp.
·   10584

Solve the following :

1.	$102 \times 94 = ?$	6.	$1004 \times 992 = ?$
2.	$103 \times 97 = ?$	7.	$1008 \times 995 = ?$
3.	$115 \times 96 = ?$	8.	$1015 \times 993 = ?$
4.	$125 \times 92 = ?$	9.	$1025 \times 994 = ?$
5.	$116 \times 95 = ?$	10.	$1075 \times 998 = ?$

PRACTICAL PROBLEMS

95. Solve the following :

1.   If I receive $1800 salary, pay $260 for board, $187.50 for clothing, $135.75 for books, $45.50 for charity, and $105.25 for other expenses anually, what can I save in five years?

2.   A merchant bought 17 bolts of calico at 4 cents per yard, 12 bolts sheeting at 7 cents per yard, 21 bolts silesia at 8 cents per yard, and 14 bolts cambric at 3 cents per yard. If the bolts contained 43 yards each, what was the amount of the bill?

3.   Jones paid $1537.50 for 375 barrels of flour. If he sold the same at $4.35 per barrel, what would be the gain?

4.   A man owing $15760, gave in payment 5 lots of land, each worth $730, 5 horses valued at $236.50 each, an interest in a mine worth $2000, and $1728.75 in money. How much remained unpaid?

5.   Bought 250 barrels of flour for $1150 ; finding 25 barrels of it worthless, sold the remainder at $4.75 per barrel. Did I gain or lose, and how much?

6.   Brown's inventory of stock consisted of the following : 18 horses worth $75 each, 13 mules worth $52.50 each, 124 milch cows worth $41.25 each, 345 beef steers worth $61.75 each, and 87 calves worth $7.50 each. What was the value of his stock?

7.   Find the total amount of the following inventory : 7 barrels N. O. Molasses, 52, 53, 54, 45, 47, 49, 44, @ 35 cents per gallon ; 4 barrels granulated sugar, 325, 334, 328, 317, @ 5 cents per lb. ; 19 sacks "A" sugar, 100 lbs. to the sack, @ 4 cents per lb. ; 5 bags Rio coffee, 121, 128, 124, 131, 132, @ 19 cents per lb.

8.   If a man earns $55 per month the first year, $65 per month the second year, $75 per month the third year, $85 per month the fourth year, and $95 per month the fifth year ; what will be his earnings for the whole five years?

9.   Smith bought bonds as follows : 105 shares Ohio 4's @ 117, 108 shares of Pensylvania 5's @ 113, 98 shares N. Y. Central @

92, 88 shares of Baltimore & Ohio @ 95, 112 shares of water bonds @ 98, and 85 shares of Santa Rosa Municipal 4½'s @ 105 ; what was his total investment?

10. Find the amount of the following bill by using short methods of multiplication: 48 yards of cloth @ 11¢, 34 yards @ 22¢, 45 yards @ 45¢, 62 yards @ 68¢, 35 yards @ 37¢, 84 yards @ 54¢, 65 yards @ 85¢, 75 yards @ 45¢, 36 yards @ 15¢, 72 yards @ 51¢.

HOME WORK—No. 4

1.   Portland, Oregon,   January 5, 1908.

MR. C. C. DONOVAN,

       328 Fourth Street

Bought of A. P. ARMSTRONG & CO.

— DEALERS IN —

Terms: 30 ds.   GRAIN, HOPS AND FARM PRODUCE

42	bu.	Barley	75					
24	"	Oats	35					
18	"	Flax	92					
76	"	Millet	84					
225	"	Wheat	95					
358	"	Corn	55			***	**

2.   Chicago, Ill., February 10, 1908.

MR. O. M. POWERS,

            City

Bought of N. K. FAIRBANK & CO.

DEALERS IN

Terms: 60 ds., 5% 10 ds.   BEEF, PORK, FEED, and PRODUCE

84 bbls.	Prime Corned Beef	12.—					
66	"	A 1 Salt Pork	23.—				
720	"	XXX R. M. Flour	6.—				
476 Sacks Barley		.96					
7340# Hazen Cheese		.17					
1644# Dairy Butter		.30					
48 bbls. N. Y. Salt		.98			***	**

3.

R. L. GOODYEAR, PRESIDENT   L. S. GOODYEAR, SEC. TREAS.

St. Louis, Mo., January 10, 1908.

MR. HARRISON L. MEYER,
          Memphis, Tenn.

          BOUGHT OF **THE GOODYEAR TEA CO.**

          Net 60 ds.

TERMS: 5% 30 ds.   **TEAS, COFFEES, and SPICES**
          10 % 10 ds.

85 lbs. Fancy "A" Oolong	85c				
64 lbs. Choice "	66c				
53 lbs. English Breakfast	57c				
48 lbs. Choice Blend	42c				
39 lbs. Fine Black	31c				
75 lbs. Japan Extra	75c			___?	

4.   All bills due subject to sight draft

E. M. Huntsinger & Company

          TEAS, COFFEES, COCOA, AND CHOCOLATE
TERMS: 30 ds. net   **China and Glassware**
          5 % 10 ds.

     SOLD TO W. F. PRICE   Hartford, Conn., Mar. 4, 1908.

135# Old Gov't Java	32c				
162# Extra Mocha	35c				
147# Costa Rico	22c				
132# Guatemala	23c				
144# Salvador	18c				
152# Vienna Blend	24c			___?	

5.

O. M. BRIGGS, PRESIDENT   ELWYN SEATON, SECRETARY   J. S. TAYLOR, TREASURER

Hard Tack Biscuit Company

          AGENTS FOR

     GOLDEN GATE AND NATIONAL BISCUIT COMPANIES

BOOK 5, Folio #7   CINCINATTI, OHIO, April 1, 1908.
SALESMAN Smith
TERMS 30 ds.   SOLD TO U. S. ARLAND, Omaha, Neb.

132 lbs. American Lunch	11c				
244 " Cocoanut Wafers	18c				
220 " Chocolate Wafers	22c				
230 " Ginger Snaps	14c				
260 " Graham Wafers	13c				
65 " Pretzels	12c				
325 " Sodas	9c			___?	

DIVISION

96. **Division** is the process of ascertaining how many times one number is contained in another.

97. The **Dividend** is the number divided.

98. The **Divisor** is the number by which to divide.

99. The **Quotient** is the result obtained by division.

100. The **Remainder** is the number left after dividing when the division is not exact.

101. The **Sign of Division** is ÷, and indicates that the number before it is to be divided by the one after it.

102. PRINCIPLES:

1. If the divisor and dividend are like numbers, the quotient is an abstract number.

2. If the divisor is an abstract number, the quotient is always like the dividend.

3. The remainder is always like the dividend.

103. PROOF: Multiply the quotient by the divisor, add the remainder, if any, and the result should equal the dividend.

EXAMPLES: $48 \div 4 = 12$.
Proof, 4 times $12 = 48$.
$56 \div 9 = 6$ and 2 remainder.
Proof, 9 times $6 + 2 = 56$.

Short Division

104. *When the Operation is Performed Mentally.*

Write the divisor at the left of the dividend with a line between. Divide the left hand digits by the divisor and write the result below. If there be a remainder prefix it mentally to the next digit and divide as before.

Example: $9) 4 \overset{2}{7} \overset{1}{8} \overset{5}{4} 6$

5 3 1 6 and 2 remainder.

Operation: $47 \div 9 = 5$ and 2 remainder; mentally prefix 2 to the next figure, and $28 \div 9 = 3$ and 1 remainder; $14 \div 9 = 1$ and 5 remainder; $56 \div 9 = 6$ and 2 remainder.

Proof: 9 times $5316 + 2 = 47846$.

Note—The superior figures should not be written, but wholly carried in the mind.

Solve the following :

1.	$3426 \div 3 = ?$	6.	$426713 \div 7 = ?$
2.	$4732 \div 4 = ?$	7.	$726645 \div 8 = ?$
3.	$9678 \div 2 = ?$	8.	$432756 \div 9 = ?$
4.	$8535 \div 5 = ?$	9.	$407301 \div 6 = ?$
5.	$9122 \div 6 = ?$	10.	$891530 \div 7 = ?$

Long Division

105.   *When the Operations are Written.*

Write the divisor at the left of the dividend with a line between. Divide as in mental operations, writing the figure of the quotient at the right or above the dividend.   Multiply the divisor by the quotient figure and subtract the product from the left hand digits of the dividend.   Bring down the next figure and proceed as before.

Thus: 135) 62352 (461 quotient

```
        540
        ───
        835
        810
        ───
        252
        135
        ───
        117 remainder.
```

Solve the following :

1.	$4272 \div 16 = ?$	6.	$125789 \div 61 = ?$
2.	$7175 \div 25 = ?$	7.	$473826 \div 79 = ?$
3.	$9676 \div 34 = ?$	8.	$587634 \div 145 = ?$
4.	$73521 \div 40 = ?$	9.	$590430 \div 470 = ?$
5.	$87965 \div 57 = ?$	10.	$787945 \div 1255 = ?$

106. *When the Divisor Ends in Ciphers.*

Cut off as many figures from the right of the dividend as there are ciphers on the right of the divisor, and divide as before. The remainder will be the figures cut off annexed to those left after the last subtraction.

EXAMPLE: Divide 3576 by 400

OPERATION: 4,00) 35,76
                    8 and 376 remainder.

Solve the following:

1.	$4500 \div 30 = ?$	6.	$75620 \div 200 = ?$
2.	$7650 \div 50 = ?$	7.	$89437 \div 700 = ?$
3.	$3842 \div 70 = ?$	8.	$296753 \div 3000 = ?$
4.	$9250 \div 80 = ?$	9.	$576780 \div 8000 = ?$
5	$38520 \div 90 = ?$	10.	$5548237 \div 90000 = ?$

PRACTICAL PROBLEMS

107.   Solve the following:

1.   A grocer bought two kinds of syrup; one for 54 cents a gallon, and the other for 62 cents a gallon. What was the average cost a gallon?

2.   Hill's sales Monday were $104; Tuesday, $97; Wednesday, $126; Thursday, $99; Friday, $142; Saturday, $120. What were his average daily sales for the week?

3.   Frese bought 140 acres of land for $7560, and sold 86 acres at $75 per acre, and the remainder at cost. How much did he gain?

4.   Jewett's gain the first year was $2140, the second year it was double the first, the third it was as much as in both former years; if he lost $750 the fourth year, and gained $1250 the fifth, what was his average gain per year?

5.   Olson paid $750 for a horse and carriage; if the horse cost $120 more than the carriage, what was the cost of each?

6.   A grocer wishes to put 351 pounds of tea into three sizes of boxes, using the same number of boxes of each kind. If the

sizes are respectively 4, 8, and 15 pounds each, how many boxes will be required?

7. A, B, and C are in partnership. A's gain is twice B's, and B's is twice C's. If their total gain is $2464, how much is each one's gain?

8. A farm raises 12775 bushels of wheat, averaging 25 bushels to the acre; 3663 bushels of oats, averaging 37 bushels to the acre; and 4992 bushels of corn, averaging 52 bushels to the acre. How many acres are there in the farm?

9. If the population of the United States is 91,020,000, what is the average number of in habitants represented by each of the 444 Congressmen?

10. Prindle & Co.'s sales averaged $1252 per week for the year. Counting 52 weeks and 313 days to the year, what were his average daily sales?

HOME WORK—No. 5

1. Solve: $(15341 \div 29) \times (8430 \div 1405) = 1587 \times ?$

2. The divisor is 15, the quotient 78, and the remainder 4; what is the dividend?

3. My taxes for 5 years were as follows: $47 the first year, $54 the second, $65 the third, $88 the fourth, and $106 the fifth; what was my average yearly taxes?

4. A and B are together worth $15760, and A is worth $1240 more than B; what is each man worth?

5. I sold a lot of wood for $423, thereby gaining $2 per cord; if the wood cost me $329, how many cords did I sell?

Properties of Numbers

108. An *Integer* is a whole number.

109. An *Even Number* is a number whose unit figure is 0, 2, 4, 6, or 8.

110. An *Odd Number* is a number whose unit figure is 1, 3, 5, 7, or 9.

111. A *Prime Number* is one that is not exactly divisible except by itself or 1; as 2, 3, 5, 7, 11, 13, etc.

112. A *Composite Number* is divisible by some number besides itself and 1; as 4, 6, 8, 9, 12, 15, etc.

113. An *Exact Divisor* of a number is one that will divide it without a remainder. Thus, 7 is an exact divisor of 21.

114. A *Factor of a Number* is an exact divisor of the number. Thus, 3 is a factor of 15.

115. A *Common Factor,* or Common Divisor, of two or more numbers is a number that will exactly divide all of them. Thus, 5 is a common factor of 10, 15, 20, 25, etc.

116. The *Highest Common Factor*, or Greatest Common Divisor, of two or more numbers is the greatest number that will exactly divide all of them. Thus, 15 is the highest common factor of 45, 60, and 75, although both 3 and 5 are common factors.

117. To *Factor* a number is to find its factors or divisors.

118. A *Multiple* of a number is a number that is exactly divisible by that number. Thus, 32 is a multiple of 8.

119. A *Common Multiple* of two or more numbers is a number that is exactly divisible by each of them. Thus, 84 is a common multiple of of 6 and 7.

120. The *Least Common Multiple* of two or more numbers is the least number that is divisible by each of them. Thus, 42 is the least common multiple of 6 and 7.

121. Principles:

1.   A divisor of a number will divide any multiple of that number.

2.   A common divisor of two or more numbers will divide their sum and also their difference.

3.   Every multiple is equal to the product of its prime factors.

4.   A common multiple of two or more numbers contains the prime factors of those numbers.

122.   Cancellation is a process of shortening operations in division by rejecting common factors from both dividend and divisor.

123.   *Divisibility of Numbers:*

1.   All even numbers are divisible by 2.

2.   Any number is divisible by 3 if the sum of its digits is divisible by 3.

3.   By 4 if the *two* right hand digits express a number that is divisible by 4.

4.   By 5 if the number ends in 0 or 5.

5.   By 6 if the number is divisible by 2 and 3.

6.   By 8 if the *three* right hand digits express a number divisible by 8.

7.   By 9 if the sum of the digits is divisible by 9.

8.   By 10 if the number ends in 0.

9.   By 12 if the number is divisible by 3 and 4.

10.   By 15 if the number is divisible by 3 and 5.

11.   By 18 if the number is divisible by 2 and 9.

12.   By 7, 11, and 13 if the number is 1001 or any multiple of it; as, 2002, 5005, 12012, etc.

124. Principle: A number is divisible by any number whose factors it contains.

125.   *To Find the Prime Factors of a Number.*

Divide the number by one of its prime factors, this quotient by another, and so on until the last quotient is a prime number.   The several divisors and the last quotient are the prime factors.

What are the prime factors of 1386?

```
2 ) 1 3 8 6
  3 ) 6 9 3      The divisors 2, 3, 3, 7, and the quo-
  3 ) 2 3 1      tient 11 are the prime factors.
    7 ) 7 7
      1 1
```

Find the prime factors of the following:

1.	2445	5.	2366
2.	2934	6.	1140
3.	2205	7.	1155
4.	2310	8.	6300

126. To Find the Highest Common Factor of Two or more Numbers.

Take the product of all the common prime factors; the result will be the highest common factor.

What is the highest common factor of 48, 72, and 120.

```
2 ) 4 8   7 2   1 2 0
  2 ) 2 4   3 6    6 0      The  product  of  the  prime
    2 ) 1 2   1 8    3 0    factors 2 × 2 × 2 × 3 = 24,
      3 ) 6   9    1 5     the highest common factor.
          2    3    5
```

Find the highest common factor of the following:

1.	42 and 112	6.	143 and 1001
2.	96 and 144	7.	138 and 529
3.	45, 75, and 105	8.	165, 255, and 285
4.	72, 128, and 192	9.	420, 630, and 840
5.	120, 310, and 360	10.	462, 1078, and 1694

127. To Find the Greatest Common Divisor when the Numbers are not Readily Factored.

Find the greatest common divisor of 364 and 925.

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

ANALYSIS: This operation is based on principles 1 and 2, article 121. A divisor of 364 will divide *twice* 364 or 728, and the G. C. D. of 728 and 975 will divide *their difference*, 247; if this G. C. D. will divide 247 and 364, it will divide *their difference*, 117; if it will divide 117, it will divide *twice* 117, or 234; if it will divide 234 and 247, it will divide *their difference*, 13; if the

G. C. D. will divide 13, it will divide 9 *times* 13, or 117. Since 13 is the greatest divisor of itself, it must be the G. C. D. of the given numbers.

Find the greatest common divisor of the following:

1.	632 and 1328	6.	1372 and 1650
2.	527 and 1207	7.	4082 and 8476
3.	378 and 648	8.	10907 and 14482
4.	906 and 2192	9.	4746 and 6667
5.	1358 and 3738	10.	14256 and 32562

128. To Find the Least Common Multiple of Two or More Numbers.

Take the product of all the prime factors of the greatest number, and such prime factors of the other numbers as are not found in the greatest number, and the result will be the L. C. M. of the numbers.

What is the least common multiple of 18, 24, and 54?

$$
\begin{array}{r}
2) \underline{18 \quad 24 \quad 54} \\
3) \underline{9 \quad 12 \quad 27} \\
3) \underline{3 \quad 4 \quad 9} \\
1 \quad 4 \quad 3
\end{array}
$$

$2 \times 3 \times 3 \times 4 \times 3 = 216.$

ANALYSIS: Reject the factors 2, 3, and 3 which are common to two or more of the numbers; the product of these common factors and the factors not common will give the least common multiple of the numbers.

Find the least common multiple of the following:

1.	27, 36, and 45	6.	8, 12, 18, 27, and 36
2.	32, 42, and 56	7.	10, 25, 75, 150, and 225
3.	21, 44, and 126	8.	18, 24, 36, 48, 72, and 96
4.	30, 42, 66, and 78	9.	17, 51, 85, 153, and 187
5.	24, 32, 72, and 96	10.	5698 and 9324

PRACTICAL PROBLEMS

129. Solve the following:

1. Find the greatest common divisor of 792, 2592, and 3456.

2. Find the least common multiple of 32, 44, 132, and 352.

3. What is the greatest number that will divide 5184 and 6924?

4. What is the least number that can be exactly divided by 17, 51, 85, and 119?

5. Johnson's farm is in the form of a rectangle, and is 2925 feet wide by 3458 feet long. What is the length of the longest board that can be used to fence it without cutting, and how many boards will be required to build a fence six boards high?

6. What is the smallest sum of money that can be paid for shoes at $1.75, $2.50, or $3.25?

7. If Brown, White, and Green have $630, $1134, and $1386 respectively, and agree to purchase horses at the highest price per head that will allow each man to invest all his money; what will be the price paid and how many horses will each one buy?

8. What is the length of the shortest rope that can be cut into 14, 28, or 35 foot lengths?

9. What is the smallest quantity of wine that will fill casks holding either 44, 48, or 56 gallons each?

10. Arland has three wine tanks that hold respectively 2109, 3363, and 3819 gallons each. He wishes to empty these tanks into casks of uniform size. the largest that will contain exactly the contents of each tank. What must be the size of the casks, and how many will it take?

HOME WORK—No. 6

1. What is the least quantity of grain that exactly will fill bins holding 36, 45, 63, or 72 bushels each?

2. What is the least sum of money that exactly can be spent for horses at $140, cows at $91, or sheep at $7 per head?

3. A commission merchant wishes to ship 30584 bushels of wheat, 3040 bushels of corn, and 1004 bushels of oats. If it must all be shipped in bags of equal size, what will each bag hold, and how many bags will be required?

4. A, B. and C have respectively $315, $567, and $693 with which to purchase horses. If they pay the highest price possible, and all pay the same price, how many horses will each buy?

5. What is the least sum of money that can be spent for tea at 72¢, or 54¢, or 45¢, or 36¢ per pound?

Outline for Review

I. Addition:
  1. Definitions.
  2. Sum.
  3. Sign of Addition.
  4. Sign of Equality.
  5. Sign of Dollars.
  6. Reading Method.
  7. Proof.

II. Subtraction:
  1. Definitions.
  2. Minuend.
  3. Subtrahend.
  4. Difference.
  5. Sign of Subtraction.
  6. Parenthesis and Bar.
  7. Principle and Proof.

III. Multiplication:
  1. Definitions.
  2. Multiplicand.
  3. Multiplier.
  4. Product.
  5. Sign of Multiplication.
  6. Abstract and Concrete Numbers.
  7. Short Methods.

IV. Division.
  1. Definitions.
  2. Dividend.
  3. Divisor.
  4. Quotient.
  5. Remainder.
  6. Sign of Division.
  7. Short and Long Division.

V. Properties of Numbers:
  1. Integers.
  2. Odd and Even.
  3. Prime and Composite.
  4. Divisors and Factors.
  5. Greatest Common Divisor and Highest Common Factor.
  6. Multiples.
  7. Common and Least Common Multiple.
  8. Divisibility of Numbers.
  9. To Find the Highest Common Factor or Greatest Common Divisor.
  10. To Find the Least Common Multiple.

CANCELLATION

130. *Cancellation* is the shortening of operations in division by rejecting common factors from both dividend and divisor.

EXAMPLE: Divide $12 \times 15 \times 32 \times 40$ by $8 \times 5 \times 9 \times 2$.

$$\frac{\overset{4}{\cancel{12}} \times \overset{3}{\cancel{15}} \times 32 \times \overset{2}{\cancel{40}}}{\underset{2}{\cancel{8}} \times \cancel{5} \times \underset{3}{\cancel{9}} \times \cancel{20}} = 32.$$

SOLUTION: Reject the factors 20, 5, 3, 3, 4, and 2 in the order named; the quotient will be 32.

Solve the following:

    1. $9 \times 14 \times 34 \div 18 \times 17$
    2. $28 \times 45 \times 11 \div 22 \times 36$
    3. $63 \times 25 \times 18 \div 12 \times 45$
    4. $54 \times 36 \times 49 \div 7 \times 9 \times 12$
    5. $81 \times 96 \times 64 \div 128 \times 54$
    6. $144 \times 84 \times 16 \div 1728 \times 28$
    7. $85 \times 92 \times 55 \div 44 \times 34 \times 46$
    8. $1050 \times 312 \div 35 \times 10 \times 52$
    9. $4096 \times 1024 \div 256 \times 512$
   10. $5280 \times 12 \div 3 \times 33 \times 40 \times 8$

PRACTICAL PROBLEMS

131. Solve the following:

1. How many tons of hay at \$18 per ton must be given for 33 cords of wood at \$6 per cord?

2. How many barrels of flour at \$4 per barrel will pay for 256 bushels of wheat at \$1 per bushel?

3. How many crates of eggs, each containing 54 dozen, worth 25 cents per dozen, will pay for 9 barrels of sugar, each barrel containing 325 pounds, worth 6 cents per pound?

4. A man worked 17 days for 119 bushels of barley worth 40 cents per bushel. What was his work worth per day?

5.. How many bushels of wheat at 60 cents per bushel will pay for 12 tons of coal at $7.20 per ton?

6. Brown exchanged 320 bushels of corn worth 75 cents per bushel for barley worth 90 cents, and oats worth 60 cents, of each an equal amount. How many bushels of each did he receive?

7. How many chests of tea, each containing 72 pounds worth 35 cents per pound, will pay for 70 boxes of prunes, each box containing 42 pounds worth 6 cents per pound?

8. L. W. Scarlett bought two kinds of cloth, one kind at 70 cents per yard, the other at 95 cents per yard. If he took twice as many yards of the first as of the second and paid for both with 329 pounds of butter at 35 cents per pound, how many yards of each kind did he buy? ·

9. J. S. Taylor exchanged 470 bushels of corn worth 60 cents per bushel, and 300 bushels of barley worth 70 cents per bushel for tea at 50 cents per pound, coffee at 30 cents per pound, and cocoa at 40 cents per pound, of each an equal amount. How many pounds of each did he receive?

10. D. M. Cook gave 12 bales of hops, 250 pounds to the bale worth 17 cents per pound, for calico worth 5 cents per yard, muslin worth 10 cents per yard, and gingham, worth 15 cents per yard. If there were twice as many yards of muslin as of calico, and twice as many yards of gingham as of muslin, how many yards of each did he buy?

HOME WORK—No. 7

(Solution and answers required.)

1. Bring in an original problem in the subjects of Addition and Subtraction, containing at least twenty different numbers.

2. Bring in an original problem in Multiplication containing ten different short cuts.

3. Bring in a model bill of not less than ten items, extended, and footed, in which short methods are used.

4. Bring in an original problem in which the greatest common divisor is to be found.

5. Bring in an original problem in which the least common multiple is to be found.

FRACTIONS

132. *Fractions* represent parts of units or things.

133. A *Simple Fraction* represents one or more of the equal parts of a unit. As, one-half and two-thirds are fractions.

134. A *Fractional Unit* is *one* of the equal parts into which a unit is divided. As, *one*-third is a fractional unit.

135. The *Denominator* of a fraction is written below the line and shows the number of parts into which the unit is divided.

136. The *Numerator* of a fraction is written above the line and shows the number of parts taken or considered.

137. The *Terms* of a fraction are its *numerator* and *denominator*. Thus, $\frac{5}{8}$ is a fraction. The denominator 8 shows that the unit is divided into 8 parts. The numerator 5 indicates that 5 parts are taken. The *terms* are the 5 and the 8.

138. A *Proper Fraction* is one whose numerator is less than its denominator. As, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{7}{8}$, etc.

139. An *Improper Fraction* is one whose numerator is equal to or greater than its denominator. As, $\frac{7}{7}$, $\frac{9}{4}$, $\frac{12}{7}$, etc.

140. A *Simple Fraction* is one having a single number for its numerator and a single number for its denominator, but may be either *proper* or *improper*. As, $\frac{3}{4}$, $\frac{7}{2}$, etc.

141. A *Compound Fraction* is a fraction *of* a fraction or two or more fractions to be multiplied together. As, $\frac{2}{3} \times \frac{3}{4} \times \frac{5}{6}$.

142. A *Complex Fraction* is one that has a fraction in either its numerator or in its denominator, or in both.

Thus, $\frac{\frac{1}{2}}{5}$ $\frac{7}{\frac{2}{3}}$ $\frac{\frac{3}{5}}{\frac{4}{7}}$ are complex fractions.

143. A *Mixed Number* is a whole number and a fraction united. As, $4\frac{1}{2}$, $5\frac{2}{3}$.

144. The *Value* of a fraction is the quotient of its numerator divided by its denominator. Thus, the value of $\frac{15}{3}$ is 5, of $\frac{25}{8}$ is $3\frac{1}{8}$.

145. *Principles of Fractions:*

1. Multiplying the numerator or dividing the denominator multiplies the fraction.

2. Dividing the numerator or multiplying the denominator divides the fraction.

3. Multiplying or dividing both numerator and denominator by the same number does not change the value of the fraction.

146. The **Reciprocal** of a number or of a fraction is 1 divided by the number or by the fraction. As, the reciprocal of 5 is $1 \div 5$ or $\frac{1}{5}$; of $\frac{2}{3}$ is $1 \div \frac{2}{3}$ or $\frac{3}{2}$.

Reduction of Fractions

147. *Reduction of Fractions* is changing their form without altering their value.

148. To reduce a fraction to **Higher Terms** is to express its terms in greater numbers. As, $\frac{2}{3} = \frac{8}{12} = \frac{16}{24}$.

149. To reduce a fraction to **Lower Terms** is to express its terms in less numbers. As, $\frac{40}{45} = \frac{10}{15} = \frac{2}{3}$.

150. A fraction is reduced to its *lowest terms* when its numerator and denominator have no common factors.

151. To reduce a fraction to its lowest terms, reject from both numerator and denominator all common factors, or divide both numerator and denominator by their greatest common divisor.

Reduce to their lowest terms:

1.	$\frac{10}{25}$	6.	$\frac{1278}{2574}$
2.	$\frac{32}{48}$	7.	$\frac{2688}{3072}$
3.	$\frac{75}{225}$	8.	$\frac{11286}{11880}$
4.	$\frac{81}{243}$	9.	$\frac{35392}{53280}$
5.	$\frac{256}{1024}$	10.	$\frac{9384}{323952}$

152. To reduce a whole or mixed number to an improper fraction, multiply the whole number by the denominator, and to

the product add the numerator of the fraction, and write the result over the denominator.

EXAMPLE: Reduce $8\frac{2}{5}$ to an improper fraction.

$$(8 \times 5) + 2 = 42. \quad \text{Answer, } \frac{42}{5}.$$

Reduce to improper fractions:

1. $11\frac{1}{4}$
2. $17\frac{1}{6}$
3. $35\frac{1}{8}$
4. $78\frac{2}{9}$

5. $96\frac{4}{11}$
6. $148\frac{13}{22}$
7. $785\frac{28}{45}$
8. $725\frac{5}{8}$

9. $1264\frac{4}{9}$
10. $3240\frac{125}{375}$
11. $5674\frac{144}{1728}$
12. $34216\frac{5}{9}$

153. To reduce an improper fraction to a whole or mixed number, divide the numerator by the denominator.

EXAMPLE: Reduce $\frac{132}{4}$ to a whole number.

$$132 \div 4 = 33.$$

Reduce to whole or mixed numbers:

1. $\frac{235}{4}$
2. $\frac{976}{9}$
3. $\frac{782}{12}$
4. $\frac{1347}{23}$

5. $\frac{3875}{125}$
6. $\frac{9261}{243}$
7. $\frac{796}{25}$
8. $\frac{1342}{41}$

9. $\frac{4748}{36}$
10. $\frac{2884}{54}$
11. $\frac{18235}{1235}$
12. $\frac{44044}{143}$

154. To reduce fractions to a common denominator, find the the least common multiple of the denominators for the least common denominator. Divide this least common denominator by the denominator of each of the given fractions and multiply its numerator by the quotient. The result will be the new numerators.

EXAMPLE: Reduce $\frac{3}{8}$, $\frac{5}{12}$, and $\frac{7}{16}$ to their least common denominator.

$$4\,)\,\tfrac{3}{8}\ \tfrac{5}{12}\ \tfrac{17}{16}$$
$$2\,)\,2\ \ 3\ \ 4$$
$$\quad\ 1\ \ 3\ \ 2$$

$4 \times 3 \times 2 \times 3 = 48$, the least common multiple of the denominators.

$48 \div 8 = 6 \qquad 6 \times 3 = 18$
$48 \div 12 = 4 \qquad 4 \times 5 = 20$ Answer, $\frac{18}{48}$, $\frac{20}{48}$, $\frac{51}{48}$.
$48 \div 16 = 3 \qquad 3 \times 17 = 51$

Reduce the following to their least common denominator:

1. $\frac{3}{5}$, $\frac{4}{15}$, $\frac{2}{9}$
2. $\frac{4}{7}$, $\frac{8}{21}$, $\frac{13}{33}$
3. $\frac{5}{9}$, $\frac{11}{21}$, $\frac{16}{35}$
4. $\frac{12}{17}$, $\frac{21}{34}$, $\frac{3}{4}$
5. $\frac{18}{35}$, $\frac{27}{49}$, $\frac{42}{65}$

6. $4\frac{1}{2}$, $1\frac{7}{6}$, $\frac{5}{8}$
7. $\frac{2}{11}$, $7\frac{1}{5}$, $\frac{16}{55}$
8. $\frac{5}{15}$, $\frac{8}{12}$, $\frac{7}{21}$, $\frac{18}{27}$
9. $6\frac{1}{3}$, $\frac{5}{8}$, $9\frac{5}{12}$, $17\frac{11}{14}$
10. $\frac{121}{168}$, $\frac{67}{84}$, $\frac{39}{42}$, $\frac{17}{21}$

Addition of Fractions

155. To Add Fractions Having a Common Denominator.

Add their numerators, write this sum over their common denominator, and find the value of the fraction.

Add the following:

1. $\frac{1}{5} + \frac{2}{5} + \frac{3}{5} + \frac{4}{5}$
2. $\frac{3}{8} + \frac{5}{8} + \frac{1}{8} + \frac{7}{8}$
3. $\frac{8}{15} + \frac{7}{15} + \frac{6}{15} + \frac{11}{15}$
4. $\frac{17}{28} + \frac{11}{28} + \frac{15}{28} + \frac{25}{28}$
5. $\frac{35}{49} + \frac{18}{49} + \frac{25}{49} + \frac{47}{49}$

6. $\frac{5}{12} + \frac{16}{12} + \frac{27}{12}$
7. $\frac{4}{135} + \frac{7}{135} + \frac{240}{135}$
8. $8\frac{1}{4} + \frac{7}{4} + 18\frac{3}{4}$
9. $27\frac{1}{3} + 45\frac{2}{3} + 85\frac{1}{3}$
10. $12\frac{5}{8} + 35\frac{1}{8} + 124\frac{3}{8}$

NOTE—Whole numbers and fractions may be added separately.

156. To Add Two Fractions Having a Common Numerator.

Add the denominators, multiply this sum by the common numerator, and write the result over the product of the denominators.

EXAMPLE: $\frac{2}{3} + \frac{2}{5} = \dfrac{(5 + 3) \times 2}{3 \times 5} = \dfrac{16}{15}$

Add the following:

1. $\frac{3}{4} + \frac{3}{7}$
2. $\frac{5}{8} + \frac{5}{9}$
3. $\frac{6}{7} + \frac{6}{11}$
4. $\frac{7}{8} + \frac{7}{12}$
5. $\frac{15}{17} + \frac{15}{23}$

6. $\frac{21}{34} + \frac{21}{26}$
7. $9\frac{2}{3} + 17\frac{2}{9}$
8. $43\frac{5}{11} + 81\frac{5}{9}$
9. $125\frac{9}{16} + 94\frac{9}{20}$
10. $247\frac{17}{25} + 481\frac{17}{35}$

157. *To Add Fractions Having neither a Common Numerator nor a Common Denominator.*

Multiply each numerator by the product of all the denominators except its own for new numerators, write their sum over the product of all the denominators.

EXAMPLE: Add $\frac{2}{3} + \frac{3}{4} + \frac{4}{5}$.

$$\left.\begin{array}{c} 2 \times 4 \times 5 = 40 \\ 3 \times 3 \times 5 = 45 \\ 4 \times 4 \times 3 = 48 \end{array}\right\} \frac{40 + 45 + 48}{60} = \frac{133}{60} = 2\frac{13}{60}$$

Add the following:

1. $\frac{1}{2} + \frac{2}{3}$
2. $\frac{3}{5} + \frac{5}{8}$
3. $\frac{4}{7} + \frac{5}{9}$
4. $\frac{7}{12} + \frac{8}{15}$
5. $\frac{9}{16} + \frac{12}{25}$

6. $\frac{1}{3} + \frac{2}{5} + \frac{3}{4}$
7. $\frac{2}{3} + \frac{3}{8} + \frac{4}{7}$
8. $\frac{5}{9} + \frac{7}{16} + \frac{11}{18}$
9. $\frac{3}{4} + \frac{4}{5} + \frac{5}{6}$
10. $\frac{5}{7} + \frac{6}{11} + \frac{17}{20}$

158. *To Add Fractions by Reducing Them to their Least Common Denominator.*

Reduce the fractions to their least common denominator, add their numerators, write the result over the least common denominator, and find the value of the fraction.

NOTE—Add whole numbers and fractions separately.

EXAMPLE: Add $5\frac{5}{12} + 7\frac{11}{18} + 12\frac{13}{24}$.

Adding $5 + 7 + 12 = 24$, sum of the whole numbers.

$$\frac{5}{12} + \frac{11}{18} + \frac{13}{24} = \frac{30}{72} + \frac{44}{72} + \frac{39}{72} = \frac{113}{72} = 1\frac{41}{72}.$$

$$24 + 1\frac{41}{72} = 25\frac{41}{72}.$$

Add the following:

1. $\frac{2}{3} + \frac{5}{9} + \frac{7}{12}$
2. $\frac{6}{15} + \frac{13}{21} + \frac{19}{35}$
3. $\frac{18}{51} + \frac{15}{34} + \frac{41}{60}$
4. $\frac{15}{28} + \frac{75}{112} + \frac{89}{140}$
5. $\frac{125}{1000} + \frac{750}{1500} + \frac{925}{2775}$

6. $8\frac{1}{2} + 9\frac{1}{8} + 10\frac{1}{10}$
7. $23\frac{5}{8} + 47\frac{3}{16} + 82\frac{15}{32}$
8. $75\frac{19}{36} + 89\frac{47}{108} + 95\frac{13}{252}$
9. $\frac{8}{11} + 17\frac{1}{5} + \frac{4}{35} + 5\frac{8}{7}$
10. $\frac{125}{33} + 145\frac{3}{11} + 16\frac{5}{132} + \frac{8}{77}$

Subtraction of Fractions

159.   To Subtract Fractions Having a Common Denominator.

Write the difference of the numerators over the common denominator.

Solve the following:

1. $\frac{7}{12} - \frac{5}{12} = ?$

2. $1\frac{6}{17} - 1\frac{1}{17} = ?$

3. $4\frac{2}{55} - 1\frac{7}{55} = ?$

4. $5\frac{5}{64} - 2\frac{9}{64} = ?$

5. $\frac{69}{88} - \frac{35}{88} = ?$

6. $1\frac{24}{175} - \frac{31}{175} = ?$

7. $15\frac{2}{3} - 7\frac{1}{3} = ?$

8. $45\frac{15}{16} - 41\frac{3}{16} = ?$

9. $82\frac{7}{25} - 53\frac{12}{25} = ?$

10. $175\frac{19}{32} - 120\frac{31}{32} = ?$

NOTE—If the fraction of the subtrahend is the greater, write one less than the difference of the whole numbers for the integral part, and the complement of the difference of the fractions for the fractional part.

Thus $5\frac{1}{2} - 2\frac{3}{4} = (5 - 2)$ *less* $1 = 2$, and the complement of $\frac{3}{4} - \frac{1}{2}$, which is $\frac{3}{4}$.   Answer, $2\frac{3}{4}$.

160.   To Subtract Fractions Having a Common Numerator.

Multiply the difference of the denominators by the common numerator and write the result over the product of the denominators.

EXAMPLE: $\frac{3}{4} - \frac{3}{7} = (7 - 4) \times 3 = 9$, the numerator.
$4 \times 7 = 28$, the denominator.
Answer, $\frac{9}{28}$.

Solve the following:

1. $\frac{1}{2} - \frac{1}{3} = ?$

2. $\frac{2}{5} - \frac{2}{7} = ?$

3. $\frac{7}{8} - \frac{7}{11} = ?$

4. $\frac{9}{16} - \frac{9}{22} = ?$

5. $1\frac{2}{17} - 1\frac{2}{29} = ?$

6. $\frac{35}{51} - \frac{35}{59} = ?$

7. $1\frac{24}{125} - 1\frac{24}{145} = ?$

8. $1\frac{50}{371} - 1\frac{50}{421} = ?$

9. $\frac{375}{968} - \frac{375}{1048} = ?$

10. $\frac{531}{1008} - \frac{531}{1241} = ?$

161.   To Subtract Fractions Having neither a Common Numerator nor a Common Denominator.

From the product of the first numerator times the second denominator take the product of the second numerator times the first denominator.   Write this difference over the product of the denominators.

Example : $\frac{3}{4} - \frac{2}{3}$.

$3 \times 3 = 9.$ $4 \times 2 = 8.$ $9 - 8 = 1$, the numerator.
$4 \times 3 = 12$, the denominator.   Answer, $\frac{1}{12}$.

Solve the following :

1. $\frac{1}{2} - \frac{2}{5} = ?$ 6. $\frac{31}{32} - \frac{19}{29} = ?$

2. $\frac{3}{4} - \frac{2}{7} = ?$ 7. $\frac{47}{63} - \frac{5}{7} = ?$

3. $\frac{5}{8} - \frac{6}{11} = ?$ 8. $5\frac{1}{2} - 2\frac{3}{4} = ?$

4. $\frac{9}{11} - \frac{4}{7} = ?$ 9. $17\frac{5}{12} - 14\frac{2}{5} = ?$

5. $1\frac{2}{17} - 1\frac{2}{29} = ?$ 10. $48\frac{1}{8} - 32\frac{2}{3} = ?$

162. To Subtract Fractions by Reducing Them to a Least Common Denominator.

Reduce the fractions to their least common denominator. Write the difference of their numerators over the least common denominator.

Solve the following :

1. $\frac{14}{15} - \frac{7}{10} = ?$ 6. $8\frac{3}{4} - 4\frac{5}{8} = ?$

2. $\frac{11}{35} - \frac{9}{28} = ?$ 7. $18\frac{5}{12} - 7\frac{1}{3} = ?$

3. $\frac{27}{65} - \frac{18}{39} = ?$ 8. $25\frac{15}{16} - 11\frac{1}{8} = ?$

4. $\frac{35}{72} - \frac{43}{84} = ?$ 9. $48\frac{1}{4} - 33\frac{7}{16} = ?$

5. $1\frac{35}{144} - 1\frac{101}{192} = ?$ 10. $135\frac{5}{7} - 107\frac{7}{9} = ?$

PRACTICAL PROBLEMS

163.   Solve the following :

1.   How many yards of cloth in five bolts measuring $45\frac{1}{4}$, $38\frac{3}{4}$, $47\frac{1}{2}$, $44\frac{1}{4}$, and $41\frac{3}{4}$ yards respectively ?

2.   A's land consists of five fields as follows : $184\frac{1}{5}$, $127\frac{3}{8}$, $224\frac{5}{16}$, $38\frac{7}{10}$, and $97\frac{7}{16}$ acres.   How much does he own ?

3.   Sold 7 pieces of cloth containing $25\frac{1}{3}$, $34\frac{1}{4}$, $42\frac{1}{8}$, $18\frac{5}{8}$, $37\frac{3}{4}$, $26\frac{3}{8}$, and $41\frac{5}{8}$ yards respectively.   How many yards in all ?

4.   The sum of two numbers is $28\frac{1}{2}$; their difference is $5\frac{1}{4}$. What are the numbers ?

5.   What number added to $135\frac{5}{9}$ will make $178\frac{5}{13}$?

6.   A merchant received a $20 bill to pay for flour $4½, sugar $2⅜, coffee $3⅝, and tea $1⅞. What change should he give?

7.   Bought goods for $125⅛, $82⅔, $87⅜, and sold them for $425½, how much was the profit?

8.   My first year's gain was $874⅝, the second was $1135⅘, my third was as much as the first and second, my fourth was a loss of $235½. What was my total gain for the four years?

9.   My income for the first month was $55¼ and for each of the succeeding eleven months was increased $5¼. What was my total income for the 12 months?

10.   A's share in a business was $2345¾, B's was $425½ more, C's was $1271¼ less than A's and B's together. What was B's and C's capital and what was the total investment?

11.   A man made purchases of $1¼, $2⅔, $3⅝, and $7⅜. What change should he receive from a $20 gold piece?

12.   A merchant bought 48 bbls. of flour at $5⅞ per bbl. and sold it for $6⅔ per bbl. What was his profit?

13.   I bought a quantity of coal for 155\frac{8}{15}$, and of lumber for $345⅔. I sold the coal for $173½, and the lumber for $390¾. What was my gain?

14.   January's sales were $5840⅔. If each of the subsequent monthly sales were increased by $1235¾, what were the entire sales for the year?

15.   A merchant's sales for Monday were $72⅘, for Tuesday they increased $15¼, for Wednesday $25⅝, for Thursday 18\frac{3}{10}$, for Friday, $5⅝, and for Saturday $44⅞. What was the total sales for the week?

Multiplication of Fractions

164. To Multiply a Fraction by a Whole Number.

Multiply the numerator by the whole number and divide the product by the denominator.

Solve the following:

1. $7 \times \frac{3}{5} = ?$
2. $9 \times \frac{5}{8} = ?$
3. $16 \times \frac{7}{12} = ?$
4. $48 \times \frac{2}{3} = ?$
5. $150 \times \frac{5}{6} = ?$
6. $125 \times \frac{3}{4} = ?$
7. $482 \times \frac{7}{9} = ?$
8. $666 \times \frac{3}{11} = ?$
9. $597 \times \frac{12}{13} = ?$
10. $885 \times \frac{15}{32} = ?$

165. To Multiply a Fraction by a Fraction.

Multiply the numerators together for a new numerator, and the denominators together for a new denominator. Cancel if possible.

Solve the following:

1. $\frac{3}{4} \times \frac{6}{7} \times \frac{14}{15} = ?$
2. $\frac{2}{9} \times \frac{7}{10} \times \frac{5}{12} = ?$
3. $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = ?$
4. $\frac{5}{8} \times \frac{12}{25} \times \frac{16}{27} \times \frac{9}{11} = ?$
5. $\frac{17}{28} \times \frac{14}{34} \times \frac{25}{39} \times \frac{13}{20} = ?$
6. $1\frac{1}{2} \times 2\frac{2}{3} = ?$
7. $3\frac{3}{4} \times 5\frac{1}{2} = ?$
8. $7\frac{1}{8} \times 2\frac{2}{3} \times 4\frac{1}{2} = ?$
9. $12\frac{1}{4} \times 7\frac{5}{7} \times \frac{2}{9} = ?$
10. $18\frac{6}{7} \times 24\frac{1}{2} \times \frac{5}{11} = ?$

166. To Find the Product of Two Mixed Numbers whose Integers are Identical and the Sum of whose Fractions is a Unit.

To the product of the integer times one greater annex the product of the fractions.

EXAMPLE: Multiply $4\frac{1}{4}$ by $4\frac{3}{4}$.
$4 \times 5 = 20$. $\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$. Answer, $20\frac{3}{16}$.

Solve the following:

1. $2\frac{1}{3} \times 2\frac{2}{3} = ?$
2. $5\frac{1}{2} \times 5\frac{1}{2} = ?$
3. $6\frac{1}{5} \times 6\frac{4}{5} = ?$
4. $8\frac{2}{7} \times 8\frac{5}{7} = ?$
5. $12\frac{1}{8} \times 12\frac{7}{8} = ?$
6. $15\frac{5}{9} \times 15\frac{4}{9} = ?$
7. $24\frac{3}{11} \times 24\frac{8}{11} = ?$
8. $58\frac{1}{2} \times 58\frac{1}{2} = ?$
9. $74\frac{1}{4} \times 74\frac{3}{4} = ?$
10. $89\frac{4}{5} \times 89\frac{1}{5} = ?$

167. *To Find the Product of any Two Mixed Numbers whose Fractions are ½.*

To the product of the integers add one-half their sum and annex $\frac{1}{4}$.

EXAMPLE: $2\frac{1}{2} \times 4\frac{1}{2} = 2 \times 4 + 3 + \frac{1}{4} = 11\frac{1}{4}$.
$3\frac{1}{2} \times 4\frac{1}{2} = 3 \times 4 + 3\frac{1}{2} + \frac{1}{4} = 15\frac{3}{4}$.

Solve the following:

1.	Multiply $2\frac{1}{2}$ by $6\frac{1}{2}$	6.	Multiply $9\frac{1}{2}$ by $11\frac{1}{2}$
2.	Multiply $3\frac{1}{2}$ by $5\frac{1}{2}$	7.	Multiply $15\frac{1}{2}$ by $17\frac{1}{2}$
3.	Multiply $3\frac{1}{2}$ by $7\frac{1}{2}$	8.	Multiply $45\frac{1}{2}$ by $61\frac{1}{2}$
4.	Multiply $4\frac{1}{2}$ by $5\frac{1}{2}$	9.	Multiply $88\frac{1}{2}$ by $102\frac{1}{2}$
5.	Multiply $8\frac{1}{2}$ by $12\frac{1}{2}$	10.	Multiply $94\frac{1}{2}$ by $116\frac{1}{2}$

168. *To Find the Product of Two Numbers whose Integers are Identical.*

To the product of the integers add the product of the sum of the fractions times the common integer and the product of the fractions.

EXAMPLE: $6\frac{1}{2} \times 6\frac{1}{3} = (6 \times 6 + (6 \times \frac{5}{6})) + (\frac{1}{2} \times \frac{1}{3})$,
or $36 + 5 + \frac{1}{6} = 41\frac{1}{6}$.

Solve the following:

1.	Multiply $8\frac{1}{2}$ by $8\frac{1}{4}$	6.	Multiply $45\frac{5}{8}$ by $45\frac{7}{9}$
2.	Multiply $12\frac{1}{3}$ by $12\frac{5}{8}$	7.	Multiply $48\frac{2}{3}$ by $48\frac{3}{4}$
3.	Multiply $14\frac{2}{3}$ by $14\frac{6}{7}$	8.	Multiply $60\frac{1}{2}$ by $60\frac{6}{8}$
4.	Multiply $24\frac{3}{8}$ by $24\frac{7}{8}$	9.	Multiply $81\frac{5}{8}$ by $81\frac{2}{3}$
5.	Multiply $35\frac{1}{5}$ by $35\frac{3}{8}$	10.	Multiply $120\frac{7}{8}$ by $120\frac{7}{10}$

169. *To Find the Product of Two Mixed Numbers when the Fractions are Identical.*

To the product of the integers add the product of the sum of the integers times the common fraction and the product of the fractions.

EXAMPLE: $4\frac{1}{3} \times 8\frac{1}{3} = (4 \times 8) + (12 \times \frac{1}{3} + (\frac{1}{3} \times \frac{1}{3})$,
or $32 + 4 + \frac{1}{9} = 36\frac{1}{9}$.

Solve the following:

1.	Multiply $6\frac{1}{4}$ by $18\frac{1}{4}$	6.	Multiply $27\frac{3}{8}$ by $21\frac{3}{8}$
2.	Multiply $9\frac{1}{3}$ by $15\frac{1}{3}$	7.	Multiply $55\frac{5}{7}$ by $22\frac{5}{7}$
3.	Multiply $36\frac{1}{2}$ by $44\frac{1}{2}$	8.	Multiply $88\frac{4}{9}$ by $11\frac{4}{9}$
4.	Multiply $72\frac{2}{8}$ by $36\frac{2}{8}$	9.	Multiply $117\frac{6}{7}$ by $51\frac{6}{7}$
5.	Multiply $47\frac{3}{8}$ by $53\frac{3}{8}$	10.	Multiply $234\frac{7}{11}$ by $481\frac{7}{11}$

Division of Fractions

170. To Divide a Fraction by a Whole Number.

Divide the numerator or multiply the denominator by the whole number.

Example: $\frac{4}{5} \div 2 = \frac{2}{5}$, by dividing numerator.

$\frac{4}{5} \div 2 = \frac{4}{10} = \frac{2}{5}$, by multiplying denominator.

Solve the following:

1. Divide $\frac{8}{11}$ by 4
2. Divide $\frac{12}{13}$ by 6
3. Divide $\frac{28}{33}$ by 7
4. Divide $\frac{36}{66}$ by 9
5. Divide $\frac{54}{77}$ by 18

6. Divide $4\frac{2}{3}$ by 8
7. Divide $12\frac{2}{5}$ by 9
8. Divide $32\frac{2}{3}$ by 49
9. Divide $48\frac{5}{8}$ by 64
10. Divide $54\frac{1}{11}$ by 119

171. To Divide a Whole Number by a Fraction.

Multiply the whole number by the denominator and divide the result by the numerator of the fraction.

Example: $8 \div \frac{2}{3}$. $8 \times 3 = 24$. $24 \div 2 = 12$.

Solve the following:

1. Divide 9 by $\frac{3}{4}$
2. Divide 15 by $\frac{5}{6}$
3. Divide 28 by $\frac{7}{8}$
4. Divide 42 by $\frac{14}{15}$
5. Divide 57 by $\frac{19}{24}$

6. Divide 65 by $\frac{5}{8}$
7. Divide 78 by $\frac{13}{18}$
8. Divide 96 by $\frac{16}{21}$
9. Divide 144 by $\frac{32}{35}$
10. Divide 272 by $\frac{17}{44}$

172. To Divide a Fraction by a Fraction.

Reduce whole or mixed numbers to improper fractions. Invert the divisor and proceed as in multiplication of fractions. Cancel if possible.

Example: Divide $\frac{3}{4} \times \frac{8}{9}$ by $3\frac{1}{9} \times \frac{4}{7}$.

$\frac{3}{4} \times \frac{8}{9} \times \frac{9}{28} \times \frac{7}{4} = \frac{3}{8}$ Ans.

Solve the following:

1. $\frac{3}{4} \times \frac{4}{5} \div \frac{7}{10} \times \frac{9}{16}$
2. $\frac{5}{6} \times \frac{7}{10} \times \frac{8}{9} \div \frac{7}{8} \times \frac{15}{28}$
3. $\frac{6}{7} \times \frac{11}{12} \div \frac{22}{49} \times \frac{3}{4} \times \frac{2}{3}$
4. $\frac{7}{9} \times \frac{13}{35} \times \frac{15}{16} \div \frac{11}{12} \times \frac{15}{22}$
5. $\frac{19}{35} \times \frac{49}{57} \div \frac{5}{8} \times \frac{4}{15} \times \frac{6}{11}$

6. $4\frac{1}{2} \times 7\frac{1}{7} \div 3\frac{3}{14} \times 2\frac{1}{2}$
7. $21 \div \frac{1}{4} \times \frac{3}{4} \times \frac{8}{9} \times \frac{2}{3}$
8. $\frac{3}{4} \times \frac{4}{5} \times \frac{6}{7} \times \frac{5}{8} \div 1\frac{2}{7}$
9. $5\frac{3}{4} \div 5\frac{1}{4} \times 5\frac{1}{3}$
10. $7\frac{1}{2} \times 9\frac{1}{3} \div 1\frac{3}{4} \times 6\frac{2}{13}$

173. *To Reduce Complex Fractions.*

Divide the numerator of the complex fraction by the denominator as in division of fractions.

EXAMPLE: Reduce $\dfrac{3\frac{1}{2}}{7\frac{1}{5}} = 3\frac{1}{2} \div 7\frac{1}{5} = \frac{7}{2} \times \frac{5}{36} = \frac{35}{72}.$

Reduce the following:

1. $\dfrac{5\frac{2}{5}}{15\frac{3}{4}}$

2. $\dfrac{25\frac{2}{7}}{4\frac{3}{14}}$

3. $\dfrac{\frac{2}{3} + \frac{3}{5}}{\frac{4}{5} + \frac{7}{15}}$

4. $\dfrac{4\frac{1}{2} \times 2\frac{7}{9}}{\frac{15}{32} \div 1\frac{1}{8}}$

5. $\dfrac{4\frac{1}{4} \div 6\frac{3}{4}}{\frac{3}{5} \times \frac{10}{11} \times 7\frac{1}{3}}$

6. $\dfrac{\frac{1}{2} + \frac{1}{3}}{1\frac{4}{5} \times 3\frac{1}{3}}$

7. $\dfrac{4\frac{1}{4} + 3\frac{2}{3}}{7\frac{1}{8} + 5\frac{7}{10}}$

8. $\dfrac{156\frac{7}{8}}{2\frac{1}{2} - 1\frac{1}{4}}$

9. $\dfrac{4\frac{2}{3}}{7}$

10. $\dfrac{\frac{2}{3} + (\frac{3}{4} \times 3\frac{1}{5}) - (2\frac{1}{7} \times \frac{11}{15})}{2\frac{23}{105} + 2\frac{3}{7}}$

PRACTICAL PROBLEMS

174. Solve the following:

1. A man gave ¼ of his fortune to his son, ⅓ to his daughter, and the remainder, $3500, to his wife. How much did his son and daughter each receive?

2. A man owned ⅓ of a business, and then bought ½ as much more. He then sold ¼ of his interests for $1200. What was the value of the whole business?

3. A's income is $2500 per year. If he spends ⅓ of ⅜ of it for board, ⅖ of ⅝ of the remainder for clothes, ⅝ of ${}_{10}^{3}$ of the remainder for books, and saves ⅘ of the remainder, how much can he save in three years?

4. A man at his death left his wife $12500, which was ½ of ⅝ of his estate. At her death she left ⅘ of her share to her daughter. What part of her father's estate did the daughter receive from her mother?

5. Jones's investment is ⅓ of Brown's, and Brown's is ⅔ of Green's. If their total investment is $4830, what is each one's share?

6. Brown lost ⅓ of his investment the first year. The second year he gained $400, and then had $800. What was his original investment?

7. Smith bought a stock of goods and sold ¼ of it at a gain of $300, ⅓ at a gain of $500, and the remainder at a loss of $200. What was the first cost of the goods, if the net gain was ⅙ of the cost?

8. Muir, Nunn, and Hakes receive $920 for doing a job of work. How much should each one get if the money is divided in proportion to ½, ⅔, and ¾.

9. Bought 27½ yards of matting at 23¼ cents a yard, and paid for the same in eggs at 13¾ cents a dozen. How many dozen eggs were required?

10. A merchant invested ⅖ of his money in shoes, ¼ — $100 in groceries, ⅙ + $200 in tea and coffee, ⅛ + $250 in hay and grain, and deposited the remainder, $588, in the bank. What was the total value of his property, and how much did he invest in each kind of stock?

HOME WORK—No. 8

1. The sum of two numbers is 12⅙; their difference is 3⅙. What are the numbers?

2. A can do a piece of work in 4½ days. If it takes B twice as long as A, and C ⅓ as long as B, how long will it take C to do it?

3. A and B together have $1190. If ¾ of A's equals ⅔ of B's, how much has each?

4. A 120 gallon tank has a pipe that will flow 15 gallons in 12 minutes. If another tank holding 180 gallons has a pipe that flows 20 gallons in 10 minutes, which tank will empty first, and in how much less time?

5. Blank saves ½ of ⅔ of his income, and Black, having the same income, spends 2½ times as much as Blank, and at the end of the year finds himself $150 in debt. What is the income of each?

6. Willis sold goods for $2340 and gained ⅛ of the cost. If he had sold them for $2050, would he have gained or lost, and how much?

7.   Brown bought a house and lot paying ¼ the price down, and the second payment was ¼ the remainder due. If the sum of the two payments thus made was $2100, what was the cost price of the place?

8.   A boy lost ⅓ of ¾ of his kite string, then added 60 feet. He then lost ⅓ of what he then had, then by adding 60 feet found it ¾ of its original length.   What was its length at first?

9.   A pole is ⅐ in the mud, ¼ in the water, and the part in the air is ⅓ its length plus 23 feet. What is the length of the pole?

10.   A's automobile travels 21 miles in 45 minutes, and B's will travel 30 miles in 65 minutes.   If the race course is 195 miles long, which will win, and by how much time?

DECIMALS

175. A **Decimal Fraction** is a fraction whose denominator is 10, 100, 1000, etc. Thus, $\frac{3}{10}$, $\frac{27}{100}$, $\frac{125}{1000}$ are decimal fractions.

176. A **Decimal** has the same value as a decimal fraction, and is expressed by writing the numerator only, the denominator being indicated by the number of decimal places. Thus, .3, .27, .125, are decimals and are read three-tenths, twenty-seven hundredths, etc.

177. The **Decimal Sign** (.), called the *decimal point*, is used to separate the decimal from the units place.

178. *A decimal always contains as many decimal places as there are ciphers in the denominator of an equivalent decimal fraction.*

179. A **Pure Decimal** consists of a decimal only. Thus, .5, .25, .375.

180. A **Mixed Decimal** consists of a whole number and a decimal. Thus, 4.5, 6.25, 27.375.

181. Decimals increase from right to left and decrease from left to right in a ten fold ratio, the same as whole numbers.

182. Decimals are read the same as decimal fractions. Thus, .8 is read eighth-tenths, and .75 is read seventy-five hundredths.

183. Read the following :

1.	.9	6.	.04
2.	.34	7.	.2045
3.	.345	8.	.00705
4.	.2487	9.	234.010735
5.	.35362	10.	2004.4002

184. Write the following :

1. Eleven hundredths.

2. Forty-two thousandths.

3. Seven hundred five ten thousandths.

4.   Five thousand two hundred ten hundred thousandths.
5.   Two hundred five thousand six hundred four millionths.
6.   Twenty-seven and two-tenths.
7.   One hundred ten and thirty-five thousandths.
8.   Thirty-three and one-third, hundredths.
9.   Three thousand and three thousandths.
10.   Seventy-two million and seventy-two millionths.

Reduction of Decimals

185.   *To Reduce a Decimal to a Common Fraction.*

Write for the denominator 1 with as many ciphers as there are decimal places in the decimal and reduce the resultant fraction to its lowest terms.

Reduce to common fractions:

1.	.8	6.	$.12\frac{1}{2}$
2.	.75	7.	$.37\frac{1}{2}$
3.	.625	8.	4.125
4.	.1525	9.	18.41875
5.	.4875	10.	$145.33\frac{1}{3}$

186.   *To Reduce a Common Fraction to a Decimal.*

Annex ciphers to the numerator and divide by the denominator. Point off as many decimal places as ciphers used.

Reduce to decimals:

1.	$\frac{1}{2}$	6.	$5\frac{1}{8}$
2.	$\frac{3}{4}$	7.	$27\frac{1}{4}$
3.	$\frac{7}{8}$	8.	$64\frac{2}{5}$
4.	$\frac{5}{16}$	9.	$4.2\frac{3}{16}$
5.	$\frac{17}{64}$	10.	$87\frac{5}{12}$

Addition of Decimals

187.   *To Add Decimals.*

Reduce all fractions to decimals. Write units of like order in the same columns. Add as in whole numbers, placing the decimal point between the units' and tenths' places.

Find the sum of the following :

1. .245, .76, .358, .1976, .40257, .38964
2. .25.2, 1.8, 325.4, 60.02, 7.6025
3. 425., .785, 30.972, .046, .0002, 880
4. $\frac{1}{2}$, $\frac{3}{4}$, $\frac{3}{16}$, $\frac{5}{8}$, $\frac{7}{10}$
5. $2\frac{1}{5}$, $27\frac{1}{2}$, $6.2\frac{1}{2}$, 387.5, .3125, $8\frac{3}{4}$

Subtraction of Decimals

188. *To Subtract Decimals.*

Reduce all fractions to decimals. Write units of like order in same columns. Subtract as in whole numbers, placing the decimal between units' and tenths' places.

Solve the following :

1. From 42.5 take 35.3
2. From 212.25 take 93.5
3. From $1216\frac{1}{4}$ take 93.5
4. From $7\frac{1}{8}$ take $3\frac{3}{16}$
5. From 1.275 take $.03\frac{1}{8}$

6. From $\frac{5}{8}$ take .54
7. From 8.02 take 8.002
8. From 126.5 take 12.65
9. From $47\frac{1}{4}$ take $2.5\frac{1}{2}$
10. From 7896 take 69.87

Multiplication of Decimals

189. *To Multiply Decimals.*

Multiply as in whole numbers. From the right point off as many decimal places in the product as there are in both multiplier and multiplicand.

Solve the following :

1. Multiply .75 by .5
2. Multiply 1.25 by .25
3. Multiply 41.75 by .03
4. Multiply 2.1875 by 1.5
5. Multiply .0525 by .0035

6. Multiply $4\frac{1}{2}$ by 7.5
7. Multiply .375 by $6\frac{1}{4}$
8. Multiply 23.54 by 41.5
9. Multiply $7\frac{1}{8}$ by $6\frac{1}{4}$
10. Multiply $1.5\frac{3}{4}$ by $93\frac{1}{8}$.

Division of Decimals

190. *To Divide Decimals.*

If necessary, annex ciphers to the dividend and divide as in whole numbers. From the right, point off as many decimal places in the quotient as those in the dividend exceed those in the divisor.

Solve the following :

1. Divide 2.16 by 3.6
2. Divide 9.654 by .03
3. Divide 102.4 by .32
4. Divide 1850 by .25

6. Divide $17\frac{1}{2}$ by .35
7. Divide $8\frac{1}{8}$ by .625
8. Divide .00261 by 300
10. Divide 202.002 by .006

Circulating Decimals

191. A *Circulating Decimal* is a decimal in which a figure or set of figures are repeated indefinitely. Thus, $\frac{1}{3} =$ .3333+, and $\frac{8}{11} = .727272+$.

192. A *Repetend* is the repeated figure or figures, and is represented by a dot over the repeated part. Thus, .3333+ = $\dot{.3}$, .727272+ = $.\dot{7}\dot{2}$, and .135135135+ = $.\dot{1}3\dot{5}$.

193. A repetend arises from the reduction of a common fraction whose denominator is not a factor of 10, 100, 1000, etc.

194. A repetend may be reduced to a common fraction by using for its denominator as many 9's as there figures in the repetend. Thus, $\dot{.3} = \frac{3}{9} = \frac{1}{3}$, $.\dot{7}\dot{2} = \frac{72}{99} = \frac{8}{11}$, $.\dot{1}3\dot{5} = \frac{135}{999} = \frac{15}{111} = \frac{5}{37}$.

195. To add or subtract repetends, continue repetend of each number until they terminate at the same place. Add or subtract as in finite decimals, carrying when necessary. Thus,

$$.\dot{3}3333\dot{3}$$
$$.\dot{7}2727\dot{2}$$
$$.\dot{1}3513\dot{5}$$
$$1.\dot{1}9574\dot{1}$$

196. In multiplication and division of decimals, it is best to reduce repetends to common fractions and then multiply or divide as required.

197. Solve the following:

1. Reduce $\frac{4}{9}$ to a circulating decimal.

2. Reduce $\frac{2}{7}$ to a circulating decimal.

3. Reduce $\frac{11}{15}$ to a circulating decimal.

4. Reduce $.4\dot{5}$ to a common fraction.

5. Reduce $.5\dot{1}\dot{3}$ to a common fraction.

6. Reduce $.\dot{1}4285\dot{7}$ to a common fraction.

7. Add $.\dot{3}\dot{5} + .\dot{7} + .\dot{1}3\dot{7} + .\dot{1}\dot{8} + .2\dot{4}\dot{1}$.

8. Add $\frac{3}{13} + .\dot{2}3076\dot{9}$ and reduce to a common fraction.

9. From $\frac{5}{7}$ take $.4\dot{3}\dot{2}$ and reduce to a repetend.

10. From $.\dot{7}5824\dot{1}$ take $.\dot{5}7142\dot{8}$ and reduce to a common fraction.

PRACTICAL PROBLEMS

198. Solve the following:

1. How many acres in a farm consisting of five fields as follows: $55\frac{1}{2}$ acres of wheat, 72.75 acres of corn, $27\frac{3}{8}$ acres of oats, $18\frac{3}{4}$ acres of barley, and 21.625 acres of pasture land?

2. How many chains in length will be the total distance around three fields, each 77.15 chains long and 54.375 chains wide?

3. A's ranch consisted of 1274.3 acres, and B's of 935.25 acres. How much more land did A own than B?

4. Find the difference between 932\frac{1}{4}$ and $9.32\frac{1}{4}$.

5. A man who owned $2460\frac{3}{8}$ acres of land, sold $375\frac{1}{2}$ acres to A, 1050.25 acres to B, and 428.1875 to C. How many acres remained unsold?

6. If a cord of wood is worth \$5.75, what are 12.25 cords worth?

7. If wheat is worth \$.87$\frac{1}{2}$ per bushel, how many bushels can be bought for \$93.625?

8.   How many bushels of oats at $.16⅔ per bushel can be bought for $51.50?

9.   An automobile travels at the rate of 27⅛ miles per hour. How far will it travel in 12⅕ hours?

10.   A man sold a horse for $125, and received in payment 12½ yards of cloth worth $3¼ per yard, and the remainder in tea at $.62½ per pound.   How many pounds of tea were required?

Outline for Review

I.   Common Fractions:

1.   Definition.

2.   Fractional unit.

3.   Terms:
       Denominator.
       Numerator.

4.   Kinds:
       Proper.
       Improper.
       Simple.
       Compound.
       Complex.
       Mixed number.

5.   Value of a fraction.

6.   Principles of fractions.

7.   Reduction of fractions:
       To higher terms.
       To lower terms.
       To an improper fraction.
       To whole or mixed numbers.
       To a common denominator.

8.   Addition of fractions.

9.   Subtraction of fractions.

10.   Multiplication of fractions.

11.   Division of fractions.

12.   To reduce complex fractions to simple.

II.   Decimals:

1.   Definition.

2.   A decimal.

3.   The decimal sign.

4.   Kinds of decimals:
       Pure decimal.
       Mixed decimal.

5.   Reduction of decimals.

6.   Addition of decimals.

7.   Subtraction of decimals.

8.   Multiplication of decimals.

9.   Division of decimals.

10.   Circulating decimals.

Decimal Currency

199. Money is any stamped metal or other substance legally used as a medium of commerce.

200. Currency is the money of a country.

201. Coin is stamped metal used as currency.

202. A **Decimal Currency** is a currency based upon the decimal system of notation.

203. The United States, Canada, France, and Germany have each adopted a more or less imperfect decimal system.

United States Money

204. United States Money is the legal currency of this country. The system was adopted in 1786, and has been changed several times by acts of congress.

205. The **Coins** of the United States are made of gold, silver, nickel-copper, and bronze. Gold and silver are mixed with a base metal, called alloy,—nine parts pure metal and one part alloy.

206. The **Gold Coins** of the United States are :

The *Double Eagle*, value $20, weight 516 grains.
The *Eagle*, value $10, weight 258 grains.
The *Half Eagle*, value $5, weight 129 grains.

NOTE—The THREE DOLLAR piece, the QUARTER EAGLE, and the ONE DOLLAR piece are no longer coined. The weight of the $1 piece is 25.8 grains.

207. The **Silver Coins** of the United States are :

The *Standard Dollar*, value $1, weight 412.5 grains.
The *Half Dollar*, value 50¢, weight 192.9 grains.
The *Quarter Dollar*, value 25¢, weight 96.45 grains.
The *Dime*, value 10¢, weight 38.58 grains.

208. The *Nickel-Copper Coin* of the United States is the *Five Cent* piece, value 5¢, weight 77.16 grains.

NOTE—The FIVE CENT piece (silver) and the THREE CENT piece (nickel-copper) are no longer coined. The NICKEL is composed of 25 parts nickel and 75 parts copper.

209. The *Bronze Coin* of the United States is the *One Cent* piece, value 1¢, weight 48 grains.

NOTE—The ONE CENT piece is composed of 95 parts copper and 5 parts alloy.

210. Money is called a *Legal Tender* when the law requires that it be received in payment of a debt.

211. United States *Gold Coins* of standard weight are legal tender for all debts in the United States.

212. *Standard Silver Dollars* are legal tender for all debts not under special contract to the contrary. The other *silver coins* are legal tender in sums not exceeding ten dollars.

213. The *Nickel* and *One Cent* piece are legal tender in sums not exceeding twenty-five cents.

214. The *Paper Money* of the United States consists of *Treasury Notes* (Greenbacks), *Gold Certificates*, *Silver Certificates*, and *National Bank Notes*.

215. *Greenbacks,* or *treasury notes*, are issued by the government, and are legal tender for all debts except duties on imports and interest on government bonds payable in gold.

216. *Gold Certificates* and *Silver Certificates* are issued by the government to represent coin in the treasury. They are principally used to facilitate the handling of large amounts of cash.

217. *National Bank Notes* are furnished by the government and issued by National Banks which are required to deposit an equal amount of U. S. bonds with the government as security for their redemption. They are not legal tender but on account of the security given, circulate without question.

218. *Table for United States Money:*

$$10 \text{ mills } = 1 \text{ cent}......\cancel{c}, \text{ or ct.}$$
$$10 \text{ cents } = 1 \text{ dime}.....d.$$
$$10 \text{ dimes } = 1 \text{ dollar}....\$.$$
$$10 \text{ dollars} = 1 \text{ Eagle}....E.$$

219. The **Unit** of measure is the dollar, and sums of money are spoken of as *dollars* and *cents*. The Eagle and dime are seldom mentioned in business transactions.

220. To reduce United States money to higher denominations, move the decimal point to the left; to lower denominations, move the decimal point to the right. Thus :

$80. = 8. Eagles; $35. = 350. dimes; $25. = 2500. cents.

Addition and Subtraction

221. To **Add** or to **Subtract** United States money.

Write units of like denomination in same columns. Add or subtract as in simple numbers.

222. Solve the following :

1. Add 35 dollars, 148 dollars and twenty-five cents, 7 dollars and seventeen cents, and one hundred dollars and 52 cents.

2. From eight hundred forty dollars and five cents, subtract three hundred four dollars and thirty cents.

3. Monday's sales were $517.62; Tuesday's, $478.25; Wednesday's, $524.88; Thursday's, $495.35; Friday's, $392.07; Saturday's, $812.22. Find the total sales for the week.

4. Jones's checks for the month of January were as follows : $28.75, $32.80, $105.40, $75.25, $1250, $35.95, $67.20. Find the total amount withdrawn.

5. Brown deposited the following sums to his credit : $750, $250, $325.50, $18.40, $926.05, $38.55; and withdrew as follows : $32.75, $42.80, $91.25, $10.35, $18.75, $31.25, $48, $82.15. What was his balance in bank?

Multiplication and Division

223. To *Multiply* or to *Divide* United States money, proceed as in multiplication or division of decimals.

224. Solve the following:

1. Multiply $125.75 by 47
2. Multiply $204.05 by 308
3. Divide $625.75 by 15
4. Divide $1875.50 by $12\frac{1}{2}$
5. Divide $274.50 by $16\frac{2}{3}$

6. $25.625 $\times$ 11 $\div$ 25 = ?
7. $142.50 $\div$ $12\frac{1}{2}$ $\times$ 65 = ?
8. $87.75 $\times$ 14 — $54 = ?
9. $271.25 $\div$.$33\frac{1}{3}$ + $71 = ?
10. $95.40 $\times$ $48\frac{1}{2}$ — $172 = ?

PRACTICAL PROBLEMS

Solve the following:

1. . Bought 1248 pounds of prunes at 4 cents per pound, 590 pounds of pears at 5 cents per pound, 1892 pounds of peaches at $3\frac{1}{2}$ cents per pound, and 636 pounds of plums at 6 cents per pound. Find the total amount of the bill.

2. Jones's income was $1250 per year. He spent $17 per month for board, $135 for clothes, $17 for shoes, $3 per month for lodge dues, 75 cents per week for washing, and $95 for sundries. How much did he have left to place in the bank?

3. Henry's salary for January was $35; this was increased $5 every month in the year. What was his total earnings for the year?

4. If it cost 7 cents per pound to raise hops, what will be the profit on a hop crop of 250 bales, weighing 275 pounds each, sold at $13\frac{1}{2}$ cents per pound?

5. A merchant bought corn at 55 cents per bushel, wheat at 90 cents per bushel, and barley at 75 cents per bushel. If he bought two bushels of wheat to every one of barley, and two bushels of corn to every one of wheat, what was the number of bushels of each if he paid $522.50 for the whole?

Simple Interest

225. *Interest* is the *sum* paid for the use of money or other value.

226. *Principal* is the money or value for the use of which *interest* is paid.

227. *Rate* is the number of cents paid for the use of $1 for one year, and is called *rate per cent*.

228. *Bank Discount* is the amount charged by banks on promisory notes or other commercial paper bought by the bank.

229. *Interest* and *Bank Discount* are estimated at a certain rate on the $1.

230. *To Find Interest or Bank Discount by the Cancellation Method.*

Write the principal, time, and rate at the right of a vertical line; at the left of this line write a year in the same denomination in which the time is expressed. Cancel and reduce. The result will be the interest for the given time and rate.

EXAMPLE: Find the interest on $720 for 7 months at 6%.

$$\begin{array}{c|l} & {}^{360}\$\cancel{720} \\ \cancel{2} & \\ \cancel{12}\ \text{mo.} & 7\ \text{mo.} \\ \hline & .\cancel{0}\cancel{6}\ \text{rate} \\ \end{array}$$

$$\$25.20 = \text{Interest}$$

EXAMPLE: Find the interest on $960 for 63 days at 8%; also on $1200 for 1 year 3 months 24 days at 7 %.

$$\begin{array}{c|l} & {}^{192}\$\cancel{960} \\ \cancel{5}\ \ \cancel{45} & \\ \cancel{360}\ \text{ds.} & \cancel{63}\ ^7\ \text{ds.} \\ \hline & .\cancel{0}\cancel{8}\ \text{rate} \\ \end{array} \qquad \begin{array}{c|l} & {}^{100}\$\cancel{1200} \\ \cancel{12}\ \text{mo.} & 15.8\ \text{mo.} \\ \hline & .07\ \text{rate} \\ \end{array}$$

$$\$13.44 = \text{Interest} \qquad\qquad \$110.60\cancel{0} = \text{Interest}$$

1 year = 12 months.   24 days = .8 of a month.   Every 3 days = .1 of a month.

NOTE—In the above examples it will be noticed that the 7 months, the 63 days, and the 15.8 months are $\frac{7}{12}$, $\frac{63}{360}$, and $\frac{15.8}{12}$ of a year respectively, and that we are only taking those fractional parts of a whole year's interest which is always found by multiplying the PRINCIPAL by the RAT E. For further discussion of the subject of interest see main topic.

231. Find the interest on the following:

1. $840 for 30 ds. at 6%   6. $150 for 4 mo. at 6%
2. $1230 for 54 ds. at 6%   7. $750 for 7 mo. at 7%
3. $1350 for 37 ds. at 8%   8. $1050 for 11 mo. at 7½%
4. $2700 for 93 ds. at 7%   9. $325.50 for 1 yr. 2 mo. at 6%
5. $3500 for 17 ds. at 9%   10. $4500 for 5 mo. 12 ds. at 10%

PRACTICAL PROBLEMS

232. Solve the following:

1. Find the interest on a $630 note for 1 year 4 months 15 days at 6%.

2. Find the proceeds of a note sold at the bank; face of note, $420; time to run, 3 months; money worth 7%.

3. Find the discount at 8 % on a note for $960 sold at bank 7 months 21 days before maturity.

4. What were the proceeds of a note for $720 discounted at bank for 105 days at 7%?

5. A $500 note, with interest at 6%, is given for 2 years 8 months 27 days. How much is due at maturity?

6. Find the proceeds of a note for $600, due in 1 year, at 6% interest, discounted at bank 4 months before due at 10%.

NOTE—Discount the AMOUNT of the note at MATURITY for the time yet to run.

7. How much would be due at maturity on Boyd's note for $1000 given for 2 years 4 months 27 days at 6%?

8. What would be the proceeds of the above note if sold at a bank and discounted 1 year 2 months 15 days before maturity at 10%?

9. After holding a note of $1000, due in 2 years with interest at 7%, for 6 months, I sell it to the bank at a discount of 9% for time yet to run, paying a collection fee of ¼%. How much should I receive? (Collection is charged on face of note.)

10. The following note was discounted at the bank July 25, 1907; rate of discount, 8%:

> $524.50   *San Francisco, Cal., December 10, 1906.*
>   *One year after date I promise to pay A. L. Ward,*
> *or order, Five Hundred Twenty-four* ⁵⁰⁄₁₀₀ *Dollars, with*
> *interest at six per cent per annum.*
>
>   *John W. Wilson.*

If a collection fee of ¼% is charged, what should be the net proceeds of the above note on date of discount?

HOME WORK—No. 9

1. Add 10 Eagles, 540 dimes, 350 cents, 182 mills, 6 dollars, 135 Eagles, 25 dimes, 5235 cents, 9840 mills, 400 mills, 1725 cents and 3 Eagles.

2. From 1847.5 dimes take 15740 mills.

3. If John received 1 dime, 2 cents, and 5 mills per hour for his labor, and works 11 months, of 26 days each, at that rate; how much will he earn if he averages 8.5 hours each day?

4. Find the net proceeds of the following note, sold to bank November 16, 1907, at 8% discount:

5. Find the net proceeds of the following note, discounted at bank April 26, 1908. Rate of discount, 10%; collection, ¼%:

NOTE—The cancellation method of calculating interest and bank discount here given will enable students to work out all ordinary problems occuring in their business practice.

6. A note for $1272 dated July 5, 1907, and drawing 7% interest, is paid September 1, 1908. What amount will be required to make settlement in full?

7. Jones owed $7800 unpaid amount on his farm which he agreed to pay in three equal yearly installments as follows: $2600, at 8% interest, due in 1 year; $2600, at 7% interest, due in 2 years; and $2600, at 6% interest, due in 3 years. What was the total amount paid?

8. Matthews & Co. owed their jobber as follows:

Jan. 1, Mdse., $480 bought on 3 mo. time.
Feb. 1, " 600 " " 1 " "
Mar. 1, " 900 " " 2 " "

If this account is all paid on May 1, how much cash will be required, money being worth 8%?

9. Having on hand a note for $1845 due in 1 yr. 4 mo. 18 ds. with interest at 6%, I sell it at the bank 7 mo. 24 ds. before due. If the bank charges me 8% discount and ¼% for collection, how much should I receive for the note?

10. Ross gave his note as follows:

$1254.60   *Oakland, Cal., July 25, 1908.*

Sixty days after date I promise to pay A. B. Glenn, or order, Twelve hundred fifty-four 60/100 *Dollars, without interest. Value received.*

KEMP ROSS.

What is due on this note December 23, 1908?

NOTE—The legal rate in California, when no rate is agreed upon, is seven per cent.

Aliquot Parts

233. The **Aliquot Parts** of a number are the fractional parts of it. Thus, 2, 3, 4, 6, 9, 12, and 18 are aliquot parts of the number 36.

234. All *composite numbers* contain aliquot parts. The aliquot parts of 100 and of 360 are those most commonly used.

235. *Aliquot Parts of 100:*

50	$=$	$\frac{1}{2}$ of 100	$8\frac{1}{3}$	$=\frac{1}{12}$ of 100
$33\frac{1}{3}$	$=$	$\frac{1}{3}$ of 100	$6\frac{2}{3}$	$=\frac{1}{15}$ of 100
25	$=$	$\frac{1}{4}$ of 100	$6\frac{1}{4}$	$=\frac{1}{16}$ of 100
20	$=$	$\frac{1}{5}$ of 100	5	$=\frac{1}{20}$ of 100
$16\frac{2}{3}$	$=$	$\frac{1}{6}$ of 100	4	$=\frac{1}{25}$ of 100
$14\frac{2}{7}$	$=$	$\frac{1}{7}$ of 100	$3\frac{1}{3}$	$=\frac{1}{30}$ of 100
$12\frac{1}{2}$	$=$	$\frac{1}{8}$ of 100	$2\frac{1}{2}$	$=\frac{1}{40}$ of 100
$11\frac{1}{9}$	$=$	$\frac{1}{9}$ of 100	2	$=\frac{1}{50}$ of 100
10	$=$	$\frac{1}{10}$ of 100	$1\frac{2}{3}$	$=\frac{1}{60}$ of 100
$9\frac{1}{11}$	$=$	$\frac{1}{11}$ of 100	$1\frac{1}{4}$	$=\frac{1}{80}$ of 100

236. *Multiples of the Aliquot Parts of 100:*

$66\frac{2}{3}=\frac{2}{3}$ of 100	$87\frac{1}{2}=\ \frac{7}{8}$ of 100
$75\ =\frac{3}{4}$ of 100	$18\frac{3}{4}=\frac{3}{16}$ of 100
$40\ =\frac{2}{5}$ cf 100	$31\frac{1}{4}=\frac{5}{16}$ of 100
$60\ =\frac{3}{5}$ of 100	$43\frac{3}{4}=\frac{7}{16}$ of 100
$80\ =\frac{4}{5}$ of 100	$56\frac{1}{4}=\frac{9}{16}$ of 100
$83\frac{1}{3}=\frac{5}{6}$ of 100	$68\frac{3}{4}=\frac{11}{16}$ of 100
$37\frac{1}{2}=\frac{3}{8}$ of 100	$81\frac{1}{4}=\frac{13}{16}$ of 100
$62\frac{1}{2}=\frac{5}{8}$ of 100	$93\frac{3}{4}=\frac{15}{16}$ of 100

237. *An Aliquot Part More or Less than 100:*

$150\ =\frac{1}{2}$ more than 100	$95\ =\frac{1}{20}$ less than 100
$133\frac{1}{3}=\frac{1}{3}$ more than 100	$90\ =\frac{1}{10}$ less than 100
$125\ =\frac{1}{4}$ more than 100	$83\frac{1}{3}=\ \frac{1}{6}$ less than 100
$120\ =\frac{1}{5}$ more than 100	$80\ =\ \frac{1}{5}$ less than 100
$116\frac{2}{3}=\frac{1}{6}$ more than 100	$75\ =\ \frac{1}{4}$ less than 100

$112\frac{1}{2} = \frac{1}{8}$ more than 100 $66\frac{2}{3} = \frac{1}{3}$ less than 100

$110 = \frac{1}{10}$ more than 100 $62\frac{1}{2} = \frac{3}{8}$ less than 100

$108\frac{1}{3} = \frac{1}{12}$ more than 100 $37\frac{1}{2} = \frac{5}{8}$ less than 100

238. *Aliquot Parts of 360:*

$180 = \frac{1}{2}$ of 360 $40 = \frac{1}{9}$ of 360

$120 = \frac{1}{3}$ of 360 $36 = \frac{1}{10}$ of 360

$90 = \frac{1}{4}$ of 360 $30 = \frac{1}{12}$ of 360

$72 = \frac{1}{5}$ of 360 $24 = \frac{1}{15}$ of 360

$60 = \frac{1}{6}$ of 360 $20 = \frac{1}{18}$ of 360

$45 = \frac{1}{8}$ of 360 $18 = \frac{1}{20}$ of 360

NOTE—The aliquot parts of 360 days are much used when computing interest

239. *To Find the Cost when the Price or Quantity is an Aliquot Part of 100.*

Take such a part of the quantity or price as the price or quantity is a part of 100.

EXAMPLE: What will be the cost of 887 yards of cloth at $33\frac{1}{3}$ cents per yard?

At $1.00 per yd. 387 yds. would cost $387.

At $33\frac{1}{3}$ cents per yd. the cost will be $\frac{1}{3}$ of $387 = $129.

240. Find the cost of the following invoices, making all extensions mentally:

1.	480# Cocoa	50¢	2.	368 yds. Cabot A	12½¢
	270# Japan Tea	33⅓¢		711 yds. Cabot W	9¢
	325# Sugar	5¢		515 yds. Muslin	14²⁄₇¢
	840# Rice	12½¢		948 yds. Linings	8⅓¢
	918# Raisins	16⅔¢		425 yds. Gingham	10¢
	385# B. Powder	20¢		432 yds. Cambric	6¼¢
3.	24 bxs. Soap	87½¢	4.	6 doz. cans Corn	6¼¢
	120# Starch	20¢		4 doz. cans Beans	8⅓¢
	48 gals. Molasses	37½¢		10 doz. cans Peas	7¢
	32 gals. Vinegar	18¾¢		15 doz. cans Oysters	11⅑¢
	320# Salt	1¼¢		7 doz. cans Clams	14²⁄₇¢
	28# Pepper	25¢		2 doz. cans Lobsters	15¢
	16# Spice	12½¢		2 doz. cans Shrimps	16⅔¢

5.	12 doz. qts. Peaches	10¢		6.	240 sks. Flour	$1.12½
	8 doz. qts. Pears	8⅓¢			80 sks. Graham	.37½
	6 doz. qts. Plums	12½¢			72 sks. Corn Meal	.62½
	6 doz. qts. Apricots	15¢			48 sks. Rye Flour	.83⅓
	12 doz. qts. Cherries	16⅔¢			48 sks. Buckwheat	1.08⅓
	10 doz. qts. Blackbrs.	6⅔¢			24 sks. Hominy	1.25
	10 doz. qts. Loganbrs.	8⅓¢			36 sks. Potatoes	1.15
	12 doz. qts. Strawbrs.	12¼¢			18 sks. Beans	3.50

241. *To Find the Price or Quantity when the Quantity or Price is an Aliquot Part of 100.*

Divide the cost by the quantity or price by dividing it by the Aliquot part the the quantity or price is of 100.

EXAMPLE: At 12½ cents per yard, how many yards of cloth can be bought for $60?

$12\frac{1}{2} = \frac{1}{8}$ of 100. $60 \div \frac{1}{8} = 60 \times 8 = 480$, No. of yards.

242. Find the price or quantity of each of the following by multiplication only:

1. At 25 cents per yd., how many yds. of flannel can be bought for $35?

2. At 33⅓ cents per bushel, how many bushels of oats can be bought for $127?

3. At 16⅔ cents per lb., how many lbs. of cheese can be bought for $52.50?

4. Bought 12½ yds. of cloth for $17.75. What was the price per yd.?

5. At 8⅓ cents per doz., how many doz eggs can be bought for $4.50?

6. At $1.25 per yd., how many yds. of silk can be bought for $37.50?

7. Bought 62½ bushels of millet for $225. What was the price per bushel?

8. At 83⅓ cents per yd., how many yds. of carpet can be bought for $120?

9. At 14⅔ cents each, how many books can be bought for $88?

10. Sold my farm of 66⅔ acres for $7500. What was the price per acre?

HOME WORK—No. 10

Extend and foot the following:

1.	2.	3.
75 yds. @ $.50	96 lbs. @ $.01$\frac{1}{4}$	189 yds. @ $.66$\frac{2}{3}$
88 yds. @ .09$\frac{1}{11}$	56 lbs. @ .02$\frac{1}{2}$	256 yds. @ .18$\frac{3}{4}$
91 yds. @ .14$\frac{2}{7}$	76 lbs. @ .05	528 yds. @ .75
72 yds. @ .12$\frac{1}{2}$	75 lbs. @ .06$\frac{2}{3}$	728 yds. @ .87$\frac{1}{2}$
78 yds. @ .16$\frac{2}{3}$	84 lbs. @ .08$\frac{1}{3}$	616 yds. @ .62$\frac{1}{2}$
96 yds. @ .25	90 lbs. @ .01$\frac{2}{3}$	775 yds. @ .60
84 yds. @ .33$\frac{1}{3}$	80 lbs. @ .06$\frac{1}{4}$	952 yds. @ .37$\frac{1}{2}$
99 yds. @ .11$\frac{1}{9}$	87 lbs. @ .03$\frac{1}{3}$	648 yds. @ .83$\frac{1}{3}$

4.	5.	6.
176 yds. @ $.31$\frac{1}{4}$	1424 prs. @ $1.50	1656 gal. @ $ .13$\frac{1}{2}$
432 yds. @ .81$\frac{1}{4}$	2562 prs. @ 1.33$\frac{1}{3}$	2454 gal. @ 2.16$\frac{2}{3}$
592 yds. @ .43$\frac{3}{4}$	1728 prs. @ 1.83$\frac{1}{3}$	3144 gal. @ 1.11$\frac{1}{2}$
678 yds. @ .16$\frac{2}{3}$	2436 prs. @ .95	4215 gal. @ 3.33$\frac{1}{3}$
816 yds. @ .56$\frac{1}{4}$	7648 prs. @ 1.25	7544 gal. @ 2.12$\frac{1}{2}$
904 yds. @ .62$\frac{1}{2}$	7734 prs. @ 1.16$\frac{2}{3}$	7776 gal. @ .15$\frac{2}{3}$
945 yds. @ .28$\frac{4}{7}$	8425 prs. @ 1.20	8592 gal. @ 1.17$\frac{2}{3}$
972 yds. @ .83$\frac{1}{3}$	9236 prs. @ 2.25	8979 gal. @ .34$\frac{1}{3}$

Find the total quantity of the following:

7.	8.
Cost $14, price per lb. $.25	Cost $35, price per yd. $ .66$\frac{2}{3}$
Cost 37, price per lb. .33$\frac{1}{3}$	Cost 44, price per yd. 1.25
Cost 54, price per lb. .16$\frac{2}{3}$	Cost 56, price per yd. 1.33$\frac{1}{3}$
Cost 67, price per lb. .12$\frac{1}{2}$	Cost 64, price per yd. .87$\frac{1}{2}$
Cost 72, price per lb. .08$\frac{1}{3}$	Cost 72, price per yd. .37$\frac{1}{2}$
Cost 83, price per lb. .14$\frac{2}{7}$	Cost 84, price per yd. 1.12$\frac{1}{2}$
Cost 86, price per lb. .11$\frac{1}{9}$	Cost 96, price per yd. 1.16$\frac{2}{3}$
Cost 91, price per lb. .06$\frac{1}{4}$	Cost 38, price per yd. 1.18$\frac{3}{4}$

Find the price of each of the following:

9.	10.
Cost $480.00, quantity 1440 yds.	Cost $112.00, quantity 336#
Cost 594.00, quantity 2376 yds.	Cost 67.20, quantity 672#
Cost 512.50, quantity 3075 yds.	Cost 107.50, quantity 430#
Cost 312.25, quantity 2498 yds.	Cost 31.20, quantity 936#
Cost 416.00, quantity 2912 yds.	Cost 144.00, quantity 192#
Cost 667.00, quantity 4002 yds.	Cost 46.00, quantity 552#
Cost 743.25, quantity 5946 yds.	Cost 88.00, quantity 528#
Cost 855.75, quantity 3423 yds.	Cost 233.40, quantity 1167#

ANALYSIS

243. *Analysis* in arithmetic is the mental separation of a problem into its elements to obtain definite results.

244. The *Unit* is the basis of all arithmetical analyses.

245. In *Simple Analysis* there is always *one* step; viz., to reduce *from* the unit, or *to* the unit.

EXAMPLE: If one hat costs $3, what will four hats cost?

ANALYSIS: If ONE hat costs $3,
 FOUR hats will cost 4 times $3, or $12.

EXAMPLE: If five hats cost $15, what will one hat cost?

ANALYSIS: If FIVE hats cost $15,
 ONE hat wil cost $\frac{1}{5}$ of $15, or $3.

246. In *Compound Analysis* there are always *two or more* steps; viz., *to* the unit, and *from* the unit.

EXAMPLE: (*a*). If 5 hats cost $15, what will 7 hats cost?

ANALYSIS: If FIVE hats cost $15,
 ONE hat will cost $\frac{1}{5}$ of $15, or $3 (to the unit), and
 SEVEN hats will cost 7 times $3, or $21 (from the unit).

EXAMPLE: (*b*). If $\frac{4}{5}$ of a ton of hay cost $12, what will $\frac{2}{3}$ of a ton cost?

ANALYSIS:

 If $\frac{4}{5}$ of a ton cost $12,
 $\frac{1}{5}$ of a ton will cost $\frac{1}{4}$ of $12, or $3 (to the fractional unit), and
 $\frac{5}{5}$, or 1 ton, will cost 5 times $3, or $15 (to the unit).

 If $\frac{3}{3}$, or 1 ton costs $15, then (from the unit)
 $\frac{1}{3}$ of a ton will cost $\frac{1}{3}$ of $15, or $5 (to the fractional unit), and
 $\frac{2}{3}$ of a ton will cost twice $5, or $10 (to the fraction).

NOTE—The discussion and problems in Analysis here given are for the purpose of developing the reasoning faculties. The amount of work is purposely limited that the student may feel that he· has time to complete it in a most thorough manner.

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247. *Comparison of Whole Numbers.*

1. If 7 coats cost $84, what will 11 coats cost?

ANALYSIS: If 7 coats cost $84, one coat will cost $\frac{1}{7}$ of $84, or $12, and 11 coats will cost 11 times $12, or $132.

2.   If 13 hats cost $39, what will 9 hats cost?

3.   If 11 pairs of shoes cost $49.50, what will 15 pairs cost?

4.   If 7 men can do a piece of work in 15 days, how long will it take 10 men to do it?

5.   If 3 men cut 12 cords of wood in 6 days, how many days will it take 4 men to cut 8 cords?

6.   If $240 will pay the board of 6 persons for 4 weeks, for how many weeks will $540 pay the board of 9 persons?

7.   If 4 men can mow 24 acres of grass in 3 days, how long will it take 6 men and 4 boys to mow 40 acres if one man can do as much as two boys?

8.   If an automobile can travel 1550 miles in 5 days of 10 hours each, how far can it go in 8 days of 12 hours each?

9.   Brown employs 45 men to do a job of work in 3 months; wishing to complete the work in 2½ months, how many addition-men would be required?

10.   If a block of granite 12 feet long, 4 feet wide, and 15 inches thick weighs 6480 lbs., what will be the weight of a similar block 15 feet long, 5 feet wide, and 2 feet thick?

248.   *Comparisons Having Fractional Numbers.*

1.   James lost 12 marbles which was ⅜ of what he had at first.   How many had he at first?

ANALYSIS: If 12 marbles is ⅜ of what James had at first, ⅛ is ⅓ of 12 marbles, or 4 marbles, and ⅜ is 8 times 4 marbles, or 32 marbles.

2.   If 7 yards of cloth cost $21, what will ⅔ of a yard cost?

3.   If ⅗ of a ton of hay costs $7.50, what will 8 tons cost?

4.   If ⅞ of a barrel of vinegar costs $5.25, what will ¹¹⁄₁₅ of a barrel cost?

5.   If ⅜ of ⅝ of an acre of land is worth $16.50, what is the value of ⅘ of ⅝ of an acre?

6.   What number is it that if you add ⅔ of itself the result is 135?

7. A young lady being asked her age replied: "If to my age you add ⅓ and ⅖ of my age, the sum is 26 years." What was her age?

8. The sum of two numbers is 35; their difference is ½ the less number. What are the numbers?

9. What part of 3 is ⅔ of 2?

10. A boy lost ⅓ of his kite string and then added 60 feet more, when he found he had ⅝ as much as at first. What was the original length?

249. *Partnership Problems.*

1. If A invests $200, and B $500, and their total gain is $210, how much of the gain should each receive?

ANALYSIS: If A invests $200, and B $500, their total investment is $700, of which A's share is ²⁄₇, and B's share is ⁵⁄₇. Their total gain is $210, and since their gain is in proportion to their capital, A's share is ²⁄₇ of $210, or $60, and B's share is ⁵⁄₇ of $210, or $150.

2. A invests $3000, B $4000, and C $5000. If their total loss is $840, what should be each one's share?

3. Jones invests $300 for 5 months; Brown, $400 for 4 months; and Smith, $700 for 2 months. If their total gain is $405, how much should each receive?

4. The total gain of a firm was $770. White puts in ½ the capital for 7 months, Green ⅓ the capital for 12 months, and Black the remainder for 10 months. How much was each one's share of the gain?

5. Hill, Cooper, and Sullivan are partners in business. Hill puts in $400 for 7 months and gains a certain sum; Cooper puts in $700 for a certain time and gains $105; Sullivan puts in a certain sum for 2 months and gains $90. If the total gain of the firm is $335, what is Hill's gain, Cooper's time, and Sullivan's capital?

250. *Labor Problems.*

1. If A can do a piece of work in 3 days and B in 5 days, how long will it take them to do it working together?

ANALYSIS: If A can do the work in 3 days, he can do ⅓ of it in 1 day. If B can do it in 5 days, he can do ⅕ of it in 1 day. Both working together can do the sum of ⅓ and ⅕, or $\frac{8}{15}$ of it in 1 day, and to do $1\frac{5}{15}$, or all the work, will require as many days as $\frac{8}{15}$ is contained in $1\frac{5}{15}$, or $1\frac{7}{8}$ days.

2. Lambert can saw a certain pile of wood in 8 days; Lewis in 12 days, and Lucien in 6 days. How long will it take all three to do it?

3. Two men can dig a ditch in 15 days. The first can dig it alone in in 25 days. How long will it take the second to dig it alone?

4. A, B, and C can do a job of work in three days. A can do it in 9 days; B in 12 days. How long will it take C to do the job?

5. Ralph can mow a field in 4 days, and Lewis can mow it in 6 days. How long will it take Ralph to finish the work after they have both worked together 1 day?

251. *Time Problems.*

1. What is the time of day, if the time past noon equals ⅓ the time to midnight?

2. What is the time of day if ½ the time to noon equals the time past midnight?

3. What is the time of day if ⅓ the time past midnight equals the time to midnight again?

4. What is the time of day if ½ the time past noon equals ⅓ the time to midnight?

5. What is the time of day if ⅔ of the time past midnight equals ⅖ the time to midnight again?

252. *Clock Problems.*

1. How many minute spaces does the minute hand gain on the hour hand every hour?

ANALYSIS: If the minute hand travels 60 minute spaces in 1 hour, and the hour hand travels 5 minute spaces in the same period, the minute hand will gain 55 minute spaces every hour.

2. At what time between 1 o'clock and 2 o'clock are the hour and minute hands together?

3. At what time between 5 and six o'clock are the hour and minute hands together?

4. At what time between 3 and 4 o'clock are the hour and minute hand in a straight line?

5. At what time between 7 and 8 o'clock are the hands of a clock at right angles?

_____

253. *Fish and Pole Problems.*

1. The head of a fish is 9 inches long; the tail is as long as the head and half the body, and the body is as long as the head and tail together. How long is the fish?

ANALYSIS: If the tail is as long as the head (9 inches) and ½ the body, the head any tail together are 9 inches and 9 inches and ½ the body; since the body is as long as the head and tail together, the length of the head and tail equals ½ the length of the fish, and 18 inches equals ½ the length of the body or ¼ the length of the fish, 72 inches.

2. The head of a fish is 6 inches long; the tail is as long as ½ the head and ¼ the body, and the body is twice the length of the head and tail together. How long is the fish?

3. A pole stands 6 feet in the water; ⅛ of its length is in the mud, and four times as much is in the air as in the mud and water together. What is the length of the pole?

4. A pole is in four sections; the first is 2 feet long; the second is as long as the first and half the third, and the third is as long as the first and second, while the fourth is as long as the first, second, and third together. How long is the pole?

5. A liberty pole was broken off ⅕ of its length plus 3 feet from the top; the part left standing was found to be 12 feet longer than three times the length of the part broken off. What was the original length of the pole?

_____

254. *Age Problems.*

1. George is 8 years old and his father is 32. How long before George will be one-half the age of his father?

ANALYSIS: If George is 8 years, and the father 32 years, the difference of their ages is 24 years. If George is to be ½ the age of his father, his age will be equal to the difference of their ages, or 24 years. If he is now 8 years, it will be 16 years before he is 24 years old.

2.   One-third of A's age equals three-fourths of B's, and the sum of their ages is 52 years.   How old is each?

3.   Two-thirds of three-fifths of Jones's age is four-fifths of five-sixths of Smith's.   If the difference of their ages is 28 years, how old is each?

4.   John is three times as old as Jack, but in 5 years he will be only twice as old.   What is the age of each?

5.   Twelve years ago Glover was one-fourth the age of his uncle.   Now he is one-half as old.   How old is each?

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255.   *Miscellaneous Problems.*

1.   A, B, and C take luncheon together.   A furnishes 4 loaves, B 3 loaves, and C pays 35 cents for his share.   If all eat equal amounts, how should the money be divided between A and B?

2.   How far can a person ride in an automobile, traveling at the rate of 20 miles an hour, and return on his bicycle at the rate of 10 miles an hour, if he is gone six hours?

3.   A hound is 60 yards behind a fox.   How far will the hound have to run to catch the fox if he runs 10 yards to every 8 of the fox, and one leap of the hound equals two of the fox's?

4.   I sold a bill of goods and gained 20%.   Had they cost me $45 more, I would have lost 10%.   What was the cost of the goods?

5.   A and B meet at a butcher shop and together buy 80 pounds of beef, the price of which is 10 cents per pound.   A takes 50 pounds of the better quality, and agrees to pay one-half cent more per pound than B does for the remainder.   How much shall each one pay?

HOME WORK—No. 11

1.   Give *original* examples, with solutions, illustrating the different steps in *simple analysis*.

2.   Give *original* examples, with complete analyses, showing the different steps in *compound analysis*.

3.   *Originate* a problem in the comparison of *whole* numbers, using not less than five integers.

4.   *Originate* a problem in the comparison of *fractional* numbers, using not less than two fractions and as many whole numbers as necessary.

5.   Refer to Article 249 and then write out a partnership problem in which the *capital* and *time* of each partner are different.

6.   Write a *labor* problem entirely unlike those given in Article 250.

7.   *Originate* a *time* problem, using time *past* noon and time *to* noon similar to those in in Article 251.

8.   *Originate* a *clock* problem, giving in degrees the angle described by the hands of the clock.

9.   *Originate* a *fish and pole* problem.

10.   Write an original *age* problem.

Bills, Invoices, and Statements

256. A **Bill** or **Invoice** is an itemized statement of goods bought or sold. The term *Bill* is also applied to any itemized statement of material furnished, labor performed, or services rendered.

257. The term *Invoice* is usually applied to bills of considerable value, and containing several or many items.

258. A *Bill* should contain the following:

1. The place and date.
2. The name and address of the buyer.
3. The name and address of the seller.
4. The terms of sale.
5. The quantity, price, and extension of each item.
6. The total amount, or footing.

INTEREST CHARGED AT 10 PER CENT. PER ANNUM ON ALL ACCOUNTS AFTER MATURITY

HOOPER & JENNINGS

Importers and Wholesale Grocers

462-464 Bryant Street

San Francisco, Cal., July 20, 1908.

Sold to W. E. GIBSON, Oakland, Cal. TERMS 60 DAYS

20 brls Pillsbury Flour	5	100	—	
10 " Family Corned Beef	12	120	~	
12 " Armour's Pickled Pork	24	288	—	
600 # Best Dairy Cheese	18	108	—	
1000 # Golden Creamery Butter	27	270	—	
400 doz Extra Prime Eggs	22	88	—	974 —

259. Bills may be *receipted* in full, or *credits given* for partial payments.

260. To *Receipt a Bill* is to write upon it an acknowledgment of payment signed by the seller.

TERMS: 30 days   SAN FRANCISCO CAL.,   Feb. 4, 1908.

Bowen & Goldberg

B & G

WHOLESALE GROCERS

Main Office: No. 1732 Market Street

SOLD TO   E. K. ISACCS, Los Angeles, Cal.

SUBJECT TO SIGHT DRAFT WHEN DUE.   INTEREST CHARGED AFTER MATURITY.

	64 # Golden Daisy Butter	32	20	48		
	72 doz. A1 Petaluma Eggs	37	27			
	196 # Sea Foam Lard	17'	33	51		
	240 # Best Eastern Cheese	22	54			
	420 # " California "	18	75	75		
	192 # Kingham Hams	21'	40	80	254	84
	Received Payment					
	Bowen & Goldberg					
	5 0					

CORRECT PROPORTIONS   THOROUGH WORKMANSHIP
PERFECT FINISH   UNION MADE

C. J. HEESEMAN
Makers of Workingmen's Best Garments

FACTORY:
1107-9-11-13 WASHINGTON STREET
PHONE MAIN 678

Sold to   KEEGAN BROS.

TERMS NET 30 DAYS   **Oakland, Cal.,**   March 29, 1908.

45	1	doz.	Com. Suits		9	00	
12	1	''	Plasterers' Overalls		6	50	
31	1	''	White Aprons		6	50	
21	2	''	Coats	9.50	19	00	
20	4	''	Eng. Overalls	9.50	38	00	
42	1	''	Blk. Golf Shirts		6	00	85	00

261. To **Discount a Bill** is to make an allowance from
the list price either to obtain the selling price or to induce the
buyer to pay the bill before it is due.

<div style="text-align:right">Chicago,   May 2, 1908</div>

F. O. GARDINER, Stockton, Cal.

<div style="text-align:center">BOUGHT OF</div>

The Gregg Publishing Company

<div style="text-align:center">1512   W A B A S H   A V E N U E</div>

TERMS CASH. Remittances must be made in
postal or express money order, or in bank draft.
Personal checks upon local banks not received
unless exchange rates are added.

24	Parkinson's Commercial Law	95	22	80			
24	Modern Business Arithmetic	1 05	25	20			
18	New Banking Blanks	40	7	20			
36	Words and Word Exercises	.25	9	00			
12	Universal Dictation (Gregg)	1 20	14	40	78	60
	10% off Net				7	86
					70	74

262. *Several discounts* are some times offered on one bill, the
terms being indicated on the bill head.

<div style="text-align:center">TERMS:
60 ds. net; 30 ds. 5%; 10 ds. 10%</div>

<div style="text-align:right">San Francisco, April 4, '08</div>

<div style="text-align:center">

L. B. LAWSON & CO.

China, Glass, and Earthenware
Chicago, Illinois.

</div>

Sold to   A. P. ARMSTRONG, Portland, Oregon

Nov	12	To 24 sets Chinaware	137	94			
	24	30 Servers	45	—			
	30	12 gross Mason Jars	41	40			
Dec	5	18 Butter Jars	22	50			
	7	12 sets Glass Teas	16	20	263	04
		Paid 12/31/07				
		L. B. Lawson & Co.				

263. A *Statement* is a summary of invoices sold, together with any credits allowed, and showing the balance remaining unpaid.

STATEMENT

San Francisco, ___April 1, 1908___

Zellerbach Paper Company

Battery and Jackson Streets

J. S. Sweet Publishing Co., Santa Rosa Cal.

Sept	12	Mdse per bill rendered		128	40			
	15	" " " "		420	—			
	24	" " " "		245	25			
Oct.	4	" " " "		88	50			
	17	" " " "		17	75	1	899	90
		Cr						
Sept	31	By Mdse returned		72	50			
		N.Y. draft		300	—			
Oct.	21	" "		250	—		622	50
		Balance					277	40

264. A *Credit Memorandum* is given when goods are returned or when a claim against a bill for some cause is allowed.

CREDIT MEMORANDUM

American Type Founders Co.

820 Mission Street,

SAN FRANCISCO, April 13 1908

CREDIT J. S. Sweet Pub. Co., Santa Rosa

Rebate on bill April 1, '08		3	15		

265. To *Extend* the items of a bill is to multiply the price of *one* by the *number* and to write the result in the first money column.

266. *Short Extension* is the placing of several items on the same line, extending only their sum to the money column.

San Francisco,___**Feb. 3, 1908.**___

A. M. CROUSE, Santa Rosa_____

TO SMITH'S CASH STORE DR.

Country Trade Solicited
Satisfaction Guaranteed

Retail Grocers

Jan	3	Starch ^{10} Vinegar ^{20} Durkee ^{30}		6 0		
		Bkg. Pdr. ^{50} Ginger ^{10} Eggs ^{45}		1 0 5		
	5	Butter ^{55} Sugar $^{1.00}$		1 5 5		
	6	Coffee ^{20} Rice ^{25} Tomatoes ^{75}		1 2 0		
		Eggs ^{40} Salmon ^{25} Crab ^{25}		9 0		
	11	Raisins ^{25} Butter ^{55} Flour $^{1.60}$		2 4 0	7 70	

267. *Commercial Signs and Abbreviations:*

Acct., or *%*, account.
@, at or per.
Amt., amount.
Bal., balance.
Bx., *Bxs.*, box, boxes.
Bo't, bought.
$^{B}/_{L}$, bill of lading.
%, in care of.
Co., company.
Ctg., cartage.
Com., commission.
Contra., against.
Exch., exchange.
C. O. D., collect on delivery.
For'd, forward.
Cr., credit, or creditor.
Dr., debit, or debtor.
E. and O. E., errors and omissions excepted.

F. O. B., or *f. o. b.*, free on board.
Mdse., merchandise.
Net., without further discount.
Sunds., sundries.
Rec'd, received.
✳, number.
#, pounds.
¢, cent.
$, dollars.
£, pounds sterling.
%, per cent.
3^1 is read $3\frac{1}{4}$.
3^2 is read $3\frac{1}{2}$.
3^3 is read $3\frac{3}{4}$.
(°), degrees.
('), foot, feet.
("), inch, inches.
Pkg., package.
L. F., ledger folio.

HOME WORK—No. 12

268. Find the cash cost of each of the following bills:

1.

<div style="text-align:right">Oakland, Cal., <u>May 18, 1908.</u></div>

M __KETTERLIN BROS., Santa Rosa, Calif.__

To Mᶜᴋinlay-Perkins Company Dʳ.

MANUFACTURERS AND IMPORTERS OF

**PAINTS, OILS, VARNISHES,
COLORS, ETC.**

SAN FRANCISCO	OAKLAND
707-9-11 Sansome Street	**17th and Campbell Sts.**

1	bbl. Paris White—357 lbs.	.15	
10	gal. XX White—5's	1.00	
300	lbs. MPC Lead—50's	.06^2	
100	'' '' '' —15's	.06	— —?

2.

<div style="text-align:center">*Chicago, Ill.,*   March 15, '08.</div>

HART, SCHAFFNER & MARX
MAKERS OF FINE CLOTHES *FOR MEN*
V a n   B u r e n   a n d   M a r k e t   S t r e e t s

SOLD TO   KEEGAN BROS.,
              Santa Rosa, California

SHIPPED VIA   June 1, '08.
   Milw., via U. P.   **TERMS:** 7% 10 ds., 5% 30 ds.

STOCK NO.

STOCK NO.							
26552	7	Suits	8.50				
26873	5	''	15.00				
32738	5	''	18.00				
30777	5	''	15.50				
29800	1	''		16	00		
27374	5	''	14.00				
26606	1	''		15	50		
27011	8	''	12.00				
26762	8	Pants	3.75				
27049	7	''	3.50				
27073	4	''	3.50			—	—?

3.

American Type Founders Co.

816-820 Mission St., San Francisco

Designer and Maker of
Fashionable Styles in

Date [March, 5, '08.]

J. S. SWEET PUBLISHING CO.,

Santa Rosa, Cal.

T Y P E

World's Largest Seller
Everything for Printers

Shipped_____   *Via* Freight_____   Your Order No. 51260

QUAN-TITY	POINT	DESCRIPTION	TYPE		SUPPLIES		PER CENT DISCOUNT	TOTAL
45#	10	Lin. Ronaldson #551 .60	—	—			list	
5#	10	Quads .45	—	—			"	
1	10	Lin. Ronaldson Slope #2	2	50			"	
1	10	l. c. " "	1	15			"	
1	18	Lin. " Clarendon	3	25			"	
1	12	" " "	2	75			"	
1	8	" " "	2	25			"	
12#	10	Mod. #510 Figures .60	—	—			"	
10#	10	Spaces & Quads .50	—	—			"	
4		Yankee Job Cases .75	—		—	—	10	
1		Quarter Cases			3	00	list	
1		Harris Rule Case			4	65	"	
					—	—		
		Less discount				—		
			—	—	—	—		
		Freight allowance				25		
			—	—	—	—		
		Total						—	

4.

Bought of BAKER & HAMILTON

Reg. No.————   Shipping No.————   **San Francisco,**   Apr. 5, '08

Sold to   KETTERLIN BROS. Santa Rosa

2	Sensible Twine Holders	.20		
3	AAA ¼ Wrenches #15	.45		
¼	doz. Atkin Excel Saw Tools	6.50		
¼	'' Bolts & Nuts—8½ Shears	4.50		
2	Coil Gal. Fence Wire #16	3.65		
1	'' Tarred Lath Yarn—93 lb.	.10¼		
¼	doz. Reload Outfits	2.80		
2	lbs. Brass Pins ¾ - 16	.78		
1	'' '' '' ⅝ -18	.94		————?

Denominate Numbers

271. A **Denominate Number** is a concrete number whose unit is a *measure ;* as, 5 inches, 10 pounds, 20 hours.

272. A **Simple Denominate Number** has but one denomination ; as, 6 yards.

273. A **Compound Denominate Number** contains two or more denominations ; as 6 yards 2 feet 8 inches.

274. A **Measure** is the unit of computation.

275. A **Quantity** is measured by the number of times it contains the unit of measure.

276. The **Classification** of measures is as follows :

1. Value or Money
2. Weight
3. Capacity
4. Extension
5. Time
6. Arcs and Angles

Measures of Value

UNITED STATES MONEY

277. **United States Money** is the legal currency of this country. The system was adopted in 1786, and has been changed several times by acts of congress.

278. The **Unit** of measure is the dollar, and sums of money are spoken of as *dollars* and *cents.* The Eagle and dime are seldom mentioned in business transactions.

TABLE :

10 mills	= 1 cent......$\cancel{c}$, or ct.
10 cents	= 1 dime.....d.
10 dimes	= 1 dollar....$.
10 dollars	= 1 Eagle....E.

NOTE—In business transactions, dollars and cents are used with the decimal point between; as, $17.50.

NOTE—For further discussion of this subject, see page 69.

CANADA MONEY

279. *Canada Money* is the legal currency of Canada, and has about the same values as the United States money. Its *unit* is the dollar.

TABLE :

10 mills = 1 cent, ¢ or ct.
100 cents = 1 dollar, $.

280. The **Silver Coins** are the *fifty cent*, *twenty-five cent*, *twenty cent*, *ten cent*, and *five cent* pieces.

281. The **Copper Coin** is the *cent* piece.

282. There are no Canadian gold coins. The larger denominations consist of paper currency and the gold coins of England and the United States.

ENGLISH MONEY

283. *English or Sterling Money* is the legal currency of Great Britain. Its *unit* is the *pound sterling*.

TABLE :

4 farthings (far.) = 1 penny, d.
12 pence   = 1 shilling, s.
20 shilling   = $\begin{cases} \text{1 pound, £.} \\ \text{1 sovereign, sov.} \end{cases}$

284. The intrinsic value of the *pound* or *sovereign* in United States money is $4.8665.

285. *Sterling* coins are made 925 parts pure gold or silver and 75 parts alloy.

286. The **Gold** coins are the *sovereign* and *half sovereign*.

287. The **Silver** coins are the *crown* (5s), *half crown*, *shilling*, and the *six* and *three penny* pieces.

288. The **Copper** coins are the *penny*, *half penny*, and *farthing*.

FRENCH MONEY

289. *French Money* is the legal currency of France. The *unit* is the *franc*.

TABLE :

10 millimes (m) = 1 centime, ct.
10 centimes   = 1 decime, dc.
10 decimes   = 1 franc, fr.

290. The intrinsic value of the *franc* in United States money is $.193.

291. The **Gold** coins of France are the 100, 40, 20, 10, and 5 *franc* pieces.

292. The **Silver** coins are the 5, 2, and 1 *franc*, and the 50 and 25 *centime* pieces.

293. The **Bronze** coins are the 10, 5, 2, and 1 *centime* pieces.

GERMAN MONEY

294. **German Money** is the legal currency of the German Empire. The *unit* is the *mark*.

TABLE :

100 pfennigs = 1 mark.

295. The intrinsic value of the *mark* in United States money is $.2385.

296. The **Gold** coins of Germany are the 20, 10, and 5 *mark* pieces.

297. The **Silver** coins are the 2 and 1 *mark* pieces, and the 20 *pfennig* piece.

298. The **Nickel** coins are the 10 and 5 *pfennig* pieces.

Measures of Weight

299. **Weight** is the measure of the earth's gravity.

300. The *unit* of weight is the Troy pound as registered at the United States mint. It contains 5760 grains.

301. **Measures of Weight** are of *four* kinds: Troy Weight, Avoirdupois Weight, Apothecaries' Weight, and Diamond Weight.

TROY WEIGHT

302. **Troy Weight** is used in weighing gold, silver, and other precious metals; in philosophical experiments, and is the standard at the United States mint.

TABLE :

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

AVOIRDUPOIS WEIGHT

303. *Avoirdupois Weight* is used in weighing all kinds of merchandise, farm produce, and metals, except the precious metals.

304. Its *unit* is the pound, which contains 7000 Troy grains.

TABLE :

16 sixteenths	= 1 ounce, oz.
16 ounces	= 1 pound, lb.
100 pounds	= 1 hundredweight, cwt.
20 cwt., or 2000 lbs.	= 1 ton, T.

305. The *Long Ton* used in estimating duties on imported goods, and in weighing coal and iron at the mines, contains 2240 avoirdupois pounds.

TABLE :

16 ounces	= 1 pound, lb.
28 pounds	= 1 quarter, qr.
4 quarters	= 1 hundredweight, cwt.
20 cwt. or 2240 lbs.	= 1 ton, T.

OTHER AVOIRDUPOIS MEASURES :

100 pounds of grain	= 1 cental.
100 pounds of fish	= 1 quintal.
100 pounds of nails	= 1 keg.
196 pounds of flour	= 1 barrel.
200 pounds of pork or beef	= 1 barrel.
280 pounds of salt	= 1 barrel.
240 pounds of lime	= 1 barrel.

306. *Gross Weight* is the total weight, including box, barrel, crate or other covering.

307. *Net Weight* is the *gross weight* less the weight of the box, barrel, crate, or other covering.

308. In California nearly all grains, vegetables, fruits, and seeds are bought and sold by the *avoirdupois pound* or *cental*.

309. In many States the *bushel* is the standard of weight in buying and selling such commodities, the weight of a bushel depending upon the law or custom of each State.

310. The following table gives the weight of a bushel in California and about the average weight in other States:

	CAL.	OTHER STATES		CAL.	OTHER STATES
Barley	50 lbs.	48 lbs.	Flaxseed	56 lbs.	56 lbs.
Beans	60 lbs.	60 lbs.	Oats	32 lbs.	32 lbs.
Blue Grass, seed	14 lbs.	14 lbs.	Onions	50 lbs.	57 lbs.
Buckwheat	40 lbs.	48 lbs.	Potatoes	60 lbs.	60 lbs.
Corn, shelled	52 lbs.	56 lbs.	Rye	54 lbs.	56 lbs.
Corn, ears	68 lbs.	68 lbs.	Wheat	60 lbs.	60 lbs.

APOTHECARIES' WEIGHT

311. *Apothecaries' Weight* is used by druggists in weighing dry medicines for filling prescriptions. Most drugs are bought at wholesale by avoirdupois weight.

312. Its **Unit** is the *pound*, containing 5760 troy grains.

TABLE :

20 grains (gr.xx) = 1 scruple, sc., or ℈.
3 scruples (℈iij) = 1 dram, dr., or ℨ.
8 drams (ℨviij) = 1 ounce, oz., or ℥.
12 ounces (℥xij) = 1 pound, lb., or ℔.

313. The *pound*, *ounce*, and *grain* are identical with Troy weight.

NOTE—Physicians usually write prescriptions in Roman notation, using small letters. Thus, 7 ounces is written ℥vij (the final "i" being written "j"); 8 drams, ℨviij; 12 scruples, ℈xij, etc.

314. SIGNS USED IN PRESCRIPTIONS :

℞ = recipe.   P = small part
aa = equal quantities.   P. aeq = equal parts.
ss = half   q. p = as much as you please.
gr. = grain   misce = mix.

DIAMOND WEIGHT

315. *Diamond Weight* is used in weighing diamonds and other precious stones.

TABLE :

2 sixty-fourths = 1 thirty-second of a carat.
2 thirty-seconds = 1 sixteenth of a carat.
2 sixteenths = 1 eighth of a carat.
2 eighths = { 1 fourth of a carat, or
              { 1 carat grain = .792 Troy grains.
4 carat grains = 1 carat = 3.168 Troy grains.

316. The word *carat* is also used to express the proportion of pure gold in a mixture, 24 carats representing pure gold. Thus, *"18 carats fine,"* means that in the mixture there are 18 parts of pure gold and 6 parts alloy, or base metal.

Measures of Capacity

317. *Measures of Capacity* are those used in estimating the contents of a given space.

318. *Measures of capacity* are divided into two classes—liquid measures, and dry measures.

LIQUID MEASURE

319. Liquid measure is used in measuring liquids of all kinds.

TABLE :

```
4 gills (gi.) = 1 pint, pt.
2 pints      = 1 quart, qt.
4 quarts     = 1 gallon, gal.
31½ gallons  = 1 barrel, bbl.
2 barrels    = 1 hogshead, hhd.
```

NOTE—The term BARREL is applied to casks of various sizes which contain 31½ gallons or over. Under 31½ gallons they are called KEGS.

320. The **Unit** of liquid measure is the *gallon*, which contains 231 cubic inches.

NOTE—In estimating the contents of cisterns, reservoirs, etc., 7½ gallons are allowed to each cubic foot.

APOTHECARIES' FLUID MEASURE

321. *Apothecaries' Fluid Measure* is used by druggists in measuring liquids for filling prescriptions.

TABLE :

```
60 minims (♏)  = 1 fluid drachm, f℥.
8 fluid drachms = 1 fluid ounce, f℥.
16 fluid ounces = 1 pint, O.
8 pints         = 1 gallon, cong.
```

NOTE—Cong., abbreviation of the Latin CONGIUS, for gallon; O., for OCTARIUS, is Latin and means ONE-EIGHTH.

NOTE—The MINIM is equivalent to one drop of water. The gallon is the same as in liquid measure, and contains 231 cubic inches.

322. As in Apothecaries' Weight the symbols are written before the numbers to which they refer. Thus, O4 f℥7 is read 4 pints 7 fluid ounces.

DRY MEASURE

323. *Dry Measure* is used in measuring grain, fruits, vegetables, and other dry articles.

324. The *Unit* of dry measure is the *bushel*, which contains 2150.42 cubic inches.

TABLE :

2 pints (pt.) = 1 quart, qt.
8 quarts   = 1 peck, pk.
4 pecks   = 1 bushel, bu.

Note—In some places the DRY GALLON of 4 quarts is used in measuring berries and small fruits. It contains 268.8 cubic inches.

Note—In estimating the contents of bins, boxes, etc., $\frac{4}{5}$ of the number of cubic feet will give the number of bushels, sticken measure, and $\frac{4}{5}$ of this number of bushels will give the number of heaped bushels.

Measures of Extension

325. *Extension* has one or more of the dimensions, *length*, *breadth*, and *thickness*. It may be a *line*, a *surface*, or a *solid*.

326. A *Line* has only *one* dimension—*length*.

1 inch	2 inches
4 inches	
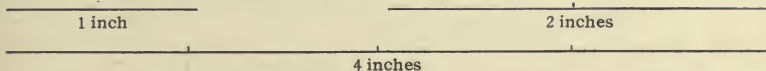
Note—An inch may be divided into halves, quarters, or eighths, or any other fractional part.

327. *Linear Measure* is used in measuring lines and distances. It is also called *long measure*.

LINEAR MEASURE

TABLE :

12 inches (in.) = 1 foot, ft.	40 rods	= 1 furlong.
3 feet = 1 yard, yd.	8 furlongs, or	
$5\frac{1}{2}$ yards, or ⎫ = 1 rod, rd.	320 rods, or ⎬ = 1 mile.	
$16\frac{1}{2}$ feet ⎭	5280 feet ⎭	

328. The *U. S. Standard Unit* of extension is the *yard* of 3 feet, or 36 inches.

SURVEYORS' LINEAR MEASURE

329. *Surveyors' Linear Measure* is used by surveyors in measuring distances on land.

330. The *Unit* is the *chain*, the measure of which is as follows:

1 chain = 4 rods.
1 chain = 22 yards.
1 chain = 66 feet.
1 chain = 100 links.
1 chain = 792 inches.

TABLE:
7.92 inches = 1 link, l.
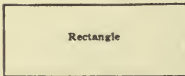25 links = 1 rod, rd.
4 rods = 1 chain, ch.
80 chains = 1 mile, mi.

Therefore, 4 rods = 22 yards = 66 feet = 100 links = 792 inches.

SQUARE MEASURE

331. *Square Measure* is used in computing the areas of plane surfaces.

332. *Surface* has two dimensions, *length and breadth*.

333. *Area* is the number of square units in a given surface.

334. A *Rectangle* is a plane figure bounded by four sides and having four right angles.

335. A *Square* is an equilateral (equal sides) rectangle.

TABLE:
144 square inches = 1 square foot, sq. ft.
9 square feet = 1 square yard, sq. yd.
$30\frac{1}{4}$ square yards = 1 square rod, sq. rd.
160 square rods = 1 acre, A.
640 acres = 1 square mile, sq. mi.
36 square miles = 1 township, Tp.

336. The *area* of a rectangle is found by taking the product of the two dimensions.

Note—In computing the square units in a given surface where the length and breadth are given, the product of these two dimensions equals the number of square units in a row multiplied by the number of rows. Thus, instead of 3 feet, the width, times 5 feet, the length, the analysis is 3 times the five square feet in a row, or 15 square feet.

SURVEYORS' SQUARE MEASURE

337. *Surveyors' Square Measure* is used in computing the area of land.

**338.** The ***Unit*** of land measure is the *acre*.

TABLE :

625 square links	= 1 square rod, sq. rd.
16 square rods, or } 10000 square links }	= 1 square chain, sq. ch.
10 square chains, or } 160 square rods }	= 1 acre, A.
640 acres	= 1 square mile.
36 square miles	= 1 township, Tp.

339. A ***Principal Meridian*** is an imaginary line extending *north* and *south*, from which government surveys are made.

340. A ***Base Line*** is an imaginary line extending *east* and *west*, crossing the meridian at a fixed point.

DIAGRAM :
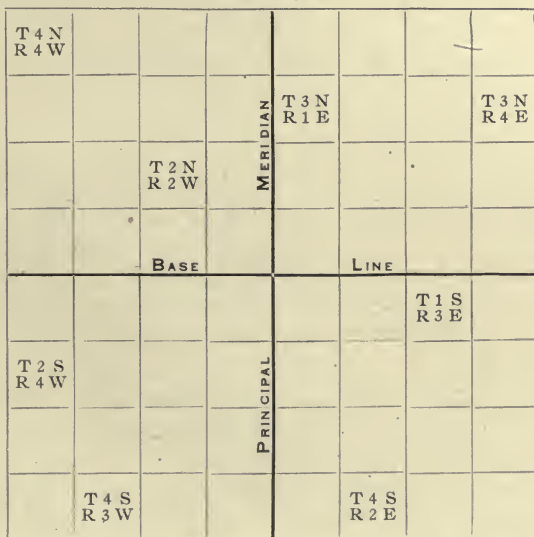
341. Townships are located *north* and *south* of the Base Line by numbers, and *east* and *west* of the Principal Meridian by the number of the range or row.

NOTE—The foregoing are read: Township 4 North, Range 4 West; Township 3 North, Range 1 East; Township 2 North, Range 2 West; etc.
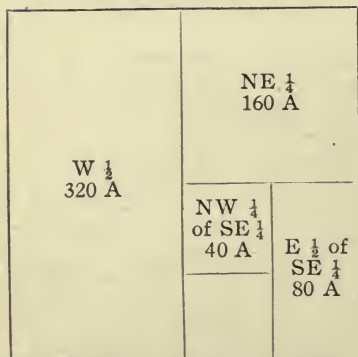
342. In **Regular Surveys,** townships are six miles square and contain 36 square miles. Irregular townships contain different areas.

343. **Regular Townships** are divided into *sections* or square miles which are numbered as follows:

DIAGRAM OF A TOWNSHIP:

NORTH

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

WEST   EAST

SOUTH

DIAGRAM OF A SECTION:

```
+----------+----------------------+
|          |                      |
|          |      NE ¼            |
|          |      160 A           |
|          |                      |
|  W ½     +----------+-----------+
|  320 A   | NW ¼     |           |
|          | of SE ¼  |           |
|          | 40 A     | E ½ of    |
|          |          | SE ¼      |
|          |          | 80 A      |
|          |          |           |
+----------+----------+-----------+
```

344. A **Section** is one mile square and contains 640 acres. Sections may be subdivided into halves and quarters; quarters into quarter-quarters, etc.

In cities and towns, land is described by giving the *number* of the lot, the *number* of the block, and the addition, or the *original* plat of the city as recorded on the official survey.
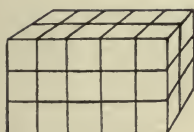
NOTE—The 40 acre portion of the above diagram would be read, "the northwest quarter, of the southeast quarter, of section No. 16.

CUBIC MEASURE

345. ***Cubic Measure*** is used in measuring the contents of solids.

346. A ***Rectangular Solid*** is one bounded by six rectangular surfaces.

347. A ***Cube*** is a *rectangular solid* whose surfaces are equal squares.

348. The ***Volume,*** or solid contents, are found by taking the product of the three dimensions.

TABLE:

1728 cubic inches = 1 cubic foot, cu. ft.
27 cubic feet   = 1 cubic yard, cu. yd.
1 cubic yard   = 1 load.

349. ***Wood Measure*** is used in measuring wood.

TABLE:

16 cubic feet   = 1 cord foot.
8 cord feet or } = 1 cord.
128 cubic feet }

350. Rough stone is sometimes reckoned by the perch, which contains 24¾ cubic feet.

Time Measure

351. ***Time*** is a measured portion of duration.

352. The revolution of the earth upon its axis causes day and night. Its revolution around the sun requires one year of 365 days 5 hours 48 minutes 49.7 seconds.

353. In reckoning time, 365 days are called a common year. This being almost one-fourth of a day less than the exact year, every fourth year is given one more day, and is called *leap year*. As this method is not absolutely accurate, the centennial years are not leap years unless divisible by 400.

354. The **Unit** of time measure is the *day* of 24 hours.

TABLE :

60 seconds	= 1 minute, min.
60 minutes	= 1 hour, hr.
24 hours	= 1 day, da.
7 days	= 1 week, wk.
4 weeks	= 1 lunar month, lu. mo.
365 days	= 1 common year.
366 days	= 1 leap year.
12 months	= 1 year, yr.
100 years	= 1 century, C.

355. The **Months** and **Seasons** of the year are as follows:

MONTH	ABBREVIATED	DAYS	SEASON
January	Jan.	31	
February	Feb.	28	WINTER
February (leap yr.)		29	
March	Mar.	31	
April	Apr.	30	SPRING
May	May	31	
June	June	30	
July	July	31	SUMMER
August	Aug.	31	
September	Sept.	30	
October	Oct.	31	AUTUMN
November	Nov.	30	
December	Dec.	31	WINTER

356. The number of days in each month may be kept in mind by memorizing the following rhyme :

> "Thirty days hath September,
>   April, June, and November ;
> All the rest have thirty-one,
>   Save February, which alone
> Hath twenty-eight, and one day more
>   We add to it one year in four."

NOTE—In business computations, 30 days are usually called a month. In reckoning time, the prevailing custom is to count years and months by dates only, and the extra days as days. Thus, from February 10th to March 31st, the time is 1 month (from February 10th to March 10th) and 21 days (from March 10th to March 31st), instead of 49 days, or 1 month and 19 days.

Circular Measure

357. *Circular* or *Angular Measure* is used in measuring angles, arcs, directions, elevations, etc.

358. The *Unit* is the *degree*, the $\frac{1}{360}$ part of the circumference of a circle.

359. A *Circle* is a plane figure bounded by a curved line, every point of which is the same distance from its center.
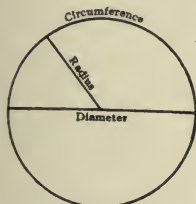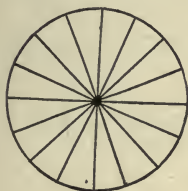
360. The *Circumference* of a circle is the line that bounds it.

361. An *Arc* is a part of a circle.

362. An *Angle* is the divergence of two lines from a common point.

363. A *Right Angle* is formed by lines drawn perpendicular to each other from a common point.

364. A *circle* may be divided into 360 degrees. A *semi-circle* into 180 degrees. A *quadrant* into 90 degrees, etc.

365. A *Diameter* of a circle is a line passing through the center and terminating in its circumference.

366. A *Radius* is one-half a diameter.

367. To measure an arc is to ascertain the number of degrees between the *radii* joined by the arc.

TABLE :

60 seconds ($''$) = 1 minute, ($'$)
60 minutes = 1 degree, ($°$)
30 degrees = 1 sign, (s.)
12 signs ⎫
360 degrees ⎭ = 1 circle, (C.)

368. *One degree* on a meridian or on the equator is equal to about 69.16 common or statute miles.

12 units = 1 dozen, doz.
12 dozen = 1 gross, gro.
12 gross = 1 great gross, G. gro.
20 units = 1 score.

24 sheets = 1 quire, qr.
20 quires = 1 ream, rm.
2 reams   = 1 bundle, bdl.
5 bundles = 1 bale.

A sheet folded into 2 leaves is called a folio.
A sheet folded into 4 leaves is called a quarto.
A sheet folded into 8 leaves is called an octavo.
A sheet folded into 12 leaves is called a 12 mo.
A sheet folded into 16 leaves is called a 16 mo.

Comparison of Weights

369. The *Unit* of Troy weight and of Apothecaries' weight is the *pound* which contains 5760 grains.

370. The *Unit* of Avoirdupois weight is the *pound* which contains 7000 grains.

371. The Troy *ounce* and the Apothecaries' *ounce* each contain $\frac{1}{12}$ of 5760 grains = 480 grains.

372. The Avoirdupois *ounce* contains $\frac{1}{16}$ of 7000 grains = $437\frac{1}{2}$ grains.

1 pound Troy or Apothecaries' weight = 5760 grains.
1 pound Avoirdupois weight   = 7000 grains.
     (Avoirdupois the greater by 1240 grains).

1 ounce Troy or Apothecaries' weight = 480 grains.
1 ounce Avoirdupois weight   = $437\frac{1}{2}$ grains.
  (Troy and Apothecaries' the greater by $42\frac{1}{2}$ grains.)

373. In changing from one kind of weight to another, the quantities must first be reduced to *grains*.

Reduction of Denominate Numbers

374. *Reduction of Denominate Numbers* is the process of changing their denominations without altering their values.

375. *Reduction Ascending* is to reduce the given number to a higher denomination. Thus, 36 pence reduced to shillings = 3 shillings.

376. *Reduction Descending* is to reduce the given number to a lower denomination. Thus, £4 reduced to shillings = 80 shillings.

377. To reduce to a *higher* denomination, divide by the number of units required to make the higher denomination.

378. To reduce to a *lower* denomination, multiply by the number of units of the lower denomination required to make one the higher.

379. *Reduction Ascending*.

EXAMPLE: Reduce 1250 farthings to £.

4 farthings = 1 penny   4) 1 2 5 0 far.
12 d. = 1 s.   12) 3 1 2 d. and 2 far. remainder.
20 s. = £1.   20) 2 6 s. and 0 d. remainder.
        £1   and 6 s. remainder.

Answer, £1 6 s. 0 d. 2 far.

380. *Reduction Descending*.

EXAMPLE: Reduce £3 7 s. 3 d. to farthings.

      20 s. = £1.   804 d.
        3   3 d. added.
      60 s.   807 d.
        7 s. added   4 far. = 1 d.
      67 s.   1628 far., Answer.
      12 d. = 1 s.
      804 d.

ENGLISH MONEY

381.   Solve the following :

1.   Reduce £4 5s. 7d. to pence.
2.   Reduce £14 10s. 9d. 2 far. to farthings.
3.   Reduce 721 pence to higher denominations.
4.   Reduce £47 11d. to farthings.
5.   Reduce 37425 far. to higher denominations.
6.   In ⁵⁄₁₂ of a £ how many pence ?
7.   In .725 of a £ how many farthings ?
8.   Reduce 845.75 pence to £ s. d. and far.

9.   A traveler from England lands in New York with £50 10s. 6d. which he exchanges for U. S. money at intrinsic value. How much does he receive ?

10.   An American traveling in England has $8273.05 changed to English money.   How much did he receive ?

FRENCH AND GERMAN MONEY

382.   Solve the following :

1.   How many francs in 3240 centimes ?
2.   Reduce 42 francs to centimes.
3.   How many dollars U. S. money in 2123 francs ?
4.   How many francs in $2123 U. S. money ?
5.   An Englishman lands in France with £200 and exchanges it for French money.   How much should he receive on the intrinsic basis ?
6.   How many marks in 4280 pfennigs ?
7.   Reduce 75 marks to pfennigs.
8.   How many dollars U. S. money in 260.5 marks ?
9.   How many marks in $2623.50 U. S. money ?

10.   A Frenchman traveling in Germany desired to change his 477 francs for marks.   How many should he receive ?

TROY WEIGHT

383.   Solve the following :

1.   Reduce 5 lbs. 7 oz. to pennyweights.

2. Reduce 3 lbs. 4 oz. 15 pwt. 10 gr. to grains.

3. Reduce 17 lbs. 18 pwt. 22 gr. to gr.

4. Reduce 5760 gr. to ounces.

5. Reduce 8880 pwt. to lbs.

6. Reduce 35179 gr. to higher denominations.

7. What will be the cost of a gold medal weighing 11 pwt. 16 gr. at 5 cents per grain?

8. How many spoons weighing 1¾ oz. each can be made from a bar weighing 5 lbs. 10 oz.?

9. A miner wishing to have a watch case made, sent to the watchmaker 2 oz. 8 pwt. 9 gr. of gold ⁹/₁₀ pure. If the watchmaker charged $17.50 for his labor, and $22.50 for the works, what was the total value of the watch?

10. What is 5 lbs. 10 oz. 15 pwt. 12 gr. of gold dust worth, at 84 cents a pwt.?

AVOIRDUPOIS WEIGHT

384. Solve the following:

1. Reduce 5 cwt. 75 lbs. 12 oz. to ounces.

2. Reduce 2 T. 16 cwt. 48 lbs. to pounds.

3. Reduce 2560 oz. to hundredweights.

4. Reduce 587650 oz. to higher denominations.

5. Reduce 29120 lbs. to long tons.

6. An importer received a shipload of 540 long tons of coal costing $3 per ton, freight 25 cents per ton, and duty 75 cents per ton. If he sell it at $5 per standard ton, what will be his gain?

7. What will be the cost of 7 carloads of wheat, each car containing 20 tons, at $1.15 per cental?

8. In building a house, I used 2 kegs of six penny nails at 3¾ cents per pound, 5 kegs of 8's at 3½ cents per pound, 7½ kegs of spikes at 3¼ cents per pound, and 1½ kegs of shingle nails at 4 cents per pound. What was the total cost of the nails?

9. What is the capacity of the smallest car that will exactly carry either barley, flaxseed, wheat, or oats, whole bushels, Cali-

fornia weights; and how many bushels of each kind would be required for a load?

10. Find the total cost of the barley, flaxseed, wheat, and oats in the above, if the cost of the flaxseed was ⅕ more than the wheat, the cost of the wheat ¼ more than the barley, the cost of the barley ⅓ more than the oats, and the oats was worth 30 cents per bushel.

APOTHECARIES' WEIGHT

385. Solve the following:

1. Reduce 3 lbs ℥8 ℈5 to drams.

2. Reduce 1 lb. ℥7 ℈3 ℈2 gr.15 to grains.

3. Reduce 4245 grains to higher denominations.

4. Reduce 12560 scruples to pounds.

5. How many 2-grain capsules can be made from ℥1 ℈1 ℈1 of quinine.?

6. A druggist made 4200 four-grain capsules of a certain kind of medicine. Allowing one grain for the weight of each shell, what was the total weight?

7. If the above medicine cost $1 an ounce, and retailed for 25 cents per dozen capsules, what would be the gain?

8. Medicine bought for $12 a pound, Apothecaries' weight, is sold for 10 cents a scruple. What would be the gain on 11 pounds?

9. An ounce of medicine will make how many doses, if each dose requires ⅒ of a grain?

10. How many 3-grain pills can be made from 2 lbs. ℥2 ℈2 ℈2 gr.2 of drugs, and what will be the cost at 15 cents a dozen?

Comparison of Weights

386. Solve the following:

1. Reduce 10 lbs. Troy to Avoirdupois pounds.

2. Reduce 10 lbs. Avoirdupois to Troy pounds.

3. Reduce 10 lbs. Avoirdupois to Apothecaries' weight.

4. Reduce 10 lbs. 10 oz. 10 pwt. 10 gr. Troy to Apothecaries' weight.

5. Reduce 17 lbs. 12 oz. Avoirdupois to Troy weight.

6. Which is the heavier and how much, a pound of gold or a pound of feathers?

7. Which is the heavier, an ounce of gold or an ounce of feathers, and how much?

8. A man bought a bar of silver weighing 125 pounds, Avoirdupois weight, for 60 cents an ounce, and sold it for 60 cents an ounce, Troy weight. Did he gain or lose, and how much?

9. A druggist bought 5 pounds of quinine at $12 per pound, avoirdupois weight, and sold it in 2-grain capsules at 10 cents per dozen. What was his profit?

10. A grocer uses an Apothecaries' scales in selling bicarbonate of soda. Out of how much does he cheat his customers in selling a 48-pound box, the selling price being 45 cents per *pound?*

LIQUID MEASURE

387. Solve the following:

1. Reduce 5 gal. 3 qts. 1 pt. to pints.

2. Reduce 3 bbls. 22 gal. 2 qts. 1 gi. to gills.

3. Reduce 4 hhds. 28 gal. 1 pt. to gills.

4. Reduce 2268 pts. to barrels.

5. Reduce 14271 gills to higher denominations.

6. How many barrels in a tank that will hold 1055 gallons 1 quart?

7. How many $1\frac{1}{2}$ pint bottles can be filled from a cask of wine containing 45 gallons?

8. How many pint, quart, and half-gallon bottles of each an equal number can be filled from a cask holding 42 gallons?

9. A grocer bought 5 bbls. of vinegar at $6 a barrel and sold it at 10 cents a quart. What was his gain?

10. A grocer's gal. measure was 1 gi. short of correct measure. How much would he profit in selling a 45 gallon cask of molasses at 62 cents per gallon by using the short measure?

APOTHECARIES' FLUID MEASURE

388.   Solve the following :

1.   Reduce cong.7 O5 f℥12 to fluid drachms.

2.   Reduce O3 f℥6 f℥7 ♏45 to minims.

3.   Reduce cong.18 f℥7 ♏35 to minims.

4.   Reduce ♏43456 to higher denominations.

5.   Reduce f℥16382 to higher denominations.

6.   How many ounce bottles can be filled from a tankard containing cong.11 ?

7.   A druggist fills 124 doz. f℥2 bottles with perfume.   What quantity was required ?

8.   Brown bought 3 gills of a tincture at 25 cents per gill and sold it at 15 cents a fluid drachm.   What did he gain ?

9.   By buying alcohol at $4 per gallon, liquid measure, and selling it at 10 cents a fluid ounce, what would be the gain on five gallons ?

10.   A druggist had 3 ounce, 5 ounce, and 8 ounce bottles, and wished to use twice as many of the 3 ounce as of the 5 ounce, and twice as many of the 5 ounce as of the 8 ounce. How many bottles would be required to hold the contents of 4 barrels each containing 33¾ gallons ?

DRY MEASURE

389.   Solve the following :

1.   Reduce 5 bu. 3 pk. 5 qt. to quarts.

2.   Reduce 17 bu. 1 pk. 3 qt. 1 pt. to pints.

3.   Reduce 17 bu. 7 qt. to pints.

4.   Reduce 128 pints to bushels.

5.   Reduce 57631 pt. to higher denominations.

6.   What will 4 bu. 2 pk. of nuts cost at 8 cents per quart ?

7.   Cranberries bought for $5 per barrel of 2½ bushels are sold at 10 cents per quart.   What is the gain on a barrel ?

8.   If one horse requires 12 quarts of oats per day, how many bushels will it take to feed 6 horses 8 days ?

9.   A grain dealer's bushel measure is too small by 1 pint. What does he make dishonestly in selling 12 tons of wheat at 90 cents a bushel?

10.   A dealer bought 2 bu. 6 qt. of berries at 40 cents a pk., dry measure, and sold them at 10 cents per qt., liquid measure. What did he gain?

LINEAR MEASURE

390.   Solve the following:

1.   Reduce 8 rd. 5 yd. 2 ft. 7 in. to inches.

2.   Reduce 1 mi. 4 ch. 2 rd 20 l. to inches.

3.   Reduce 4 leagues 2 mi. 7 fur. 4 yd. 1 ft. to inches.

4.   Reduce 71364 inches to higher denominations.

5.   Reduce 35824 links to higher denominations.

6.   If it costs $16000 per mile to build a railway, what will be the cost to build 5 fur. 23 rd. 5 yd. 1 ft. 6 in.?

7.   How many linear feet of boards will it take to fence a field 25 rods wide by 40 rods long, the fence to be five boards high?

8.   If a steamer travels 20 miles an hour, how far will she go in 5 days 10 hours and 30 minutes?

9. What will it cost to fence a field 140 rods long, 80 rods wide, at $.37½ per rod for posts, and 3 cents per linear foot for the wire fencing?

10.   An automobile wheel is 100 inches in circumference. How many times will it revolve in going from San Francisco to Los Angeles, a distance of 484 miles?

SQUARE MEASURE

391.   Solve the following:

1.   Reduce 5 sq. yd. 4 sq. ft. 72 sq. in. to square inches.

2.   Reduce 12 A. 48 sq. rd. 21 sq. yd. to square yards.

3.   Reduce 2 A. 64 sq. rd. 140 sq. ft. to square feet.

4.   Reduce 14285 sq. in. to higher denominations.

5.   Reduce 7235 sq. rd. to acres.

6.   What will it cost to lay a walk 8 feet wide around the outside of a block 300 feet square, at 16⅔ cents per square foot?

7.   Find the cost of flooring a room at 5 cents per square foot, the distance around it being 280 feet, and the width ¾ the length.

8.   What will be the cost of plastering the walls and ceiling of a room 40 feet wide by 6o feet long and 16 feet high at 33⅓ cents a square yard, allowing for a 4-foot wainscoting, but no allowance to be made for doors or windows? ·

9.   A city lot containing ⅛ of an acre is sold at $100 per front foot.   If the lot is 90 feet deep, what is the total selling price?

10.   Find the cost of carpeting a lodge room the floor of which is 36 feet wide, and 54 feet long; the carpet to be regular 27 in. tapestry $1.55 per linear yard; strips to run lengthwise the hall, and 9 inches allowed on each strip for matching.

SURVEYORS' SQUARE MEASURE

392.   Solve the following:

1.   How many acres in 4 sections?

2.   Reduce 640 sq. ch. to acres.

3.   Reduce 2 A. 5 sq. ch. 12 sq. rd. to square links.

4.   Reduce 17342 sq. l. to higher denominations.

5.   Reduce 5760 sq. rd. to square chains.

6.   How many acres in a field 23½ chains wide, and 27½ chains long?

7.   Hill owns the S. E. ¼ of the N. W. ¼ of a section of land. How many acres has he?

8.   The E. ½ of the S. W. ¼ of a section of land was bought for $75 per acre and sold at $110 per acre.   How much was gained?

9.   A sold the N. ½ of the S. W. ¼ and the S. ½ of the N. W. ¼ of a section of land at $62.50 per acre.   How much did he get for his land?   Draw diagram and locate the property.

10. What is the cost of a farm bought at $125 an acre and described as follows: The E. ½ of the N. W. ¼ of the S. E. ¼ of the N. E. ¼ of the S. W. ¼ of section 16, Tp. 2 N. Range 3 W.? Draw diagram of section 16, and locate the farm.

CUBIC MEASURE

393. Solve the following:

1. Reduce 17 cu. ft. 132 cu. in. to cubic inches.
2. Reduce 25 cu. yd. 22 cu. ft. to cubic feet.
3. Reduce 12 cords to cubic feet.
4. Reduce 51840 cu. in. to cubic feet.
5. Reduce 18 cd. ft. to cubic inches.
6. What will it cost to dig a cellar 16 feet wide by 24 feet long and 9 feet deep at 60 cents a cubic yard?
7. How many cords in a pile of wood 48 feet long, 6 feet high, and 4 feet wide?
8. What will be the cost of building a wall 132 feet long, 4 feet 6 inches high, and 18 inches wide, at $2.40 a perch?
9. Allowing 7 bricks to the square foot for each tier of bricks, how many bricks will it take to build the sides and one end of a store building 27 feet wide, 120 feet long, the walls being 22 feet high, no allowances for openings or corners, and the walls three bricks thick?
10. A railway tunnel is ¾ of a mile long, 20 feet wide, and 18 feet high. If it cost $1.40 per cubic yard to excavate it, $2.75 per linear yard to timber it, and $28 per rod to lay the track; what was the total cost when finished?

TIME MEASURE

394. Solve the following:

1. Reduce 12 yrs. 7 mos. 15 ds. to days.
2. Reduce 7 wks. 1 da. 12 hrs. 20 min. to minutes.
3. Reduce 1620 hours to higher denominations.
4. Reduce 1342782 seconds to higher denominations.
5. How many minutes in February, 1908?
6. How many more seconds in July than in June?

7. Find the exact time from March 15th to August 23d.

8. How many times will a clock that ticks 3 times in every 2 seconds tick in a day?

9. A note given September 15, 1907, is due April 2, 1910, How long has it to run? Give answer in years, months, and days.

10. A note dated July 1, 1907, is written, "one year after date I promise to pay, etc." If this note is discounted at bank December 21, 1907, what is the term of discount?

CIRCULAR MEASURE

395. Solve the following:

1. Reduce $7° 24' 30''$ to seconds.

2. Reduce $45° 50' 54''$ to seconds.

3. Reduce $21485'$ to higher denominations.

4. Reduce $457864''$ to higher denominations.

5. Reduce $145°$ to statute miles.

6. New York is $74° 3'$ west of Greenwich. How many seconds are they apart.

7. San Francisco is $122° 26' 45''$ west of Greenwich. How many geographic miles is San Francisco from New York?

8. A dial of a clock represents a circle. How many degrees from 12 m. to 8 p. m.?

9. How many statute miles around the earth on its greatest circle?

10. The earth revolves on its axis once every 24 hours. How many degrees, minutes, and seconds will it revolve in 4 hours 24 minutes 30 seconds?

MISCELLANEOUS TABLES

396. Solve the following:

1. What will be the cost of a great gross of lead pencils at 30 cents per dozen?

2. Brown sold 5 gross of penholders at 5 cents each. What did they bring?

3. In a crate containing $\frac{3}{16}$ of a G. gro. of eggs, 1 out of every 18 was broken; the remainder were sold at 25 cents per dozen. What did they bring?

4. A is 2 score years of age; B is as old as A and C, and C is $\frac{1}{2}$ the age of A. What is the age of each?

5. John is 12 years old; James is as old as John, plus $\frac{1}{2}$ of Henry's age, and Henry is as old as John and James together. Find the age of James and Henry.

6. How many sheets of paper in 2 reams?

7. What will 15 reams of 20# 14 x 17 Queen Bee flat paper cost at 9 cents per lb. ?

8. Bought 2 bundles of 16# folio linen typing paper (500 sheets 17 x 22) at 12 cents per lb., and after cutting the same into letter size (fourths), sold it at 60 cents per 500 sheets. What was my gain?

9. How many sheets of paper 28 x 42 will it take to print 1000 16 mo. books of 320 pages each?

10. Ten reams of paper will make how many octavo booklets, reckoning 500 sheets to the ream; and how many pages in each allowing one sheet to each booklet?

HOME WORK—No. 13

1. Which has the greater intrinsic value, £20, 400 marks, or 500 francs, and by how much in U. S. money?

2. Which is the heavier, a 10-pound steel sledge, or a 10-pound sack of silver, and how much?

3. Which is the heavier, a 4-ounce gold watch case or a 4-ounce boxing glove, and how much?

4. How many 10-grain powders can be made from ℔1, ℥vij, ʒiv, ℈ij of drugs?

5. How many pint, quart, and two-quart bottles, of each an equal number, can be filled from a keg containing 10 gal. 2 qts. of cider?

6.   A farm is 60 chains long and 124 rods wide.   How many acres does it contain?

7.   Draw a map and locate Tp. 2 N. and R. 3 E., also locate the N. ½ of the S. W. ¼ of the N. E. ¼ of Section 21.   How many acres?

8.   How many perches of stone in a wall 66 ft. long, 15 ft. high, and 2 ft. 6 in. thick?

9.   How many more seconds in January than in February 1908?

10.   A grocer's scales is ½ oz. short in every pound.   Out of how much does he cheat his customers in selling a 310-pound barrel of sugar worth 6 cents per pound?

Longitude and Time

397. A **Meridian** is any imaginary line extending from pole to pole on the earth's surface.

398. There are three *First Meridians :*

   1. The *Meridian of Greenwich* — the one passing through Greenwich, a suburb of London, England.

   2. The *Meridian of Washington, D. C.* — the one passing through the observatory at Washington.

   3. The *Meridian of Paris* — the one passing through Paris, France.

399. **Longitude** is the distance east or west of a *first meridian*.

400. Using the **Meridian of Greenwich** as the *first meridian*, Washington is $77° 0' 15''$ *west longitude*, and Paris is $2° 20'$ *east longitude*.

401. **Standard Time** in the United States, for convenience, has been established as follows :

1. *Eastern time*, taken when the sun is on the meridian $75°$ west of Greenwich.

2. *Central time*, taken when the sun reaches the meridian of $90°$ west.

3. *Mountain time*, taken when the sun reaches the meridian of $105°$ west.

4. *Pacific time*, taken when the sun reaches the meridian of $120°$ west.

402. It will be noticed that the difference of longitude of the above is $15°$ each. The difference of time is one hour, the same time being used in all territory of $7\frac{1}{2}°$ east and west of each standard meridian.

403. The **Earth** makes one revolution in 24 hours. Its circumference is $360°$. $360° \div 24 = 15°$ the distance passed in 1 hour.

404. If a point on the earth passes $15°$ in 1 hour or 60 minutes, in 1 minute it will pass $\frac{1}{60}$ of $15°$ or $15'$. In 1 minute or 60 seconds it passes $15'$; in 1 second it will pass $\frac{1}{60}$ of $15'$ or $15''$.

405. Another analysis is: If a point on the earth passes $15°$ in 60 minutes, to pass $1°$ would take $\frac{1}{15}$ of 60 minutes or 4 minutes. If it passes $15'$ in 60 seconds, to pass $1'$ would take $\frac{1}{15}$ of 60 seconds or 4 seconds.

406. *To Find the Difference in Time when the Difference in Longitude is Given.*

Divide the difference of longitude by 15, and the result will be the difference in time ; or multiply the difference in longitude by 4, and the result will be minutes and seconds.

EXAMPLE : Find the difference of time between New York and Chicago.

$$\text{Chicago is } 87° \ 27' \ 45'' \text{ west}$$
$$\text{New York is } \underline{74 \quad 3 \quad 0} \text{ west}$$
$$\text{Dif. of Long. } 15)\ \overline{13 \quad 24 \quad 45}$$
$$0 \text{ hr. } 53 \text{ min. } 39 \text{ sec.}$$

Or,   Dif. in Long. $13° \ 24' \ 45''$
$$\underline{\qquad\qquad 4}$$
Dif. in Time 53 min. 39 sec. 0 rem.

407. *To Find the Difference of Longitude when the Difference of Time is Given.*

Multiply the difference in time by 15, and the result will be the difference in longitude ; or divide the difference in time expressed in minutes and seconds by 4, and the result will be the difference in longitude.

EXAMPLE : Find the difference of longitude between Boston and San Francisco, the difference of time being 3 hours 25 minutes 33 seconds.

$$\text{Dif. in Time } 3 \text{ hr. } 25 \text{ min. } 33 \text{ sec.}$$
$$\underline{\qquad\qquad 15}$$
$$\overline{51° \quad 23' \quad 15''} \text{ Dif. in Longitude}$$

Or, 3 hr. 25 min. 33 sec.
Reduce hr. to min. $4)\ \overline{205 \text{ min. } 33 \text{ sec.}}$
$$\overline{51° \quad 23' \quad 15''} \text{ Dif. in Longitude.}$$

408. The following table gives the longitude of some of the principal cities of the world :

Albany	73° 44′ 50″ W.		New Orleans	90° 3′ 0″ W.
Astoria,	124° 0′ 0″ W.		Omaha	95° 56′ 14″ W.
Boston	71° 3′ 30″ W.		Paris	2° 20′ 0″ E.
Berlin	13° 23′ 45″ E.		Philadelphia	75° 9′ 3″ W.
Bombay	72° 54′ 0″ E.		Rome	12° 27′ 0″ E.
Cincinnati	84° 29′ 32″ W.		Rio Janeiro	43° 20′ 0″ W.
Chicago	87° 37′ 45″ W.		San Francisco	122° 26′ 45″ W.
Detroit	83° 3′ 0″ W.		St. Paul	95° 4′ 55″ W.
Honolulu	157° 52′ 0″ W.		St. Louis	90° 15′ 15″ W.
Mexico	99° 5′ 0″ W.		Salt Lake City	111° 53′ 47″ W.
New York	74° 3′ 0″ W.		Washington	77° 0′ 15″ W.

409. In finding the difference of the longitude of two places, subtract if both are east or west longitude; add if one is east and the other west.

410. Solve the following :

1 Find the difference in the time of Boston and Chicago.

2. Between Detroit and Omaha.

3. When it is noon at Washington what time is it in San Francisco?

4. When it is noon at Philadelphia, what time is it at Paris?

5. When it is 6:30 P. M. in Rome, what time is it in San Francisco?

6. In traveling from Chicago west, my watch gained 2 hours 15 minutes 30 seconds. What was my longitude?

7. Since starting on my journey, my watch has lost 1 hour 32 minutes 45 seconds. Which way did I travel and what was the difference of longitude?

8. I started from Salt Lake City at 9:15 A. M., and after traveling two days found my watch had lost 1 hour 49 minutes 37 seconds. What direction had I traveled, and what large city has the same longitude as my destination?

9. What is the difference of time between Bombay and Honolulu?

10. In sailing from San Francisco to Bombay, will a chronometer gain or lose time, and how much?

HOME WORK—No. 14

NOTE—Questions should be answered in writing.

1.   Why multiply by 15 in reducing longitude to time, and why does this number hold good as regards minutes and seconds.

2.   Why add in some instances and subtract in others in finding the difference of longitude between two places ?

3.   What is the longitude and latitude of your home city from London ?   From Washington ?

4.   What is the difference of time between your home city and London ?   Your home city and Washington ?

5.   What is the difference of time between New York and San Francisco ?

6.   In traveling west from Boston, Mass., I find my watch to vary from correct time by 1 hr. 6 min. 17 sec.   What large city has the same longitude as my destination ?

7.   When it is noon in Philadelphia, what time is it at St. Louis, Mo.?

8.   When it is 4 P. M. in St. Paul, what time is it in Washington, D. C. ?

9.   Will a chronometer gain or lose and how much in traveling from Rome to Omaha ?

10.   The great earthquake at San Francisco occurred April 18, 1906, at 5:15 A. M.   Had the news been telegraphed to New York without loss of time at what hour should it have been received ?

Denominate Fractions

411. *Denominate Fractions* may be reduced from one denomination to another by the same operations and principles which apply to denominate numbers.

412. *To Reduce a Denominate Fraction or Decimal to Lower Denominations.*

Multiply by the number of units of the next lower denomination required to make one of the given fraction or decimal. If there be a fractional remainder, treat it in the same manner.

EXAMPLE: Reduce $\frac{5}{6}$ of a £ to lower denominations.

$$£\tfrac{5}{6} \times 20 = 16\tfrac{2}{3}\text{s.}$$
$$\tfrac{2}{3}\text{s.} \times 12 = 8\text{d.}$$
Answer, 16s. 8d.

EXAMPLE: Reduce £.190625 to lower denominations.

£.190625	.8125s.	.75d.
20	12	4
3.812500s.	9.7500d.	3.00 far.

Answer, 3s. 9d. 3 far.

413. Solve the following:

1. Reduce £$\frac{9}{32}$ to lower denominations.

2. Reduce £.31875 to lower denominations.

3. Reduce $\frac{7}{12}$ of a rod to lower denominations.

4. Reduce .245 mi. to lower denominations.

5. Reduce .54375 lbs. Troy to lower denominations.

6. Reduce .365375 T. Avoirdupois to lower denominations.

7. How many acres in .375 of a section?

8. How many gills in $\frac{7}{16}$ of a gallon?

9. A sold $\frac{1}{3}$ of $\frac{4}{5}$ of .75 of a ton of coal for $5. What was the selling price per cwt.

10. How many sq. 1. in .012345 of an acre?

414. *To Reduce a Denominate Fraction or Decimal to a Higher Denomination.*

Divide by the number of units required to make one of the higher denomination.

EXAMPLE :   Reduce ½ minute to days.

$$\frac{1}{2} \times \frac{1}{60} \times \frac{1}{24} = \frac{1}{2880} \text{ days.}$$

EXAMPLE :   Reduce .64 quarts to bushels.

$$.64 \div (8 \times 4) = .02 \text{ bu.}$$

415.   Solve the following :

1.   Reduce ⅔ pt. to gallons.

2.   Reduce ⅞ ft. to yards.

3.   What fraction of a bushel is ⅚ of a quart ?

4.   What fraction of a mile is ⁵⁄₁₂ of a rod ?

5.   What decimal of a ton is 45 lb ?

6.   What decimal of a day is 10.8 minutes ?

7.   What part of a mark is ⅝ pfennig ?

8.   Reduce .33⅓ of a shilling to the fraction of a £.

9.   Three-fourths of a lb. Avoirdupois is what fraction of a bushel of wheat ?

10.   One-third of B's age equals ¾ of A's.   If the sum of their ages is .75 of 52 years, what is the age of each ?

416. *To Reduce a Denominate Number to a Decimal or Fraction of a Higher Denomination.*

Reduce the denominate numbers by dividing the lowest first, and successively the others, annexing the fractional part at each change in denomination.

EXAMPLE :   Reduce 13 hours 30 minutes to the fraction of a day.   To decimal of a day.

FRACTION :

30 min. $\times \frac{1}{60} = \frac{1}{2}$ hr.

13½ hrs. $= \frac{27}{2}$ hrs.

$\frac{27}{2}$ hrs. $\times \frac{1}{24} = \frac{9}{16}$ da. Ans.

DECIMAL :

$$6 0) \overline{30 \text{ min.}}$$
.5 hr.
13.   hr.
$$2 4) \overline{13.5 \text{ hr.}}$$
Ans., .5625 days.

417. Solve the following :

1.   Reduce 2 yd. 2 ft. 6 in. to the fraction of a rod.
2.   Reduce 87 lb. 12 oz. to the decimal of a cwt.
3.   Reduce 2 pk. 5 qt. 1 pt. to the fraction of a bushel.
4.   Reduce 2 sq. ft. 117 sq. in. to the decimal of a sq. yard.
5.   What part of 4 hours is 42 minutes 30 seconds ?
6.   What part of a hhd. is 10 gal. 2 qt. 1 pt. 2 gi. ?
7.   What part of a f℥ are f℥5 ♏36 ?
8.   What decimal part of a cwt. is ⅐ of 22¾ lbs. ?
9.   What decimal part of a circle are 18 deg. 20 min. 15 sec. ?
10. What decimal part of a ream are 12 qr. 18 sheets of paper ?

Addition of Denominate Numbers

418. To **Add** denominate numbers is to unite them into one sum whether simple or compound.

419. *To Add Denominate Numbers.*

Write like denominations in the same columns ; add and reduce each sum to higher denominations when possible.

EXAMPLE :	£	s.	d.	far.	
	4	3	8	2	
	5	9	4	4	
	7	2	0	3	
	8	10	9	2	
	24	24	21	11	sums of each column.
Reduced =	25	5	11	3	Ans.

420. Solve the following :

1.   Add 5 cwt. 46 lb. 12 oz., 12 cwt. 9 lb. 8 oz., 2 cwt. 25 lb., 21 lb. 10 oz.

2.   Add 4 da. 21 hr. 36 min. 10 sec., 14 hr. 24 min. 15 sec., 2 da. 22 min., 3 da. 12 hr. 40 sec.

3.   Add 8 yd. 2 ft., 5 yd. 1 ft. 3 in., 2 ft. 9 in., 3 yd. 2 ft. 6 in., 2 ft. 10 in., 7 yd 1 ft. 8 in.

4.   Add 2⅔ hhd., 36 gal. 3 qt. 1¼ pt., ⅞ gal., 12 qt. ¾ pt., 1 bbl. 3 gal. 3 gi., ⅝ qt. 1 gi.

5.   Add ℔5 ℥7 ℨ3, ℔12 ℥10 ℨ5 ℈2, ℥2 ℨ4 ℈1 gr.15, ℔10 ℥7 gr. 12, ℥6 ℈2½.

Subtraction of Denominate Numbers

421. To **Subtract** denominate numbers is to find their difference.

422. *To Subtract Denominate Numbers.*

Write like denominations in the same columns; subtract as in simple numbers, taking a unit of the next higher denomination when necessary to increase the minuend.

EXAMPLE:	bu.	pk.	qt.	pt.
	4	2	6	0
	1	3	2	1
	2	3	3	1 Ans.

423. Solve the following:

1. From 25 rd. 2 yd. 2 ft. 6 in., take 14 rd. 4 yd. 1 ft. 10 in.

2. From 4⅝ bu. take 3⅘ bu.

3. From 44 cd. 4 cd. ft. 10 cu. ft. take 18 cd. 6 cd. ft. 14 cu. ft.

4. From a cask of cider containing 44 gal., 12 gal. 3 qt. 1 pt. 1 gi. was drawn off. How much remained?

5. A sold from his farm, containing 320 A., two lots of land; the first contained 72 A. 32 sq. rd.; the other 112 A. 4 sq. ch. How much did he have left?

Multiplication of Denominate Numbers

424. *Multiplication* is a short method of making additions of the same number.

425. *To Multiply a Denominate Number.*

Multiply as in simple numbers. Reduce to higher denominations when necessary.

EXAMPLE: Multiply 3 mo. 10 ds. 5 hrs. 20 min. 30 sec. by 5.

	mo.	ds.	hrs.	min.	sec.
	3	10	5	20	30
					5
	15	50	25	100	150 product.
Reduced =	16	21	2	42	30 Ans.

Solve the following:

1. Multiply 32 rd. 1 yd. 2 ft. 5 in. by 10.

2. Multiply 4 bu. 3 pk. 5 qt. by 9.

3. Multiply 2 gal. 2 qt. 1 pt. 3¼ gi. by 64.

4. If an acre of land will produce 35 bu. 3 pk. 6 qt. 1 pt. of grain, how much will a farm of ¼ section produce?

5. What will be the cost of 8 casks of vinegar, each cask containing 42 gal. 3 qt. 1 pt. at 22 cents per gallon?

Division of Denominate Numbers

426. Division is the process of finding one of the equal parts of a number.

427. *To Divide a Denominate Number.*

Divide as in simple numbers.   Reduce remainder to lower denominations when necessary.

Example: Divide 47 bu. 2 pk. 7 qt. 1 pt. by 5.

$$5)\ 47\ bu.\ 2\ pk.\ 7\ qt.\ 1\ pt.$$
$$9\quad\quad 2\quad\quad 1\quad\quad 1\ Answer.$$

(Dividing and reducing each remainder.)

428. Solve the following:

1. Divide 426 A. 123 sq. rd. 25 sq. yd. 7 sq. ft. by 12.

2. Divide £44 8s. 10d. by 8.

3. Divide 320 gal. 3 qt. 1 pt. 3 gi. by 42.

4. How many boxes holding 1 bu. 1 pk. 7 qt. each can be filled from 356 bu. 3 pk. 5 qt. of berries?

5. A township 6 miles square is divided into farms each containing 153 A. 6 sq. ch. How many farms were there?

Areas or Surfaces

429. A *Straight Line* is one whose points all lie in the same direction.
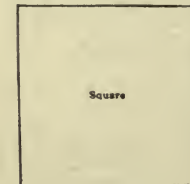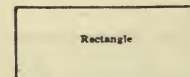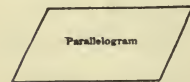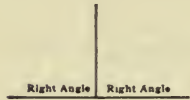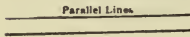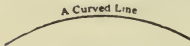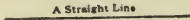
A Straight Line

NOTE—A straight line is the shortest distance between two points.

A Curved Line

430. A *Curved Line* is one that changes its direction at every point.

Parallel Lines

431. *Parallel Lines* are equidistant in their entire length.

432. An *Angle* is the divergence of two lines from a common point.

Right Angle | Right Angle

433. A *Right Angle* is formed where one straight line meets another straight line making two equal angles.

Acute Angle

434. An *Acute Angle* is less than a right angle.

Obtuse Angle

435. An *Obtuse Angle* is greater than a right angle.

Quadrilateral

436. A *Quadrilateral* is a plain figure having four sides and four angles.

437. A *Parallelogram* is a *quadrilateral* whose opposite sides are parallel.

Parallelogram

438. A *Rectangle* is a right-angled *parallelogram*.

439. A *Square* is an equilateral *rectangle*.

Rectangle

440. A *Trapezoid* is a *quadrilateral* having only two sides parallel.

441. A *Trapezium* is a *quadrilateral* whose opposite sides are not parallel.

Square

Trapezoid

Trapezium
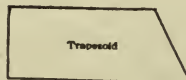
442. A **Triangle** is a plane figure having three sides and three angles.

443. An **Isosceles Triangle** is one having two equal sides and two equal angles.

444. An **Acute-Angled Triangle** is one all of whose angles are acute.

445. An **Obtuse-Angled Triangle** is one having one obtuse angle.

446. The **Base** of a figure is the side upon which it is supposed to rest.

447. The **Altitude** is the perpendicular distance between the base line and the highest point opposite.

448. The **Hypothenuse** of a right-angled triangle is the side opposite the right angle.

449. The **Diagonal** of a quadrilateral is a line connecting two opposite angles.
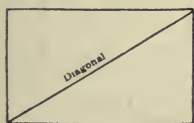
450. A **Rhomboid** is an oblique-angled parallelogram.

451. A **Rhombus** is an equilateral rhomboid.
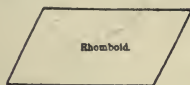
452. A **Polygon** is a plane figure bounded by straight lines.

Note—Polygons are named from their number of sides. Thus, one of five sides is called a PENTAGON; of six sides, a HEXAGON; of seven, a HEPTAGON; of eight, an OCTAGON; etc.

453. The **Perimeter** of a polygon is the total length of its boundary lines.

Pentagon. Hexagon. Heptagon. Octagon. Nonagon. Decagon.

Surface Measure

454. A *Surface* has two dimensions, length and breadth.

NOTE—A square inch is a rectangular surface whose length and breadth are each ONE inch.

455. The *Area* of a surface is the number of square units within its perimeter.

NOTE—Thus a rectangle 3 inches wide and 5 inches long has three rows of square inches with four square inches in a row, or 15 square inches in all.

456. *To Find the Area of a Rectangle.*

Multiply the length by the breadth expressed in the same linear units.

457. Solve the following and draw diagram for each :

1.   Find the area of a garden 15½ rods long by 7½ rods wide.

2.   A floor is 42 ft. 6 in. long by 20 ft. wide. What is the area ?

3.   Ten windows are each 9 ft. by 3 ft. 4 in.   What is their entire area in square yards ?

4.   A walk extends around the outside of a court 20 yds. wide by 80 ft. long.   If the walk is 3 yds. wide, what is its area ?

5.   What is the area in square yards of a tennis court 10 rods long by 60 feet wide ?

458. *To Find the Area of a Triangle.*

Multiply the base by one-half the altitude ; or, multiply the altitude by one-half the base.

NOTE—Every rectangle may be divided into two equal triagles ; therefore the area of a triangle is one-half the area of its rectangle.

459. Solve the following and draw diagram for each :

1.   Find the area of a triangle whose base is 12 ft. and whose altitude is 17 ft.

2.   What is the area of a triangle whose base is 25 ft. and whose altitude is 32 ft ?

3. The gable of a house is 20 ft. wide and 8 ft. high. How many square feet?

4. A triangular field is 15 chains on one side and the perpendicular distance from the opposite angle is 15 rods. How many acres in the field?

5. At $90 per acre, what will be the cost of a farm bounded as follows: Starting at a certain point and measuring 73.54 ch. north, thence 44.82 ch. west, thence southeasterly in a direct line to the starting point?

460. *To Find the Area of any Parallelogram.*

Multiply its base by its altitude.

NOTE—Since any quadrilateral may be divided by its DIAGONAL into two triangles, the sum of the areas of those triangles will be the area of the quadrilateral.

461. Solve the following and draw diagram for each:

1. Find the area of an oblique angled parallelogram whose base is 21 ft. and whose altitude is 16 ft.

2. Find the area of a trapezoid whose opposite sides are respectively 18 ft. and 24 ft., and whose altitude is 7 ft.

3. One side of a field is 64 chains long, the opposite and parallel side is 36 chains long, and the nearest distance between these sides is 25 chains. How many acres in the field?

4. The diagonal of a trapezium is 44 feet. The perpendicular distances from this diagonal to the angles opposite are 17 ft. and 14 ft. What is its area?

5. From a California Redwood tree a plank 72 ft. long, 72 in. wide at one end and 54 in. wide at the other is sawed. How many square feet in its surface?

462. *To Find the Area of a Circle.*

Multiply the circumference by one-fourth the diameter; or, square the diameter and multiply by .7854; or, square the radius and multiply by 3.1416.

NOTE—In mathematics, a circle is considered to be composed of an infinite number of triangles with their vertices at the center, and the circumference the total sum of their bases. One-fourth the diameter equals one-half the altitude of the triangles. The circumference is always 3.1416 times the length of the diameter.

463. Solve the following:

1. Find the area of a circle whose circumference is 314.16 ft. and whose diameter is 100 ft.

2. How many sq. yds. in a circle 60 ft. in diameter?

3. The circumference of a circle is 636.174 ft. What is its area?

4. How many acres in a circular field surrounded by a race course 1 mile long?
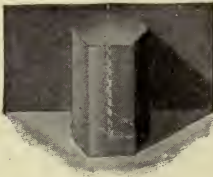
5. A plaza 400 ft. in diameter is surrounded by a walk 20 ft. wide. How many square feet in the walk?

464. To Find the Lateral Area of a Prism or Cylinder.

Multiply the perimeter of the base by the length.
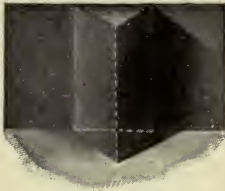
465. To Find the Lateral Area of a Pyramid or Cone.

Multiply the perimeter of its base by one-half its slant height.

466. To Find the Lateral Area of a Frustum of a Pyramid or Cone.

Multiply one-half the sum of the perimeter of both bases by the slant height.
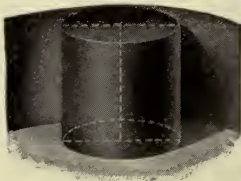
467. To Find the Area of a Sphere.

Multiply the diameter by the circumference; or, square the diameter and multiply by 3.1416.

468. Solve the following and draw diagram for each:

1. What is the total area, including base, of a pyramid 12 ft. square and 20 ft. slant height?

2. Find the lateral surface of a frustum of a cone whose lower base is 10 in., and whose upper base is 4 in. in diameter, the slant height being 24 inches.

3. How many square feet in a length of stove pipe 24 inches long and 6 inches in diameter?

4. A sphere 15 inches in diameter requires how many square inches of gold leaf to cover it?

5. A State capitol has a dome 60 feet in diameter. What would be the cost to gild it at $2.50 per square foot if it is a perfect hemisphere?

Volumes or Solids

469. A **Solid** or **Volume** is anything that has length, breadth, and thickness.

470. A **Rectangular Solid** is one whose lateral surfaces are rectangles.

471. A **Cube** is a rectangular solid whose surfaces are equal squares.

472. A **Prism** is a volume whose upper and lower bases are equal polygons and whose sides are quadrilaterals.

473. A **Cylinder** is a volume whose upper and lower bases are equal circles and whose lateral surface is curved.

CUBIC INCH

474. The **Altitude** of a solid is the perpendicular distance from its highest point to its base.
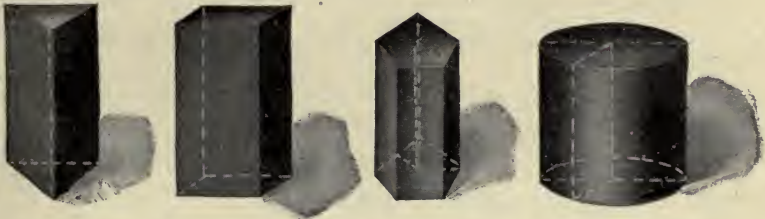
Triangular Prism   Rectangular Prism   Pentangular Prism   Cylinder

475. The **Unit of Measure** for solids is the *cube*, the edge of which is a unit of some known length.

476. A **Frustum** of a pyramid or cone is that part of the solid between the lower base and any other plane parallel to the base.
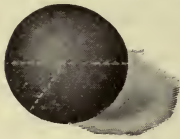
477. A **Sphere** is a volume bounded by a curved surface every point of which is equidistant from the center.

478. A **Pyramid** is a volume having a polygon for its base and its sides triangles meeting at a point called the *vertex*.
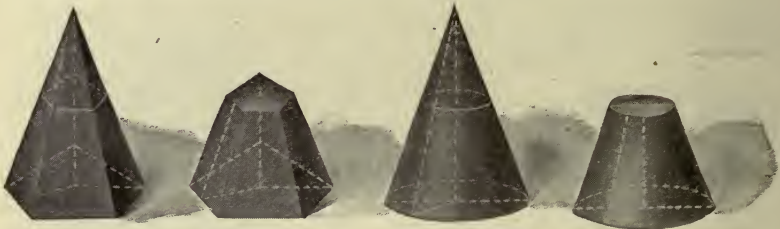
| Pyramid | Frustum of a Pyramid | Cone | Frustum of a Cone |

479. A **Cone** is a volume having a circle for its base and tapering uniformly to a point called the *vertex*.

480. *To Find the Contents of a Rectangular Solid.*

The product of the length, breadth, and thickness expressed in the same denominations will give the number of cubic units.

481. Solve the following :

1. What are the solid contents of a block of granite 8 ft. long, 3 ft. wide, and 2 ft. thick?

2. Find the solid contents of a cube whose length is 33 inches.

3. What are the solid contents of a cube whose superficial area is 726 square inches?

4. A watering trough is 11 ft. long, 21 in. wide, and 18 in. deep. How many gallons will it hold?

5. Reckoning a cubic foot equal to $\frac{4}{5}$ bushels, how many bushels of wheat will a bin 12 ft. long, 8 ft. wide, and 5 ft. deep hold?

481. *To Find the Volume of a Prism or Cylinder.*
Multiply the area of the base by the altitude.

482. Solve the following :

1. A column of stone is 2 ft. 6 in. square and 16 ft. high. What are its solid contents?

2. What is the volume of a shaft 12 ft. by 15 ft. and 90 ft. high, and what would it cost at $.31½ per cubic ft. to erect it?

3. A mining shaft was 300 ft. deep and 6 ft. square. What was the cost of excavating and timbering, excavations costing $3.50 per cu. yd., and timbering 45 cents per sq. ft. of lateral area?

4. A triangular prism is 25 in. high; its base is right angled, 4 in. by 3 in. by 5 in. What are its contents?

5. What are the solid contents of a hollow cylinder 4 ft. long and 20 inches in diameter, the hollow being 10 inches in diameter?

483. *To Find the Volume of a Pyramid or Cone.*
Multiply the area of the base by ⅓ the altitude.

484. Solve the following :

1. What are the solid contents of a pyramid 5 ft. square at the base and 9 ft. high?

2. What are the solid contents of a rectangular pyramid the base of which is 20 ft. by 30 ft. and whose altitude is 104 ft. ?

3. Find the volume of a cone whose base is 24 ft. in diameter and whose height is 60 ft.

4. A pyramid 75 ft. high and 20 ft. square at the base is cut off 25 ft. from the top. What are the solid contents of the remaining frustum?

5. Reckoning 144 cu. in. to a board foot, how many board feet of timber in a telegraph pole 8 in. square at the base, 4 in. square at the top and 30 ft. high?

485.   *To Find the Volume of a Sphere.*

Multiply its superficial area by ⅓ its radius ; or, multiply the cube of its diameter by .5236.

1.   Find the solid contents of a solid shot 4 in. in diameter.

2.   What are the contents of a sphere whose diameter is 10 feet ?

3.   An orange is 15.708 in. in circumference.   How many cu. in. in its contents ?

4.   The earth is 8000 miles in diameter.   How many cubic miles in its solid contents ?

5.   A spherical cannon shell is 9 in. in diameter and 1 in. thick.   How many cubic inches of solid metal in it ?

HOME WORK—No. 15

1.   How many acres in a rectangular farm 72 rods wide by 72 chains long ?

2.   A park is in the form of a rightangled triangle, the base being 40 rods and the altitude 30 rods.   How many acres ?

3.   A piece of cardboard is cut so that its opposite sides are parallel.   Their lengths are 21 in. and 25 in., and the perpendicular distance between them is 15 in.   What is its area ?

4.   How many square yards in a circular garden 200 feet in diameter ?

5.   Find the number of square feet of radiation of a 2-inch steam pipe 32 feet long.

6.   How many cubic feet in a column of granite, 5 ft. square and 24 ft. high ?

7.   A cistern is 4 ft. by 5 ft. 6 in., and 6 ft. deep.   How many gallons of water will it hold ?

8.   How many feet of lumber in a 40-foot telegraph pole 10 in. square at the bottom, and 4 in. by 10 in. at the top ?

9.   A liberty pole is 150 ft. high, 12 in. in diameter at the base, and tapers to a point.   What is its weight at 30 lbs. per cubic foot ?

10.   What is the weight of a leaden casket 12 in. long, 6 in. wide, and 4 in. thick, the lead on all six sides 1 in. thick and weighing 1 lb. to every 3 cubic inches ?

Relation of Measurements

486. *Similar Lines, Areas,* and *Volumes* have relation according to the following principles :

Note—For full discussion of the subject of proportion see page 148.

PRIN. I. *Corresponding lines of similar figures are in pro-portion.*

EXAMPLE : What is the width of a rectangle 42 feet long if a similar one is 5 feet by 14 feet ?

> Length : Breadth :: Length : Breadth
> 42 ft.   : ( ) ft. :: 14 ft.   : 5 ft.

42 times 5 divided by 14 equals 15, No. ft. in width.

PRIN. II. *Similar areas are in proportion as the squares of their like dimensions.*

Note—The square of a number is its product when used twice as a factor. As, 3 times 3 equals 9.

EXAMPLE : If a rectangle whose base is 18 feet contains 162 square feet, what will be the area of a similar rectangle whose base is 12 feet ?

> Area   : (Base)^2 :: Area : (Base)^2
> 162 sq. ft. : $(18)^2$ :: ( ) : $(12)^2$

162 times $(12)^2$ divided by $(18)^2$ equals 72, No. sq. ft. in area.

PRIN. III. *Similar volumes are in proportion as the cubes of their like dimensions.*

Note—The cube of a number is its product when used three times as a factor. As, 3 times 3 times 3 equals 27.

EXAMPLE : If a rectangular solid 6 inches long contains 60 cubic inches, what will be the contents of a similar volume 12 inches in length ?

> Volume   : (Length)^3 :: Volume : (Length)^3
> 60 cu. in. : $(6)^3$ :: ( )   : $(12)^3$

60 times $(12)^3$ divided by $(6)^3$ equals 480, No. cu. in. in volume.

PRACTICAL PROBLEMS

1. If a block of granite 4 ft. thick weighs 2 tons, what will a similar one 8 ft. thick weigh?

2. If the diagonal of a rectangular garden whose area is 12 sq. rd. is 82 ft. 6 in., what is the area of a similar one whose diagonal is 15 rds. ?

3. If a leaden shot 2 in. in diameter weighs 2 lbs., what should be the weight of one 4 in. in diameter?

4. If a reservoir can be emptied by a 3 in. pipe in 12 hours, how long will it take a 4 in. pipe to empty it?

5. If a man 5 ft. tall weighs 150 lbs., what will be the weight of one of similar build who is 6 ft. tall ?

Practical Measurements

Plastering, Painting, Papering, Carpeting, Etc.

487. Plastering is computed by the square yard; painting by the square yard, or by the *square* of 1000 square feet; paving by the square yard, or square foot; carpeting by the square yard, or by the lineal yard, and papering by the roll, which is usually 8 yards long and 18 inches wide.

488. In computing the cost of materials, make allowances for openings, but in computing the cost of labor, make no such allowances, except when called for in the contract.
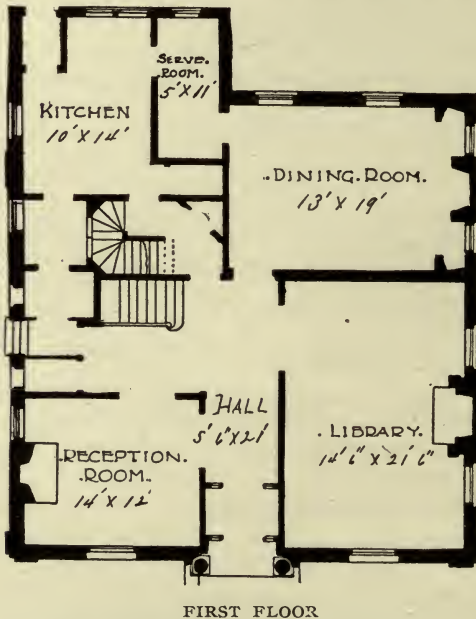
FIRST FLOOR

EXPLANATION: This diagram represents the plan of the first floor of a house whose extreme outside measurements are 36 feet by 42 feet.

ROOMS: The dimensions of the rooms are given on the diagram; the height from floor to ceilings is 12 feet.

OPENINGS: The openings will average two square yards each, except the archways between the hall and reception room and between the hall and library, which are four square yards each.

SECOND STORY: The dimensions of the four rooms of the second story are given on the diagram for the second floor plan. The height from floor to ceilings on this floor is 10 feet.

489. Solve the following:

1. Find the cost of plastering the reception room in the foregoing diagram, walls and ceiling, at 30 cents a sq. yd., deducting one-half the area of the openings.

2. Find the cost of plastering the library walls and ceilings, at 30 cents a sq. yd., deducting one-half the area of the openings, and allowing for 3-foot wainscoting.

3. Find the cost of plastering and paneling the dining-room, the paneling to be 7 ft. high and to cost 12½ cents per sq. ft., the top of the walls and the ceiling to be plastered and stuccoed at 50 cents per sq. yd., allowing a reduction of one-half of area of openings, all in the paneling.
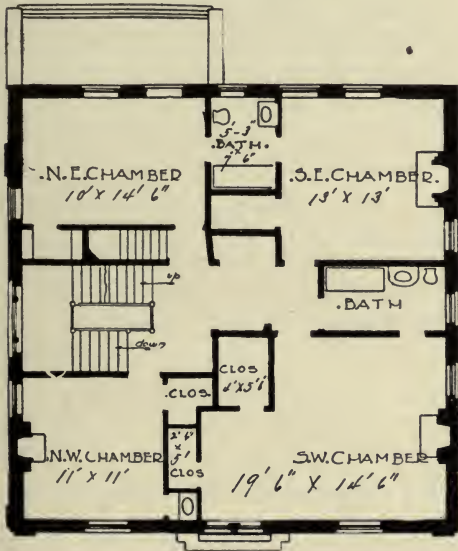
SECOND FLOOR

4. Find the cost of hardfinishing the kitchen and serving room at 40 cents per sq. yd., and providing for a four foot tile wainscoting, costing 25¢ per sq. ft., no allowances for openings in plastering, but 100 sq. ft. allowed for openings in tiling.

5. Find the cost of plastering the four chambers of the second story at 35 cents per sq. yd., deducting one-half of the area of the openings.

6. Find the cost of flooring the second story of this building (35 ft. x 35 ft.) with Oregon pine costing $42 per M., allowing one-fourth for matching and waste, and no deductions made for walls.

7.. Find the cost of flooring with eastern oak at 15 cents per sq. ft., actual measurement, of reception room, library, dining-room, and hall (200 sq. ft).

8. Find the cost of tinting library and reception room at 15 cents per sq. yd., allowing for wainscoting in library and 12 in. base-boards in reception room.

9.   What will be the cost of papering the walls and ceilings of the four chambers with wall paper costing 55 cents per roll and the ceiling paper 35 cents per roll, no allowance to be made for openings?

10.   What will be the entire cost of carpeting the house as follows: Reception room rug, 9 x 12 , costing $2.25 per sq. yd.; library rug, 12 x 18, costing $2.50 per sq. yd.; dining-room rug, 11 x 16 , costing $1.80 per sq. yd.; kitchen linoleum, covering entire floor, costing $1.50 per sq. yd.; four hall rugs, costing $7.50 each; 34 yards stair and hall carpet, costing $1.50 per yd.; carpet for all four chambers, covering entire floors, 27 in. wide, strips to run longest way of the room, and costing $1.20 per lineal yard?   No allowance to be made for waste.

Brick, Stone, Concrete, and Excavations

490.   *Brick Work* is estimated by the number of bricks required to build the walls.   If the wall is only one brick or four inches thick, seven common sized brick are required for each square foot of superficial area, fourteen bricks are required if two bricks thick; twenty-one, if three bricks thick, etc.

491.   *Stone* is estimated by the *perch* which is 16½ feet long 18 inches wide, and 1 foot thick, containing 24¾ cubic feet..   *Cut stone* is sometimes estimated by the surface square foot.

492.   *Concrete* pavements are estimated by the square foot; solid walls by the cubic foot, or by the perch.

493.   When *material* alone is to be estimated, allow for all corners and openings.   When *labor* alone is to be estimated, make no allowances unless by special contract.   When a general estimate on *material and labor* together is to be made, use exterior measurements and allow one-half for openings.

PRACTICAL PROBLEMS

494.   Solve the following:

1.   What will be the cost of a 6-foot concrete sidewalk across the front of a 50-ft. lot, at 17 cents per sq. ft.?

2. What will be the cost of a concrete foundation 24 in. wide across the base, 12 in. across the top, and 18 in. deep, for a house 36 ft. square, at 12½ cents per cu. ft. ?

NOTE—Estimate the length of wall to be the same as the perimeter of the building, 144 feet.

3. How many common bricks in a 13-in. fire wall 92 ft. long and 30 ft. high ?

4. What will be the cost of building a brick smoke-house 12 ft. square and 8 ft. high, the walls to be two bricks thick ? No allowances ; material and labor to cost $24.50 per M. ?

5. What will be the cost of the basement walls to rest on the concrete foundation in problem No. 2 above, walls to be three bricks thick, 5 ft. high, and 36 ft by 36 ft. full size of the building ; the brick to cost $15 per M. ; allowance made for corners, also 7 openings 3ft. by 4 ft. ; the labor to cost $5 per M. with no allowances ?

6. Find the cost of excavating a cellar, 18 ft. by 36 ft. and 6 ft. deep, at 60 cents per cu. yd.

7. Find the cost of building the four walls to the above cellar, walls to be 12 in. thick, at $2.25 per perch.

8. At 17 cents per sq. ft. for concrete floor, and 30 cents per sq. yd. for cement walls, what would be the cost of finishing the above cellar ?

9. Find the cost of digging and walling the cellar of a house whose length is 41 ft. 3. in. and whose width is 33 ft.; the cellar to be 8 ft. deep, and the wall 1½ft. thick. The excavating will cost $.50 a load, and the stone and mason work $3.75 a perch.

10. How many common bricks will it take to build the four exterior walls of a house 36 ft. by. 36 ft.; the walls to be 20 ft. high and 3 brick thick, allowing for 28 openings averaging 3 ft. by 7 ft., also for the four corners ; and what would be the total cost at $18 per thousand bricks ?

Wood and Lumber

495.   A *Cord* of wood is 8 ft. long, 4 ft. wide, 4 ft. high, and contains 128 cu ft.

496.   *Lumber* is measured by the *board foot* which is 12 in. square and 1 in. thick.

497.   Lumber less than 1 in. thick is estimated as though an inch in thickness.   If more than 1 in. thick, a proportionate increase is estimated.

498. *To Find the Number of Board Feet in any Piece of Lumber.*

Multiply the length in feet by the width and thickness in inches and divide by 12.

PRACTICAL PROBLEMS

499.   Solve the following:

1.   Find the number of cords of wood in a pile 4 ft. wide, 6 ft. high, and 24 ft. long.

2.   How many cords of wood in a pile 48 ft. long on the ground, 36 ft. on the top, 4 ft wide, and 6 ft. high?

3.   How many feet of lumber in a board 16 ft. long, 10 in. wide, and 1 in. thick?

4.   How many feet of lumber in 60 boards 14 ft. long, 8 in. wide, and 1 in. thick?

5.   Find the contents of a board 18 ft. long, 20 in. wide at one end and 14 in. at the other, and 1 in. thick.

6.   Find the cost of 180 planks 24 ft. long, 14 in. wide, and 3 in. thick, at $27 per M.

7.   Find the cost of flooring a two-story house, 36 ft. by 36 ft., at $30 per M., the flooring to be 1¼ in. thick, allowing ¼ for matching and waste.

8.   Find the cost of the following bill of lumber :

120 pcs.	15 ft. by 10 in.	@ $21 per M.
240 "	14 ft. " 12 in.	" 22 "
64 "	18 ft. " 2x4 in.	" 18 "
88 "	12 ft. " 2x12 in.	" 20 "
160 "	18 ft. " 2x6 in.	" 20 "

9.   A field 16 ch. long by 8 ch. wide is enclosed by a board fence 5 boards high ; the boards are 16 ft. long and 6 in. wide, supported by posts every 8 feet. The lumber for fencing cost $20 per M., and the posts $10 per C. What was the cost of lumber and posts to fence the field?

10.   How many shingles will it take to shingle a roof 60 ft. long, the girt from eaves to eaves over the ridge of the roof being 48 ft. ; the shingles laid 4 in. to the weather, and the eave rows doubled..

NOTE—A shingle is 4 inches wide or 3 to the lineal foot.

Capacity of Bins, Cisterns, Etc.

500.   To find the **_Exact Contents_** of a bin in bushels, reduce the contents to cubic inches and divide by 2150.42, the number of cubic inches in a bushel.

501.   To find the **_Approximate Contents_** of a bin in bushels, reduce the contents to cubic feet and take ⅘ (or .8) of the result for _stricken measure_. For _heaped measure_, take ⅘ of the number of bushels of stricken measure, or .64 of the number of cubic feet.

NOTE—Corn in the ear, potatoes, roots, and coarse articles are usually measured by heaped measure; grains and fine articles by stricken measure.

502.   To find the **_Exact Capacity_** of a tank or cistern in gallons, reduce the contents to cubic inches and divide by 231, the number of cubic inches in a gallon.

503.   To find the **_Approximate Contents_** of a tank or cistern in gallons, reduce the contents to cubic feet and multiply by 7½, the number of gallons in a cubic foot.

PRACTICAL PROBLEMS

504. Solve the following:

1. Find the exact number of bushels in a bin 8 ft. 4 in. long, 6 ft. 8 in. wide, and 4 ft. 2 in. deep.

2. Find the approximate contents of a bin 24 ft. long, 18 ft. wide, and 10 ft. deep.

3. What must be the depth of a bin that is 6 ft. 4 in. long by 4 ft. 6 in. wide, that will hold 72⅕ bushels, approximate measure?

4. What is the length of a wagon box 3 ft. 4 in. wide, and 18 in. deep that will hold 32⅘ bu. of corn in the ear, heaped measure.

5. A corn crib 75 ft. long, 10 ft. wide, and 10 ft. deep, is filled with corn in the ear. What should it bring at 60 cents per bushel, if 2 bushels of corn in the ear are equal to one bushel of shelled corn?

6. What is the exact contents in gallons of a tank 4 ft. square and 5 ft. 3 in. deep?

7. Find the number of barrels a cistern 6 ft. square and 8 ft. deep will hold, exact measure.

8. Find the approximate number of gallons in a watering trough 12 ft. long, 24 in. wide, and 18 in. deep.

9. How many barrels will a circular cistern 7 ft. 6 in. deep and 6 ft. in diameter hold, approximate measure?

10. What must be the depth of a reservoir that will hold 3,000,000 gallons of water, its length being 200 ft. and its width 100 ft. ?

Ratio and Proportion

Ratio

505. *Ratio* is the relation between two numbers.

506. The *Terms* of a ratio are the numbers compared.

507. The *Antecedent* is the first term, the dividend.

508. The *Consequent* is the second term, the divisor.

509. The *Sign* is the colon (:) and is read "*is to.*"

510. The *Value* of a ratio is the *quotient* obtained by dividing the *antecedent* by the *consequent*. Thus, the ratio of 18 to 3 is 6, or 18 : 3 = 6.

511. A *Simple Ratio* is the ratio between two numbers only; as 14 : 7.

512. A *Compound Ratio* is the ratio of two sets or groups of simple ratios whose products must be taken. Thus,

$$\left.\begin{array}{c} 6 : 2 \\ 10 : 5 \end{array}\right\} = 60 : 10 = 6, \text{ value of the compound ratio.}$$

513. Solve the following :

1. What is the ratio of 42 to 7 ? Of 96 to 12 ?

2. The antecedent is 324; the consequent 9. What is the ratio?

3. The antecedent is 5; the consequent is 45. What is the ratio?

4. The antecedent is 243; the ratio is 27. What is the consequent?

5. The consequent is 35; the ratio is 7. What is the antecedent?

6. What is the ratio of 25 bu. to 10 pks. ?

7. What is the ratio of 25 lb. 11 oz. 4 pwt. to 19 lbs. 5 oz. 8 pwt. ?

8. What is the ratio of $\dfrac{12\frac{1}{2}}{\frac{4}{7}}$ to $\dfrac{\frac{2}{3} \text{ of } \frac{3}{4}}{\frac{1}{2}}$?

9. Find the value of the compound ratio, $(10 : 35) \times (4 : 28)$ $\times (7 : 15)$.

10. Find the value of the compound ratio, $(\frac{4}{5} : \frac{3}{4}) \times (\frac{7}{8} : \frac{2}{3})$ $\times (\frac{1}{2} : 8)$.

Proportion

514. **Proportion** is an equality of ratios. Thus, $12 : 4$ $= 21 : 7$, the ratio of each couplet being 3.

515. The **Sign** of proportion is the double colon (::), and is read "*as*," and expresses the equality of the ratios. Thus, $3 : 21 :: 5 : 35$ is read 3 *is to* 21 **as** 5 *is to* 35.

516. The **Terms** of a proportion are the two antecedents and the two consequents of the equal ratios.

517. The **Extremes** are the *first* and *fourth* terms.

518. The **Means** are the *second* and *third* terms.

519. PRINCIPLE: The product of the *means* of any proportion is equal to the product of the *extremes*.

520. **To Find any Term of a Proportion.**

Divide the product of the means by the given extreme. Or, divide the product of the extremes by the given mean.

521. Solve the following:

1. Find the fourth term of the proportion, $17 : 85 :: 6 : (?)$.

2. Find the third term, $6 : 15 :: (?) : 75$.

3. Find the second term, $12 : (?) :: 42 : 294$.

4. Find the first term, $(?) : 56 :: 19 : 14$.

5. Find the missing term, $\left. \begin{matrix} 7 : 9 \\ 4 : 10 \end{matrix} \right\} :: \left\{ \begin{matrix} 28 : 18 \\ (?) : 40 \end{matrix} \right.$.

6. Find the missing term, $\$5 : \$17 :: 35$ lb. $: (?$ lb.$)$

7. Find the missing term, 10 horses : 45 horses :: $(?$ bu.$)$: 25 bu.

8. Find the missing term, 7 da. : $(?$ da.$) :: 98$ bu. $: 56$ bu.

9. Find the missing term, $(?) : 28$ men $:: 10$ T. $: 140$ T.

10. Find the missing term, $\left. \begin{matrix} 6 \text{ men} : (?) \\ 10 \text{ hr.} : 9 \text{ hr.} \end{matrix} \right\} :: \left\{ \begin{matrix} 15 \text{ A.} : 45 \text{ A.} \end{matrix} \right.$

CAUSE AND EFFECT

522. *Every Problem* in proportion may be resolved into *Causes* and *Effects*.

EXAMPLE: If 4 men earn $72 in 1 week, what will 10 men earn at the same rate? Here the 4 men are a *cause*, the $72, the money earned, the *effect*. The 10 men will be a *second cause*, and the *second effect* is the number of dollars required. Thus,

$$\text{1st Cause : 1st Effect :: 2d Cause : 2d Effect}$$
$$\text{4 men} \quad : \quad \$72 \quad :: \quad \text{10 men :} \quad (?).$$
$$\frac{72 \times 10}{4} = \$180, \text{ Ans.}$$

NOTE—Proportions in Cause and Effect may be written:
"1st Cause : 2d Cause :: 1st Effect : 2d Effect
4 Men : 10 Men :: $72 : $180.

523. Study the conditions of each problem. Causes are *like* quantities. Effects are *like* quantities. Thus, if men, horses, time, money, etc., belong to the first cause they will also be found in the second cause. Effects usually include the object and all its qualities and measurements.

524. In **Compound Proportion** there may be several elements in *each cause* and also in *each effect*.

PROBLEMS IN PROPORTION

525. Solve the following :

1. If 32 lb. of sugar cost $1.92, what will 75 lbs. cost?

2. If 12 horses consume 36 bu. of oats in a given time, how many horses will consume 288 bu. at the same rate?

3. If 15 sheep can be bought for $62.25, how many sheep can be bought for $398.40?

4. What will a pile of wood cost, 40 ft. long, 4 ft. wide, and 4 ft. high, if a pile 12 ft. long, 4 ft. wide, and 8 ft. high cost $28.50?

5. If a certain capital earn $1500 in 1 yr. 8 mo., in what time will double the capital earn $1200 at the same rate?

6.   If 12 men in 48 da., working 10 hr. to the day, can build a wall 120 rods long, how many rods can 22 men build in 60 da., working 8 hr. to the day?

7.   If 10 rms. of paper are required to print 600 copies of a book containing 240 pages each, 32 lines to the page, averaging 10 words to the line, and 5 letters to the word, how many books can be printed from 24 rms. of paper, 200 pages to the book, 36 lines to the page, 12 words to the line, averaging 4 letters to the word?

8.   If it takes 33600 bricks to build a wall 80 ft. long, 20 ft. high, and 3 bricks thick, each brick 8 in. long, 4 in. wide, and 2 in. thick, how many bricks 12 in. long, 5 in. wide, and 2½ in. thick will it take to build a wall 120 ft. long, 30 ft high, and 2 bricks thick?

9.   If 4 men in 7 da., working 9 hr. per day, can dig a ditch 14 rods long, 3 ft. wide, and 32 in. deep, how many men would have to be added to the crew in order to dig it in 3 da., if the ditch was widened to 5 ft. and the men worked 10 hr. per day?

10.   If 8 men can do a piece of work in 12 da. how many men must be added after the work is ⅔ done that it may be completed in 2 days more?

PERCENTAGE

526. **Percentage** embraces those subjects in arithmetic which use 100 as the basis of computation.

527. There are **Two** classes of subjects in Percentage: 1. Those in which *time is not* a factor. 2. Those in which *time is* a factor.

528. The subjects of the **First Class** are:

       1. Profit and Loss.
       2. Trade Discount.
       3. Commission.
       4. Stocks and Bonds.
       5. Taxes.
       6. Duties or Customs.
       7. Insurance.

529. The subjects of the **Second Class** are:

       1. Simple Interest.
       2. Periodic Interest.
       3. Compound Interest.
       4. Partial Payments.
       5. Bank Discount.
       6. True Discount.
       7. Domestic and Foreign Exchange.

530. **Per Cent.** is a contraction of *per* (by) *centum* (hundred) and means "by the hundred."

531. The **Sign of Percent** is %, and is read *per cent.*

532. *Per cent* is usually expressed as hundredths. Thus, 5% may be written .05, or $\frac{5}{100}$.

533. At least **Three Essential Elements** are considered in all applications of percentage.

534. The **Base** is the number or quantity upon which the percentage is computed.

535. The **Rate** expresses the number of hundredths of the *base* to be taken.

536. The **Percentage** is the number or quantity which is a certain number of hundredths of the base.

537. The **Amount** is the *sum* of the base and percentage.

538. The **Difference** is the base less the percentage.

539. The **Amount Per Cent.** is 100% plus the rate.

540. The **Difference Per Cent** is 100% minus the rate.

541. The **Unit of Percentage** is 100%, or the whole; therefore any rate that is an *aliquot part* of 100 may be reduced to its lowest terms, and the fractional part taken. Thus, if the rate is 25%, $\frac{25}{100}$ reduced equals $\frac{1}{4}$.

TABLE OF ALIQUOT PARTS OF 100%

$50\% = \frac{1}{2}$	$11\frac{1}{9}\% = \frac{1}{9}$	$33\frac{1}{3}\% = \frac{1}{3}$	$80\% = \frac{4}{5}$
$33\frac{1}{3}\% = \frac{1}{3}$	$10\% = \frac{1}{10}$	$66\frac{2}{3}\% = \frac{2}{3}$	$16\frac{2}{3}\% = \frac{1}{6}$
$25\% = \frac{1}{4}$	$9\frac{1}{11}\% = \frac{1}{11}$	$25\% = \frac{1}{4}$	$83\frac{1}{3}\% = \frac{5}{6}$
$20\% = \frac{1}{5}$	$8\frac{1}{3}\% = \frac{1}{12}$	$75\% = \frac{3}{4}$	$12\frac{1}{2}\% = \frac{1}{8}$
$16\frac{2}{3}\% = \frac{1}{6}$	$6\frac{2}{3}\% = \frac{1}{15}$	$20\% = \frac{1}{5}$	$37\frac{1}{2}\% = \frac{3}{8}$
$14\frac{2}{7}\% = \frac{1}{7}$	$6\frac{1}{4}\% = \frac{1}{16}$	$40\% = \frac{2}{5}$	$62\frac{1}{2}\% = \frac{5}{8}$
$12\frac{1}{2}\% = \frac{1}{8}$	$5\% = \frac{1}{20}$	$60\% = \frac{3}{5}$	$87\frac{1}{2}\% = \frac{7}{8}$

CASE I

542. Given, the **Base** and **Rate** to find the *Percentage*.

Multiply the base by the rate; or, take such a part of the base as the rate is a part of 100.

FORMULA: Base $\times$ Rate = Percentage.

543. Solve the following:

1. What is 6% of $400? 12% of 900 lbs.?

2. What is 25% of 720 bu.? 33⅓% of 840 tons?

3. What is 12½% of 936 hrs.? 16⅔% of $1554?

4. Bonds's salary of $1250 per year was increased 24%? What is his monthly salary?

5. Jones's income the first year was $2500; the second year it increased 20%; the third, it decreased 33⅓%; the fourth year it increased 35%. What was his income the fourth year?

6. Prindle had $18400 invested ; 12½% in bonds, 20% in in bank stock, 15% in city lots, 30% farm property, and the remainder in merchandise. What was his merchandise investment?

7. A failed for $12400. The assignee was able to pay three installments, the first of 20%, the second of 25%, and the third of 30%. What was B's loss if A was indebted to him $3200?

8. A man owned ⅔ of a business. He sold ½ of his share for $3000. The firm's gain for the year was 25% of the capital stock. Find the total gain.

9. Cushman on Jan. 1st had $4200 in the bank. On April 1st he drew out 33⅓% of it; on May 1st he drew out 14²⁄₇%, and on July 1st he drew out 37½%. How much had he left in the bank?

10. Olson bequeathed his entire estate of $50000 as follows : 20% to his eldest son, 25% of the remainder to his second son, 33⅓% of the remainder to his daughter, 10% of the remainder to charity, and the remainder to his wife. How much did the wife receive?

CASE II

544. Given, the **Percentage** and **Base** to find the *Rate*.

Divide the percentage by the base ; or, take such a part of 100 per cent. as the percentage is a part of the base.

FORMULA : Percentage ÷ Base = Rate.

545. Solve the following :

1. What % of 300 is 150? Of $900 is $225?

2. What % of 720 mi. is 18 mi.? Of 4500 oz. is 900 lb.?

3. What % of 24 is 96? Of $750 is $2250?

4. What % of ¾ is ⅗? Of ⅝ is ⁹⁄₁₆?

5. A farmer raised 40 bu. of oats from 1 bu. of seed. What % of the crop was the seed?

6. A merchant sold from a barrel of molasses containing 48 gallons, ⅓ of the contents the first week, and ¼ the second week, and 12½% the third week. What % of the original contents remained?

7. A boy had 6 doz. marbles. He lost 25% of them the first day; 33⅓% of the remainder the second day, and 16⅔ of the remainder the third day. What % of the original number did he then have?

8. My stock of goods increased in value 10%; then decreased 20%; then increased 50%. If the original value was $1200, what is it now worth, and what is the % of increase?

9. A firm begins business with $18750 capital. The first year they gain 33⅓%, which amount is added to their capital; the second year they lose 10%, which is charged to investment; the third year they gain $4500. What is their % of gain the third year?

10. Green finding himself deeply in debt, made an assignment in favor of his creditors. If his total assets amounted to $7945, and his total liabilities, including $280, assignee's costs, were $10500; what rate % could he pay his creditors?

CASE III

546. Given, the **Percentage** and **Rate** to find the *Base.*

Divide the percentage by the rate; or take as many times the percentage as 100% is times the rate.

FORMULA: Percentage ÷ Rate = Base.

547. Solve the following:

1. Of what is 72 12½%? Is 143 33⅓%?

2. Of what are $420 16⅔%? Are $343 25%?

3. James lost 120 ft. of his kite string and then had 37½% left. What was its original length?

4. A drew out 20% of his money from the bank on July 10th; 25% on Aug. 1st, when he had $605 left in bank. What was his original amount on deposit?

5. Smith owned 66⅔% of a business; he then sold 25% of his share for $1250. What was the total value of the business?

6. A merchant paid $75 for platform scales, which was 62½% of the cost of his wagon, and the cost of the wagon was 75% of the cost of his horse. What was the total cost of his chattels?

7.   A young man spends 25% of his income for board, 15% for clothes, and saves 45%. The remainder, $225, he spends for charity, lodge dues, and sundries.   What is his total income?

8.   The Surplus Fund of a bank is 200% of its Circulation; its Circulation is 50% of its Capital Stock, and its Capital Stock is 300% of the Cash on Hand.   If the Surplus Fund is $150000, what is the Cash on Hand?

9.   In a cask of vinegar 7 gallons of water was added.   This was 14²⁄₇% of the total contents.   How many gallons of pure vinegar in the cask at first?

10.   Hardin lost 25% of his stock in a blizzard, 20% of the remainder died before spring; he then sold 33⅓% of the remainder, and found that he had 280 head left.   How many did he have at first?

CASE IV

548.   Given, the **Amount** or **Difference** and the **Rate** to find the *Base.*

Divide the amount by 100% plus the rate to find the base.   Divide the difference by 100% minus the rate to find the base.

Formula: Amount ÷ 100% + Rate = Base.
         Difference ÷ 100% — Rate = Base.

549.   Solve the following :

1.   What number increased by 10% of it self will equal 88? By 12½% of it self will equal 108?

2.   What amount decreased by 6% of itself will equal $188? By 16⅔% of itself will equal $300?

3.   After increasing his flock of sheep 33⅓%, Jones found he had 728.   How many had he at first?

4.   John lost 20% of his marbles on Monday, and 10% of the remainder on Tuesday, when he had 54 remaining.   How many had he at first?

5.   A bookkeeper's salary was increased 30% of 90% and was then $1016 per year.   What was it before the increase?

6. A manufacturer's profits were 20% less the second year than the first; 25% less the third year than the second when they amounted to $8100. What were the profits the first year?

7. Taylor had 1008 acres of wheat after increasing his acreage 20% each year for two years. How many acres had he to begin with?

8. An assignee paid the creditors 70 cents on the dollar. What was A's loss if he received $1330?

9. I sold a piano for $425 and gained 25%. Had I paid $50 more for it would I have gained or lost, and how much?

10. A city's population increased 25% the first year, 20% the second year, 33⅓ the third, 40% the fourth, and 50% the fifth, when it was found to be 46200. What was the population at the beginning of the first year?

HOME WORK—No. 16

1. I drew out 33⅓% of the $5220 I had in the bank; I then drew out 20% of the remainder; then deposited 15% of what I drew out. How much had I then in the bank?

2. Twenty per cent. of A's money equals 30% of B's. If they together have $1250, how much has each?

3. I sold two pieces of land, each for $6480. On one I lost 10%, on the other I gained 12½%. Did I gain or lose on the whole transaction, and how much?

4. Brown sold his automobile for $1980 which was 10% less than his asking price, and his asking price was 10% more than the cost. What did it cost him?

5. A, B, and C are partners in business. A invests twice as much as B, and B invests twice as much as C. If A's gain is 20% of his capital, B's 25% of his, and C's 33⅓% of his, and their total gain and capital together is $7770, what did each invest?

Profit and Loss

550. **Profit and Loss** treats of the gains and losses in business.

551. **Gains** and **Losses** are usually estimated at a certain rate per cent., therefore the principles of Percentage apply to this subject.

552. The **Elements** of Profit and Loss are: The *Cost*, the *Rate of Gain or Loss*, the *Gain or Loss*, and the *Selling Price*.

553. The **Cost** is the *base* of percentage and represents the investment.

554. The **Rate** is the profit or loss *per cent.*

555. The **Profit** or **Loss** is the *percentage*.

556. The **Selling Price** is the *amount* if there be a gain, or *difference* if their be a loss.

557. In solving the problems of Profit and Loss, note the elements given and apply the principles of Percentage.

CASE I

558. Given, the **Cost** and **Rate** to find the *Gain* or *Loss*.

FORMULA: Cost × Rate = Gain or Loss.

559. Solve the following:

1. What is the gain on a piano bought for $400 and sold at a profit of 25%?

2. Bought potatoes at 40 cents per bushel and sold them at 37½% gain. Find the profit.

3. Find the gain on goods bought for $1500 and sold at an advance of 16⅔%.

4. I bought 50 bales of hops, averaging 175 lbs. to the bale, at 11 cents per lb., and sold them at a profit of 25%. Find my gain.

5.   How much dld I receive for goods bought for $245 and sold at a loss of 15%?

6.   I bought goods for $38.50, paid freight $1.25, drayage $.75, and sold them at a profit of $33\frac{1}{3}\%$.   Find the selling price.

7.   Brown bought an automobile for $1250; he then sold it to Jones and gained 20%; Jones sold it to Smith at a profit of 25%.   What did Smith pay for the machine?

8.   What is the selling price of a car bought for $2650 and sold at a loss of 10%?

9.   Lambert sold 40% of his stock of produce at 20% gain; 30% at 15% gain, and the remainder at 10% loss.   If his total stock cost $420, what was his total net gain?

10.   Bernardi bought goods for $16424.   He sold $\frac{1}{4}$ of them at 20% profit, $\frac{1}{3}$ of the remainder at 25% profit, $\frac{1}{2}$ of those yet remaining at $12\frac{1}{2}\%$ loss, and the remainder at 10% gain. What was his net gain?

CASE II

560.   Given, the **Gain** or **Loss** and the **Cost** to find the *Rate*.

FORMULA :   Gain or Loss ÷ Cost = Rate.

561.   Solve the following:

1.   Goods bought for $80 on which a gain of $20 is made is a gain of what %?

2.   If the cost of a carriage is $120 and it is sold at a profit of $30, what is the rate of gain?

3.   I made a profit of $72 on a piano that cost me $400. What was the rate of profit?

4.   Smith sold a house for $2150 that cost him $1500.   What was his gain %?

5.   If wheat selling for 21 cents per bushel more than cost brings 91 cents per bushel, what is the rate of gain?

6.   What % does a grocer make who buys sugar at 4½ cents per lb. and sells it at 5 cents per lb.?

7.   Wool that cost 28 cents per lb. was damaged and then sold for 21 cents per lb.   What was the rate % of loss?

8.   Find the average rate of gain on the following: Calico bought at 4 cents and sold at 5½ cents; gingham bought at 8 cents and sold at 12½ cents; silesia bought at 7 cents and sold at 10½ cents.

9.   A contractor pays his men $3.50 per day for their labor and receives $4.20 per day.   What % of profit does he make?

10.   My salary was increased 20% the first month; 25% the second month; 33⅓% the third month.   What was the total rate of increase?

CASE III

562.   Given, the **Gain** or **Loss** and the **Rate** to find the *Cost.*

FORMULA: Gain or Loss ÷ Rate = Cost.

563.   Solve the following:

1.   My profit was $12.50 and the rate of gain was 25%.   Find the cost.

2.   If my gain was 18%, or $126, what was the cost?

3.   I lost 16⅔ by selling goods $540 below cost.   Find the cost.

4.   By selling hops at a gain of $320, I made 16%.   I invested the proceeds in oranges which I sold at a loss of $40. For what did I sell the oranges?

5.   Find the cost of goods sold at $700 profit, or a gain of 14²⁄₇%.

6.   Lumber sold at a profit of $3.50 per M. is a gain of 17½%.   Find the cost.

7.   My gain for the month is $385.50, or 20% on the cost. What was the cost of the goods sold?

8. A and B each gains 33⅓% on his investment. A's gain is $420, and B's gain is $510. How much more had B invested than A?

9. Brown's gain is 15% of his investment; Green's is 22½% of his. If they each gain $900, how much more has Brown invested than Green?

10. The profits of a bank for six months was $16500, or 7½% . on the Capital Stock and Surplus. If the Surplus was $120000, what was the Capital Stock?

CASE IV

564. Given, the **Selling Price** and the **Rate** to find the *Cost*.

FORMULA : Selling Price ÷ 1 + Rate = Cost ; or,
Selling Price ÷ 1 — Rate = Cost.

565. Solve the following :

1. Find the cost of goods sold for $27.50, the rate of gain being 10%.

2. Find the cost of a piano sold at a loss of 16⅔% and bringing $280.

3. Having used my automobile for 6 months, I sold it for $1000, which was 25% below cost. What did it cost?

4. I sold a carriage to Smith and gained 12½% ; Smith sold it to Jones for $132 and gained 10%. What did the carriage cost me?

5. Some city lots increased in value each year 25% on each previous year's value. At the end of 4 years they were sold for $3906.25. What did they cost?

6. At what price shall I mark goods that cost me $420 that I may give a 10% discount and still make a 20% profit?

7. Flour that cost $3.60 per bbl. must be listed at what price that a reduction of 25% may be made and still leave a profit of 25%?

8. I sold 2 pianos, each for $384; on one I gained 20%; on the other I lost 20%. Did I gain or lose on the whole transaction, and how much?

9. Brown sold his crop of grapes at a profit of 12½% on the cost of raising. Had the cost been $720 more, he would have lost 12½%. For what did he sell them?

10. If I buy goods at 25% off list and sell them at 20% above, what % do I make?

HOME WORK—No. 17

1. I buy goods at 50% off and sell at 25 and 10% off list price. What per cent. profit do I make?

2. I mark goods at 33⅓% above cost. If I allow a discount of 10% from the marked price, what per cent. profit do I make?

3. I sold a piano at a loss of 12½% and lost $80. What would I have gained had I sold it at a profit of 18¾%?

4. Bought oranges which I sold at a gain of 16⅔%, and invested the proceeds in eggs which I sold at a profit of 10%. If the eggs brought $423.50, what did the oranges cost?

5. Hanson's sales for January were $5544. What was his rate of gain if his total profits were $792?

6. At what price shall I mark goods that cost $70 that I may discount the bill 12½% and still make 20%?

7. A grocer buys goods on an average discount of 20% off list price. What per cent. profit does he make if he sells at an average of 10% above list price?

8. A dealer sold two lots of land at $1012 each. On one he made a profit of 15%, and on the other he lost 12%. Did he gain or lose on both transactions, and how much?

9. A's gain of 20% was equal to B's gain of 30%. If their total gain amounted to $675, what was the capital of each?

10. By selling goods at a certain price a merchant gained 16⅔%. Had the goods cost him $300 more he would have lost 6⅔%. What was the cost of the goods?

Trade and Cash Discounts

566. *Trade Discount* is a deduction made from the list price of an article to fix its selling price.

567. *Cash Discount* is a deduction made from the selling price of an article to secure cash payment.

568. The *List Price* is an established price, usually published in catalogues, for the purpose of securing a basis from which *trade discounts* may be made.

569. The *Selling Price* is the contract price for which the goods are sold and is called the *net amount*.

570. The *Terms* are the conditions upon which a bill is sold and they are usually printed, stamped, or written upon the "bill heads." Thus, "Terms, 60 ds.; 30 ds., 5%; 10 ds. 10%;" etc.

571. *Legal Interest* may be collected on all bills over due, and when paid before maturity, a discount is usually allowed.

572. A *Succession of Discounts* are frequently made. Thus, 20 and 10% off = 100% — 20% = 80%. 10% off 80% = 8%. 80% — 8% = 72%, Ans.

573. *Trade and Cash Discounts* are estimated at a certain per cent., therefore the principles and cases of Percentage apply to this subject.

CASE I

574. Given, the *List Price* and *Rates of Discount* to find the *net amount* of the Bill.

FORMULA: List Price × 100% — Rate % of Discount = Net Amount of Bill.

575. If a *succession of discounts* are given, treat each *net amount* as a new list price and compute the discount as given in the above formula.

EXAMPLE: Find the net amount received for a piano, listed at $800, and sold for 25% and 10% off.

$$100\% - 25\% = 75\%, \qquad \$800 \times 75\% = \$600.$$
$$100\% - 10\% = 90\%. \qquad \$600 \times 90\% = \$540, \text{ Ans.}$$

It will be noticed that the sum of 25% and 10%, or 35%, is *not* the same as 25% and 10% off.

576. Solve the following:

1. Find the net amount of goods listed at $500, less 25% discount.

2. List price $840, less 12½% discount.

3. List price $1250, less 20 and 10% discount.

4. List price $4320, less 16⅔ and 25% discount.

5. List price $1200, less 33⅓, 25, and 10% discount.

6. Find the net amount of a bill for a carload of 14 tons of prunes, listed at 8 cents per lb., less 25 and 33⅓% discount.

7. Pianos listed at $1200, $1000, $900, $800, and $600 were were discounted 33⅓, 20, and 10% off. Find the net values of each.

8. A bill of clothing which amounted to $1420, was discounted 20 and 5% off, with an additional discount of 2% for cash. What amount of cash would pay the bill?

9. The " terms " of a bill were " 60 ds., 5% 30 ds., 10% 10 ds." If the total amount was $720, with a trade discount of 15 and 10%, what amount would settle the bill if paid in 8 days? In 20 days? In 40 days?

10. Which is better for the buyer, 50, 20, and 10% off, or 33⅓, 25, and 25% off, and how much?

CASE II

577. Given, the **Net Amount** of a bill and the **Rate of Discount** to find the *List Price*.

FORMULA : Net Amount ÷ 100% — Rate of Discount = List Price.

578. If a *succession of discounts* are made, treat each *list price* found as a new net amount and proceed as per formula.

EXAMPLE : Find the list price of a piano sold for $540, the discounts being 25 and 10% off.

$$100\% - 10\% = 90\%. \qquad \$540 \div 90\% = \$600.$$
$$100\% - 25\% = 75\%. \qquad \$600 \div 75\% = \$800, \text{ Ans.}$$

579. Solve the following :

1. Find the list price of goods sold for $315, the discount being 10%.

2. Selling price $551.25, discount 25%.

3. Selling price $504, discount 33⅓ and 10% off.

4. Selling price $612, discount 20, 33⅓. and 10% off.

5. Selling price $801, discount 33⅓, 25, 20, and 10% off.

6. Find the list price of gloves per dozen, which retailed at 90 cents per pair, a discount of 50 and 10% being allowed.

7. I made 25% on goods that cost me $280, by selling at a discount of 20% from marked price. Find the marked price.

8. At what price shall I mark goods that cost $208.80, that I may discount the bill 40 and 20% and still make 33⅓% ?

9. Sewing machines were sold for $45.60. If the first discount was 20% and the total discount 32%, what was the second discount ?

10. Smith & Co. buy shoes listed at $96 per case of 2 doz. each, at 40 and 30% off. What discount in addition to 25% shall they make in order to sell at a gain of 50% ?

1.   My discount on a piano listed at $800 was $160.   What was the rate of discount?

2.   I paid $36 for a sewing machine, which was a discount of $9 from the list price.   What was the rate of discount?

3.   Which is the greater rate of discount, and how much, $24.30 off $450, or $15.40 off $280?

4.   If I buy goods marked at $900, at 33⅓% and a second rate off, for $480, what is the second rate of discount?

5.   What discount is equivalent to 40, 33⅓, and 20% off.

6.   Which is the cheaper, to buy goods for 25, 33⅓, and 10% off, or 40, 20, and 5% off, and how much on a purchase listed at $400?

7.   A machine listed at $360 was discounted 20% and $14.40. What was the second rate of discount and the selling price?

8.   Jones paid $512 for goods after being allowed a discount of 33⅓ and 20% off.   What was the marked price?

9.   Smith received a discount of 60, 25, 16⅔, and 10% on hardware that cost him $1575.   What was the list price?

10.   I sold a piano for 35 and 25% off list for $585, and still made 17% profit.   Find the cost and the list price.

COMMISSION

580. *Commission* is a compensation charged by an agent for *buying*, *selling*, or *collecting* for another.

581. An *Agent* is one who transacts business for another.

582. A *Commission Merchant* is an agent whose principal business is to buy and sell goods for others for a commission.

583. A *Principal* is one for whom an agent transacts business.

584. A *Shipment* is the merchandise sent to a commission merchant to be sold.

585. A *Consignment* is the merchandise received by a commission merchant to be sold.

Note—A shipment by the principal is a consignment to the agent.

586. The *Consignor* or *Shipper* is the one who sends the goods.

587. The *Consignee* is the one to whom the goods are sent.

588. *Freight* and *Drayage* are the charges paid to the railway and transfer companies for transportation.

589. *Insurance* and *Storage* are sometimes charged by a commission merchant to reimburse him for sums paid on general insurance and rent accounts.

590. *Guaranty* is a charge to insure against loss through bad debts. It is generally included in the commission charged.

591. A *Shipment Invoice* is a list of goods forwarded to be sold on commission.

592. An *Account Sales* is a statement rendered by a commission merchant to the consignor, and contains :

1. A list of goods received to be sold.
2. An itemized list of goods sold.
3. The charges in detail.
4. The net proceeds.
5. A communication stating the manner of remittance or of making the credit.

593. The **Total Sales** is the sum received for the goods before any charges are deducted.

594. The **Net Proceeds** is the sum left after deducting all charges.

595. An **Account Purchase** is an itemized statement of goods purchased by a commission merchant together with freight, commission, and other charges.

596. The **Entire Cost** is the total amount, including first cost of goods and all charges.

597. Since *Commission* is usually computed at a certain rate per cent., the cases of percentage may apply.

598. The Amount of Sale, Purchase or Collection is the Base. The Rate of Commission is the Rate. The Commission is the Percentage. The Entire Cost is the Amount, and the Net Proceeds is the Difference.

CASE I

599. Given, the **Amount of Sale, Purchase,** or **Collection,** and the **Rate of Commission** to find the *Commission.*

Formula : Amount of $\left\{\begin{array}{l}\text{Sale}\\\text{Purchase}\\\text{Collection}\end{array}\right\}$ × Rate = Commission.

Example : A commission merchant sells a consignment of eggs for $440, and charges 5% commission. What is his commission?

$440 × 5% = $22, commission.

600. Solve the following :

1. What is the commission on a sale of $1200 at 3% ?

2. On a purchase of goods amounting to $4260 the commission charged was $2\frac{1}{2}\%$. Find amount of commission.

3. My agent collected bills amounting to $575, on a commission of 10%. What is his commission, and what amount should I receive?

4. My agent sold 52 bales of hops, averaging 180 lbs. each, at 15 cents per lb., and sent me a draft to cover the sales less his commission of 4%. Find face of the draft.

5. A commission merchant was instructed to purchase 20 boxes of oranges at $2.75 each; 15 crates of bananas at $3 each; and 12 boxes of lemmons at $3.50 each. Find the entire cost, the freight charges being $2.25, and his commsssion 6%.

6. An agent collected the following bills: J. E. Brown, $141.25; I. J. King, $78.40; H. C. Hill, $27.70; R. L. Jones, $189.25; T. E. Smith, $52.50. What did his principal receive if he paid $2.60 expenses and $12\frac{1}{2}\%$ commission for collecting?

7. L. Ayers directed his agent to purchase $9000 worth of prunes and to ship the same to a New York agent who sold them for $13520. If the freight charges were $300, and the rate of commission for buying was 5%, and for selling 4%, what did he profit by the transaction?

8. Find the net proceeds of the following:

<div align="center">

Account Sales

B. S. TAYLOR & COMPANY

COMMISSION MERCHANTS

</div>

Received of THE MERRITT FRUIT PACKING CO.,
                              Santa Rosa, California

To be sold on their account and risk:
          400 boxes Early Crawford Peaches
          100 Crates Strawberries

		SALES:						
July	2	200 Boxes Peaches	$1.40					
		50 Crates Strawberries	6.—					
4uly	3	200 Boxes Peaches	1.25					
		50 Crates Strawberries	5.—					
		CHARGES:						
July	1	Freight			81	25		
		Cartage			14	73		
July	3	Commission, 10% on sales						
		Net Proceeds remitted in cash						

9. Find the entire cost of the following:

Account Purchase

☙ **R. J. PERKINS & COMPANY** ☙

COMMISSION MERCHANTS

Los Angeles, Cal., July 28, '08.

Bought for KETTERLIN BROS.,
Santa Rosa, California

The following goods per their order of July 25, 1908.

PURCHASES:				
50 Boxes Navel Oranges	$3.25			
40 " " "	2.75			
35 " Lemons	3.50			
CHARGES:				
Freight		12 25		
Cartage		3 50		
Commission, 3%				
Amount charged	– –			

10. A commission merchant sells 7 tons of potatoes at 1½ cents per lb.; 24 crates of cabbage, 120 lbs. each, at 3 cents per lb,; 270 bbls. apples at $3.25 per bbl., and 120 cases of eggs, 36 doz. to the case, at 18¾ cents per doz. His charges are $23.50 for cartage; $5.80 for storage; ½% for insurance; 1½% for guaranty on the sale of apples which were sold on account, and 3% for his commission. What were the net proceeds.

CASE II

601. Given, the **Amount of Sale, Purchase,** or **Collection** and the **Commission** to find the *Rate of Commission.*

FORMULA: Commission ÷ Amount of $\left\{ \begin{array}{l} \text{Sale} \\ \text{Purchase} \\ \text{Collection} \end{array} \right\}$ = Rate.

EXAMPLE: The commission on a sale of cotton amounting to $6440 was $225.40. Find the rate of commission, and the net net proceeds.

Com. $225.40 ÷ Amt. of Sale $6440 = $3\frac{1}{2}\%$, Rate.
$6440 — $225.40 = $6214.60, Net proceeds.

602. Solve the following:

1. Find the rate of commission when $24.60 is charged for selling goods amounting to $1230.

2. Find the rate of commission when $16.71 is charged for buying $278.50 worth.

3. My agent sold a house and lot for $2850. His commission was $71.25. Find the rate charged.

4. A lawyer collected a bill of $324.40 and charged $40.55 commission. What was the rate for collecting?

5. Find the rate of commission charged when $235.40 is paid for buying 26750 lbs. of wool at 32 cents per lb.

6. If a commission merchant charged $\frac{1}{2}\%$ for insurance, $2\frac{1}{2}\%$ for guaranty, and the total charges on sales amounting to $1475.50 were $88.53, what was the rate of commission?

7. I paid my Chicago agent $20.25 from a sale of $320 worth of dried fruit. If the cartage was $4.25, what was the rate of commission?

8. An agent sent me $1072.56 as the net proceeds of a total sale amounting to $1117.25. Find the rate of commission charged.

9. The entire cost of an account purchase was $968.30. If the incidental charges were $9.20, and the cost of the goods bought $920, what was the rate of commission charged?

10. A owed B $850. Not being able to collect the bill, B placed it in the hands of a collector who succeeded in collecting 80% of the debt. If the collector's charges were $42, including notary's fee of $1.20, what was the rate of collection, and what was B's loss?

CASE III

603. Given, the **Commission** and the **Rate of Commission** to find the *Amount of Sales*, *Purchase*, or *Collection*.

FORMULA: Commission ÷ Rate = Amount of $\begin{cases} \text{Sale} \\ \text{Purchase} \\ \text{Collection.} \end{cases}$

EXAMPLE: An agent's commission was $41.35 at a 5% rate. Find the amount of goods sold.

Com., $41.35 ÷ Rate, 5% = Amt. of sale, $827.

604. Solve the following:

1. The commission is $210; the rate is 3%. Find the amount of goods sold.

2. The commission is $123.50; the rate 2½%. Find the amount of purchase.

3. My agent collected a bill charging 8% commission. If his fee amounted to $19.40, how much did I receive?

4. My agent's commission on a sale was $99.40; the rate charged was 7%. What was the amount of sale?—

5. A commission merchant charged a commission of 5%, guaranty 1%, and insurance ½%. If his total charges were $94.25, what was the amount of sale?

6. My agent charged 5% for selling and 4% for buying. What would be the net proceeds of a sale, and the entire cost of a purchase if his commissions were $135.25 and $123.40 respectively?

7. An agent collected a bill on a commission of 6% and remitted the proceeds less his commission of $38.40. What was the amount remitted?

8. A collection agent's charges, including notary's fees of $2.75, and $1.50 for recording, were $33.27; his rate of collection was 4%. What amount did his principal receive?

9. A commission merchant sold a consignment of cotton at 11 cents per lb. and charged a commission of 3½%, guaranty 1½%, insurance ½%, freight $128.44, and cartage $34.60. If his total charges amounted to $454.80, how many pounds of cotton did he sell?

10.   My agent sold a consignment of goods at 33⅓, 25, and 10% off list price, charging me 6% commission. If his commission was $76.95, what was the list price?

CASE IV

605.   Given, the **Net Proceeds** or **Entire Cost** and the **Rate of Commission** to find the *Amount of Sale, Purchase,* or *Collection.*

FORMULA: Net Proceeds ÷ 100% — Rate = Amount of Sale or Collection; or, Entire Cost ÷ 100% + Rate = Amount of Purchase.

EXAMPLE: The net proceeds of a sale of hams and bacon was $695.52. If the agents commission was 4%, what was the value of the goods sold?

Net Proceeds, $695.52 ÷ 100% — Rate, or 96% = Amt. of Sale, $724.50.

606.   Solve the following:

1.   I received $502.20 from my agent as the net proceeds of a sale. His commission was 7%. What was the total amount of sale?

2.   Smith & Co., directed their agent to purchase lumber, the entire cost of which was $17757.20. If the agent's commission was 3%, what was the net price of the lumber?

3.   The Goodyear Rubber Company received a New York draft for $876.28 as the net proceeds of a collection upon which a commission of 5% had been charged. What amount was collected?

4.   What was an agent's commission at 6% on a collection the net proceeds of which were $324.30?

5.   Fairbank & Co., of Chicago, sent their N. Y. agent a consignment of canned goods to be sold on a 2½% commission. The net proceeds, after paying freight $32.50, drayage $41.25, storage $12.60, and the commission, was $12159.65. What was the amount of sale?

6.   I sent my St. Louis agent a car load of oranges to be sold on a commission of 5%, and directed him to invest the proceeds

in flour after deducting his commission of 3% for buying. If the oranges brought $2140, what was the cost of the flour?

7. A. L. Bagley & Co. sent their agent $930.75 with instructions to purchase potatoes after deducting his commission of 2%, and to sell the same as soon as the market price advanced 10%. If the agent's commission for selling was 4%, did they gain or lose by the transaction, and how much?

8. Zimmerman & Co. received $402.33 as the net proceeds of a sale of butter after deductions were made as follows: Freight, $4.38; cartage, $1.25; insurace, ½%; guaranty, 2½%; and a commission of 3%. How many pounds of butter were sold, if the price paid was 28 cents per pound?

9. A commission merchant received $49043.27, and was directed to invest one-half in Island cotton at 12 cents per pound. the remainder he invested in Southern Alabama cotton at 10 cents per pound, after deducting 2% for buying each kind. How many pounds of each kind of cotton did he purchase?

10. I sent a commission merchant a shipment of wine and directed him to sell the same and invest the proceeds in sugar after deducting his commission of 5% for selling and 4% for buying. If his total commission was $450, what was the selling price of the wine, and the cost of the sugar?

HOME WORK—No. 19

1. A commission merchant bought goods costing $38450 on a commission of 2%. What was the entire cost of the goods?

2. The net proceeds of a sale, after deducting $152.25 expense and a commission of 5%, was $6820.75. What was the amount of the sale?

3. A commission merchant retained $22.25 to defray the charges for selling a piano for $350. If the cartage was $4.75, what rate of commission did he charge?

4. A sale of $940 netted me $902.40 after paying insurance 1% and a commission. What was the rate of commission?

5. My agent remitted me $258 in cash after paying storage $11.40 and retaining his commission of 10%. What was the amount of sale, and his commission?

6. I bought goods on a commission of 6%. If the entire cost of the purchase was $1847.05, what was my commission?

7.   An agent sold a consignment of wool for $7210 and was instructed to invest the proceeds in structural steel, after deducting his commission of 5% for selling and 3% for buying.   What was his total commission, and what was the price paid for the steel?

8.   I sent my agent $1440.40 in cash and directed him to invest in flour, after deducting his commission of 4% for buying. He then sold the flour at a gain of 20% on the cost price. What was his rate for selling, if his total commission amounted to $138.50?

9.   The net proceeds of a sale of dried fruits consisting of 8400 lbs. of prunes sold at $3\frac{1}{2}$ cents, 4200 lbs. peaches sold at $4\frac{1}{2}$ cents, and 12500 lbs. apples sold at 4 cents per lb. were $905.40. If the charge for storage was $7.50, and for insurance $10.12, what was the commission and rate of commission?

10.   I sent my agent a consignment of hops to be sold on commission and directed him to invest the proceeds in wheat, after deducting 7% commission for selling and 3% for buying.   If if his total commission was $400, what was the selling price of the hops, and the cost price of the wheat?

Outline for Review

I. Percentage:

1. Definitions.
2. Classes of Subjects:
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   Second.
3. Sign.
4. Essential Elements:
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   Amount.
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II. Profit and Loss:

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4. Shipment, Consignment.
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8. Acct. Sales, Acct. Purchase.
9. Total Sales, Net Proceeds, Entire Cost.
10. Cases.

Stocks and Bonds

607. A **Corporation** is an association of individuals chartered by law to transact business.

608. The **Articles of Incorporation** are the regulations governing the organization of the association.

609. The **Articles** must contain the following:

1. The name of the corporation.
2. The purpose for which it is organized.
3. Its principal place of business.
4. The term of its existence.
5. The number and names of the directors.
6. The amount of capital stock and the par value of each share.
7. The amount of capital stock actually subscribed.

610. The **Capital Stock** is the total amount of all the shares that may be issued at their par value.

611. **Stocks** is a general term applied to shares of capital stock of all kinds.

612. Stocks are at *par* when they sell for their face value; *above par* when they sell for more, and *below par* when they sell for less than their face value.

613. **Certificates of Stock** are issued by the officers of the corporation to those who contribute to the capital stock, and are usually transferable.

614. The **Market Value** of stock is the amount for which it can be sold.

615. **Premium** and **Discount** are terms used to indicate the difference between the *par value* and the *market value*.

616. **Brokerage** is the percentage charged by a broker for buying or selling stocks. It is usually ¼% or ⅛% on the par value of the stocks.

617.   A **Stock Broker** is one who buys and sells stocks.

618.   An **Installment** is a portion of the capital stock paid in by the subscribers.

619.   An **Assessment** is a sum required of the stockholders to meet current losses or needs of the company.

620.   A **Dividend** is a percentage paid to the stockholders from the profits of the business.

621.   **Bonds** are the promissory notes of a government, state, municipality, or corporation.

622.   **Stock Quotations** are the published prices for which stocks are selling.

623.   *Bonds* like *Stocks* may sell at a premium or at a discount.

624.   Bonds are of two kinds, *Registered* and *Coupon*.

625.   **Registered Bonds** are those payable to the owner as registered on the books of the company.

626.   **Coupon Bonds** have certificates of interest attached, which when due may be cut off and presented for payment.

627.   **Treasury Stock** is that portion cf the *Capital Stock* which has not been subscribed.   It is usually reserved for the future needs of the corporation and may be sold to increase its working capital.

628.   **Preferred Stock** is stock issued usually to rehabilitate a corporation in a weakened condition, and takes precedence in the matter of drawing dividends.   Thus, preferred stock may receive a certain per cent. dividend from the profits cf a business and the remainder, if any, may be distributed as dividends on the common stock.

629.   **Watered Stock** is stock issued for which no consideration is received.   The issuing of watered stock is usually for the purpose of either inflating the value of the stock of a corporation or for reducing the high rate per cent. of profit which in some states is forbidden by law.

630.   Bonds are sometimes designated by the rate of interest they bear.   As " Missouri 5's " = Missouri bonds drawing 5%.

631. Since the Premium, Discount, and Brokerage are estimated at a certain rate per cent., the cases of Percentage apply to the subject of Stocks and Bonds.

632. The **Quantities** considered in Stocks and Bonds are; Par Value = Base; Rate of Premium, Discount, Dividend, or Brokerage = Rate; Premium, Discount, Dividend, Assessment, or Brokerage = Percentage; Market Value = Amount or Difference.

NOTE—The par value of the stock in the following problems is $100, and the rate of brokerage is ¼ per cent. unless otherwise specified. Brokerage is always estimated on the par value.

CASE I

633. Given, the **Par Value of the Stocks** and the **Rate** to find the *Premium*, *Discount*, *Dividend*, *Assessment* or *Brokerage*.

FORMULA: Par Value × Rate = $\begin{cases} \text{Premium or Discount} \\ \text{Dividend or Assessment} \\ \text{Brokerage.} \end{cases}$

EXAMPLE: I sold 44 shares of S. P. R. R. stocks at 12% premium. How much was the premium?

44 shares at $100 each = $4400.
$4400 × 12% = $528.

634. Solve the following:

1. What was a broker's commission on 120 shares of N. Y. Central's sold at 5% discount?

2. Chicago and Rock Island shares are selling at 8% discount. What is my broker's commission on 82 shares sold at that price?

3. I received an 8% dividend on 128 shares of B. & O. stock. How much cash did I receive?

4. My profit on a sale of 32 shares of Union Pacific's was 12½% less brokerage. What was my gain?

5. A bank whose capital stock is $150000 declares a dividend of 3%. What is the total dividend, and how much does Jones receive who owns 25 shares?

6. Lake Shore stocks are selling for $107½. What would be the premium on 46 shares?

7. Amalgamated Copper is 12¾ below par. How much would I receive for 96 shares after paying brokerage?

8. Anaconda Copper Co.'s stocks ($50) are paying a 2% quarterly dividend. What annual income should Green receive who owns 77 shares?

9. I buy 140 shares of Canadian Pacific's at 167¼ and sell the same at 171¾, paying brokerage both for buying and selling. What is my profit?

10. Goldfield Consolidated levied an assessment of 5% upon its stock ($50) for development purposes, 2% for current expenses, and 4% for machinery. What would be the total assessment on 1000 shares, and how much would be required of A who owns 45 shares?

CASE II

635. *Other Quantities* being given to find the *Rate of Premium, Discount, Dividend, Assessment* or *Brokerage.*

FORMULA: Prem., Dis., Div., Ass., or Brok. ÷ Par Val. = Rate.

EXAMPLE: A dividend of $128 was received as a dividend on 64 shares of Bank Stock. What was the rate?

Div.. $128 ÷ Par Val., $6400 = 2% Rate.

636. Solve the following:

1. The par value of stocks is $800; the dividend is $60. What is the rate of dividend?

2. Par value, $1200; dividend, $132. Find the rate.

3. Brokerage, $14.50; par value, $5800. Find the rate of brokerage.

4. I sold 42 shares of Balt. & Ohio at a discount of $189. What was the rate of discount?

5. A broker's commission is $3.50. What rate does he charge if the sale is 56 ($50) shares?

6. Stock received at par was sold at a net gain of $608. If 76 shares were sold and brokerage charged, what was the rate of premium?

7. An electric power company with a capital of $500000 has gross earnings amounting to $82000, and its total expenses are $43250. What whole rate of dividend may it declare, and what surplus would remain?

8. The net earnings of the Bullfrog Mining company for the year were $275000. The capital stock consists of 5000 shares of preferred stock, guaranteed 4% semi annual dividends, and 10000 shares of common stock. What annual rate of dividend can be declared on the whole stock after paying preferred stock dividends?

9. A National bank with a capital of $150000 has net earnings of $21345.20. If 10% of this is placed in a reserve fund, what is the greatest whole per cent. of dividend that it may declare, and what will be the remaining undivided profits?

10. A gas company is able to declare a dividend of 18% on its capital stock of $200000. If it waters its stock by the addition of 3000 shares, what rate of dividend may it declare on the same income and still place $1000 in the reserve fund?

CASE III

637. Other Quantities being given to find the *Par Value*, *Market Value*, or the *Rate of Investment*.

FORMULA: Prem., Dis., Div., Ass., or Brok., ÷ Rate = Par Value.

Par Val. × 100% + Rate = Market Value.

Div. ÷ Market Val. = Rate of Investment.

EXAMPLE: Stocks sold at a premium of $135 yields a premium of 9%. What is the par value of the stocks?

Prem., $135 ÷ Rate, 9% = $1500, Par Val.

EXAMPLE: The par value of electric railway stock is $4500; the rate of discount is 10%. Find the market value.

Par Val., $4500 × 90% = $4050, Market Value.

EXAMPLE: School bonds bought at 120 yield 6% interest. What is the rate of income?

Div., $6 ÷ Market Val., $120 = 5%, Rate of Investment.

638. Solve the following:

1. Brown receives a 3% semi annual dividend of $480. How many ($50) shares does he own?

2. What will be the cost of 270 shares of N. Y. Central Ry. stock at 110⅜; brokerage ⅛%?

3. My broker sold 115 shares of Southern Pacific's at 77½ charging brokerage at ¼%. What did I receive for my stock?

4. I invested $5120 in Northern Pacific's at 127¾, paying brokerage. If a dividend of 8% is declared, what rate of investment do I receive?

5. How many shares of stock bought at 110½ and sold at 116¾, brokerage ¼% for buying and ¼% for selling, will gain $690?

6. What amount must be invested in ($50) stock at $62.50 per share, paying brokerage ¼%, to yield an income of $720, the stock paying 12% dividend?

7. Which is the better investment, Union Pacific 5's at 110 or Rock Island 6's at 120, and how much on an investment of $39600?

8. I directed my agent to sell 200 shares of preferred stock at 97½, yielding 3% semi-annual dividends, and directed him to buy Edison Electric's at 208 which yield 15% annually. Did I increase or diminish my income, and how much, and what surplus was left, paying brokerage both ways?

9. Glenn & Co. sold through a broker 500 shares of United Fruit ($100) stock at 107, paying annual dividends of 6%, and directed him to invest the proceeds in U. S. Rubber ($50) at 35½ and paying 2% semi-annual dividends. Did they increase or decrease their income and how much, and what surplus was left; brokerage ¼% both for selling and buying?

10. J. A. McDonald & Co., through their broker, invested a sum of money in Mich. 6's at 109¾, and twice as much in Ohio 5's at 98¾ ; brokerage in each case ¼%. The annual income from both investments was $2772. How much did they invest in each kind of stock?

HOME WORK—No. 20

1. The Western Railway Company with a capital stock of $500000 declares a 2% quarterly dividend. What will be A's annual income on 420 shares?

2. A mining company with a capital of $250000 has net earnings amounting to $14275. What is the highest whole rate per cent. of dividend that may be declared, and what surplus would remain?

3. What per cent. of income does stock paying 6% dividend yield when bought at 120?

4. What will be the cost of 240 shares of the Wright Bros. Aerial Navigating Company quoted at 84¼ ; brokerage ¼%?

5. My broker bought 320 shares of S. P. ($50) stock at 62⅜ which yielded a semi-annual dividend of 2½%. What was my annual rate of income on my investment; brokerage ¼%?

6. I directed my broker to sell 80 shares of Ohio 6's at 96¾ and to buy Pennsylvania 5's at 79¾. Did I increase or diminish my income, and how much? What was the surplus?

7. What price must be paid for stocks paying 4% dividends to yield 5% on the investment?

8. Which is the better investment, stocks bought at 112½ and paying 5%, or stocks bought at 88 paying 4%, and how much on an investment of $19800?

9. My income from an investment in Wabash ($50) 6's was $114. If I paid 66⅞ and brokerage ¼%, what amount did I invest?

10. I sold through my broker 54 shares in Consolidated Virginia ($100) stock at 148¼ paying 3% quarterly dividend, and directed him to purchase Bakersfield Oil Stock ($50) at 94¼ paying 8% semi-annual dividends. Did I increase or decrease my income; how much, and what was the surplus; brokerage ¼%?

TAXES

639. A **Tax** is a certain sum levied on the person, property, or income of a person, firm, or corporation for the purpose of defraying the expenses of the government.

640. **Property Tax** is a tax on property. Property is of two kinds, *Real Estate* or *Personal Property*.

641. A **Poll Tax** is a tax on every male citizen of the State.

642. **Real Estate** is land and permanent improvements thereon.

643. **Personal Property** consists of all kinds of movable property, called chattels.

644. An **Assessor** is the person who prepares the assessment rolls and estimates the values of property.

645. The **Tax Collector** receives the taxes and gives receipts for the same.

646. **Collection** is a sum paid to a collector for collecting taxes.

647. The **Assessment Roll** is the list of the taxable property together with its assessed valuation.

648. Taxes are levied for different purposes; as, county, state, school, library, street, highways, etc.

649. Since taxes are estimated as a certain per cent. of the assessed value of the property, the cases of Percentage may apply.

650. To find the *Tax*, *Rate of Taxation*, and *Assessed Value* of taxable property.

FORMULÆ: Assessed Value × Rate = Tax.
Tax ÷ Rate = Assessed Value.
Tax ÷ Assessed Value = Rate.

651. Solve the following :

1. The assessed valuation of the city of Santa Rosa, Cal., is $6,000,000, and the rate of taxation for state and county purposes is 1.42%, and for municipal purposes 1.25%. What is the total tax?

2. If a collection fee is 1%, how much must be the total tax in order to raise sufficient funds to build a courthouse to cost $321750?

3. A tax on a store building assessed at $27500 was $68.75. At the same rate, what would be the value of another building taxed for $92?

4. The assessed value of the property of a town is $1420000. The total tax to be raised is $31950. What would be A's tax who is assessed for $8400?

5. What is Brown's tax in a city whose rates are as follows : 1% for improvements, 5 mills on the dollar for library, 75 cents on the $100 for county tax,14 mills on the dollar for State tax, if he is assessed at $1200 and one poll at $2?

6. How much will be a person's tax who has property assessed for $10540, if he pays 1¼% city tax, .54% State tax, 2 mills on the dollar school tax?

7. A special tax was levied on a town for the purpose of building a bridge the net cost of which was to be $1370.85. If the collector's commission was 2½% and the rate of taxation 2½ mills on the dollar, what was the assessed valuation of the town?

8. The assessor's roll footed up $17235850. The expenses of the county for roads was 7 mills on the dollar; for salaries, 4 mills on the dollar; for jail, county farm, and other charities, 1½ mills on the dollar; for schools, 25 cents on the $100; for state tax, 60 cents on the $100. If there are 12000 polls at $2 each, what is the entire tax of the county?

9. What is my total tax if the assessed value of my property is $7200 and the rates are as follows : Schools, 4 mills; general purposes, 5 mills; library, .5 of a mill; state tax, 3.5 mills; hospital, 1 mill; other expenses, 3 mills; and I pay road tax and poll tax $2 each?

U. S. Customs or Duties

652. *Customs or Duties* are taxes levied upon imported goods for the purpose of raising funds for the government and to protect home industries.

653. A *Custom House* is the place where duties are collected.

654. A *Port of Entry* is the city in which a custom house is located.

655. The *Collector of the Port* is the officer who collects duties for the government.

656. A *Manifest* is a statement in detail of a ship's cargo.

657. A *Clearance* is the certificate given by the collector of port that a vessel has complied with the requirements of law and is allowed to depart.

658. A *Tariff* is a schedule of the rates of duty required by law to be paid on imported goods.

659. *Ad Valorem Duty* is the duty estimated upon the entire cost of the goods in the country from which they are exported.

660. *Specific Duty* is the duty estimated upon the weight or quantity of the goods imported without regard to their value.

661. *Allowances* are made for the *tare, leakage, breakage,* etc., before the duties are computed.

662. *Tare* is an allowance made for the box, crate, or covering containing the goods.

663. *Leakage* is an allowance made for waste of liquids imported in casks, barrels, etc.

664. *Breakage* is an allowance made on account of waste of goods shipped in glass or other breakable material.

665. *Gross Weight* or *Gross Value* is the entire weight cr value before any deductions are made.

666. *Net Weight* or *Net Value* is the weight or value after all deductions are made.

667. Since duties are estimated at a certain rate per cent., the cases of Percentage will apply.

668. To find the *Duty*, *Rate of Duty*, or *Value of Goods* imported.

FOMULÆ :   Net Value × Rate = Duty.
             Duty ÷ Rate = Net Value.
             Duty ÷ Net Value = Rate.

EXAMPLE :   What is duty on 540 yds. of silk, invoiced at 3 francs per yd.; boxing and cartage, 5 francs; the specific duty being $12\frac{1}{2}$ cents per yd., and the ad valorem duty $33\frac{1}{2}\%$?

540 yds. × 3 fr. = 1620 fr.
1620 fr. + 5 fr. = 1625 fr., total invoice cost.
1625 fr. × 19.3 cents = $313.63.
$314 × $33\frac{1}{3}\%$ = $104.67, ad valorem duty.
540 yds. × $12\frac{1}{2}$ cents = $67.50, specific duty.
$104.67 + $67.50 = $172.17, total duty.

NOTE—The LONG TON of 2240 lbs. is used in weighing goods at the custom house.

The VALUE of the £ is $4.8665. The franc, $.193. The mark, $.2385.

A BONDED WAREHOUSE is a place where goods on which duty has not yet been paid may be stored.

Duties are computed on WHOLE DOLLARS only. If the fraction is 50 cents or more, it is counted as a whole dollar; if less than 50 cents, it is dropped.

PRACTICAL PROBLEMS

669. Solve the following :

1. What is the duty on 720 yds. of carpet invoiced at 10 s. 6 d. per yd., the duty being 25% ?

2. Find the specific duty on 38080 lbs. of tool steel at $58.50 per ton.

3. What is the entire duty on an invoice of 40 doz. pairs of kid gloves, costing 1420 francs; boxing and cartage, 30 francs; specific duty, $1.80 per doz. pairs, and ad valorem duty, 20% ?

4.   An invoice of goods from Germany was billed at 7240 marks.   What was the duty at 35%?

5.   Find the duty on 13200 yds. of China silk, imported from Shanghai, invoiced at 2 s. 6 d. per yd.   Ad valorem duty $16\frac{2}{3}\%$, and specific duty 8 cents per yd.

6.   A merchant imported 240 pieces of carpet, each piece containing 96 yds., invoiced at $2\frac{1}{2}$ marks per yd.   The ad valorem duty was $12\frac{1}{2}\%$, and the specific duty $8\frac{1}{3}$ cents per yd.   What was the entire cost of the carpet?

7.   What is the rate of duty on an invoice of goods, the entire cost of which was $1095.35, including boxing and cartage $22.50. and an ad valorem duty of $182.60?

8.   A New York jobber imported from England 10 cases of English broadcloth; gross weight, 1240 lbs.; value £550.   What was the cost of the cloth after being allowed 5% tare on weight, the duties charged being 40 cents per lb., and $37\frac{1}{2}\%$ ad valorem?

9.   A wine merchant imported 200 doz. bottles of champagne invoiced at $15 per doz., and 20 casks of port wine, each containing 30 gals., invoiced at $2.25 per gal.   A breakage of 10% and a leakage of 20% is allowed by the custom officers.   What is the duty at $33\frac{1}{3}\%$ ad valorem on the champagne, and 20% on the port?

10.   I imported two kinds of watches; on the first I paid a duty of $33\frac{1}{3}\%$, on the second 35%.   Including duty, I invested twice as much in the second kind as in the first.   If the total duty paid was $1660, what was the total cost of each kind?

HOME WORK—21

1. The assessed value of a town is $4750000, and the rate of taxation is as follows: General purposes, 80 mills; hospital, 4 mills; school, 24 mills; road, 27 mills, and library, 10 mills on the $100. Find the total tax.

2. My total rate of taxation was 2¾ cents on the dollar, and my tax amounted to $229.35. What was the assessed value of my property?

3. The county rate of taxation was $1.25, the state rate $.45. What was the school rate if my tax was $192 on an assessed valuation of $9600?

4. A village school house to cost $3981.25 was paid for by a tax of 1¼ cents on the dollar. If the collector's commission was 2%, what was the assessed value of the property?

5. The assessed value of the property of a town is $4,552,800. If there are 1145 polls at $2 each and a collector's fee of 1%, what rate of taxation will be required to meet a net expenditure of $77392.26?

6. What is the duty on imported goods invoiced at 3240 francs, the rate of duty being 42%?

7. A firm imported 4800 yds. of body brussels carpet invoiced at 5 marks per yard, a charge of 45 marks for boxing and cartage being added to the bill. What is the total duty at 33⅓% advalorem, and 15 cents per yard specific?

8. What will be the total cost of an invoice of watches, imported from London, and billed at £584 15s. 6d., the rate of duty being 35%, exchange being $4.88?

9. A paper company imported from Canada 500 long tons of wood pulp invoiced at 1¼ cents per lb. What was the entire cost, if the boxing and cartage was $1.37½ per ton; freight, $1250, paid in Holyoke, Mass.; specific duty, $2.25 per ton, and an advalorem duty of 20%?

10. Hall & Co imported merchandise billed at 4320 marks, on which there were prepaid charges of 150 marks. The gross weight was 7 tons, on which a tare of 20% was allowed. If the specific duty was $1.75 per ton, and the advalorem duty 25%, what was the entire cost of the goods?

INSURANCE

670. *Insurance* is indemnity against loss. There are many kinds of insurance, and they take their names from the nature of their risks; as, *Fire Insurance*, *Marine Insurance*, *Life Insurance*, *Accident Insurance*, *Health Insurance*.

NOTE—Among the many special forms of insurance are: GUARANTEE COMPANIES that act as bondsmen, PLATE GLASS INSURANCE, HAILSTORM AND CYCLONE INSURANCE, STEAM BOILER INSURANCE, LIVE STOCK INSURANCE, etc., etc.

671. *Fire Insurance* is indemnity against loss or damage by fire.

672. *Marine Insurance* is indemnity against loss or damage to vessels and their cargoes.

673. *Accident Insurance* is indemnity against loss by accidents.

674. *Health Insurance* is a remuneration paid for loss of time or for expense caused by ill health.

675. The *Insurer* is the party guaranteeing against loss.

676. The *Insured* is the party indemnified.

677. The *Policy* is the contract of insurance.

678. The *Face of the Policy* is the amount of insurance guaranteed.

679. The *Premium* is the sum paid for insurance.

680. The *Term of Insurance* is the time for which the insurance is given.

681. There are two principal kinds of insurance companies: *Mutual* and *Non-Mutual*.

682. *Mutual Companies* are those in which the insured share in the gains or losses.

683. The *Non-Mutual Companies* are those owned exclusively by stockholders and the insured do not share in the gains or losses.

NOTE—Many companies combine the mutual and non-mutual plans as above described.

Fire Insurance

684. Since the premiums paid for fire insurance are esti-
mated at a certain rate per cent., the principles of Percentage
will apply.

685. To find the *Premium*, *Rate of Premium*, and *Face of
Policy*.

FORMULÆ: Face of Policy × Rate = Premium.
                Premium ÷ Rate = Face of Policy.
                Premium ÷ Face of Policy = Rate.

EXAMPLE: A house valued at $4500 is insured for 3 years at
⅔ its value. If the annual rate charged is ¾%, what is the
premium?

         ⅔ of $4500   = $3000, face of policy.
         $3000 × ¾% = $22.50, prem. for 1 year.
         $22.50 × 2   = $45, prem. for 3 years.

NOTE—Policies are issued for 1 year or for 3 years. The cost for 3
years is double that for 1 year.

PRACTICAL PROBLEMS

686. Solve the following:

1. How much will it cost to insure a house for $2500, the
rate of premium being ⅗%?

2. My house is insured for $2200, and my furniture for $800.
What is my premium at 1¼%?

3. Brown insured his house worth $6000 for ¾ its value in
the Northwest National for three years at an annual rate of 70
cents on the $100. What premium did he pay?

4. The Ætna Insurance Company takes a year's risk of $8000
at a 90 cent rate. A fire occurs causing 25% damage. What
is the company's loss?

5. A paid $29.25 for insurance on his stock of merchandise
at a 65 cent rate. What was the face of his policy?

6. If a three years' policy at an annual rate of 70 cents cost $24.50, what is the amount of insurance?

7. As an agent my commission of 25% on insurance premiums amounted to $2227.86. What was the total amount covered, if the average annual rate was 60 cents on the $100?

8. I insured my dwelling in the Phœnix Company for $3220 at 1%; my household goods and furniture in the Island Company for $1200, at 90 cents; my store building for $1800 in the Lion Company, at $1\frac{1}{4}$%, and my stock of merchandise for $12000 in the Home Company, at $1.20. What was the total amount of premium paid, and what was the average rate?

9. B's property valued at $14560, is insured for $\frac{3}{4}$ its value at $1\frac{1}{5}$% premium. A fire occurs causing a loss equal to $\frac{2}{3}$ the face of the policy. What is B's loss if the insurance company pay only 90 cents on the dollar?

10. The Hartford Insurance Company took a risk on a warehouse for 3 years at $1\frac{1}{2}$% premium and reinsured $\frac{3}{4}$ of their policy in the Commercial at $1\frac{3}{5}$%. A fire occurred in which the entire plant was destroyed. If the loss of the Hartford Company was $2440, what was the face of the policy?

Life Insurance

687. *Life Insurance* is a contract by which the insurer agrees to pay a beneficiary a certain sum upon the death of the insured or at a specified time.

688. The ***Beneficiary*** is the one named in the policy to receive the benefit.

689. There are *many kinds* of policies written by life insurance companies; among them are: *Ordinary Life Policy, Limited Life Policy, Endowment Policy, Annuity Policy, Mutual Policies*, etc.

690. The ***Ordinary Life Policy*** requires regular premiums to be paid during life, and the benefit to be paid only upon the death of the insured.

691. The *Limited Life Policy* requires premiums to be paid for a stated number of years, the benefit to be paid upon the death of the insured.

TABLE OF INSURANCE RATES, 1908
Premium Rates for $1000 of Insurance

AGE	ORDINARY LIFE			20-YR. ENDOWMENT			20-PAYMENT LIFE		
	Annual	Semi-Annual	Quar-terly	Annual	Semi-Annual	Quar-terly	Annual	Semi-Annual	Quar-terly
20	$15.50	$8.06	$4.11	$42.79	$22.25	$11.34	$23.31	$12.13	$6.18
21	15.84	8.24	4.20	42.83	22.28	11.35	23.69	12.32	6.28
22	16.19	8.42	4.29	42.89	22.31	11.37	24.08	12.53	6.39
23	16.57	8.62	4.40	42.94	22.33	11.38	24.48	12.73	6.49
24	16.96	8.82	4.50	43.00	22.36	11.40	24.91	12.96	6.61
—25—	17.37	9.04	4.61	43.05	22.39	11.41	25.35	13.19	6.72
26	17.80	9.26	4.72	43.12	22.43	11.43	25.80	13.42	6.84
27	18.26	9.50	4.84	43.20	22.47	11.45	26.27	13.66	6.97
28	18.73	9.74	4.97	43.27	22.50	11.47	26.76	13.92	7.10
29	19.24	10.01	5.10	43.36	22.55	11.49	27.27	14.18	7.23
—30—	19.77	10.28	5.39	43.46	22.60	11.52	27.80	14.46	7.37
31	20.33	10.58	5.24	43.57	22.66	11.55	28.36	14.75	7.52
32	20.92	10.88	5.55	43.69	22.72	11.58	28.94	15.05	7.67
33	21.54	11.20	5.71	43.81	22.79	11.61	29.53	15.36	7.83
34	22.20	11.55	5.89	43.97	22.87	11.66	30.16	15.69	8.00
—35—	22.90	11.91	6.07	44.13	22.95	11.70	30.83	16.04	8.17
36	23.63	12.29	6.27	44.31	23.05	11.75	31.51	16.39	8.35
37	24.40	12.69	6.47	44.52	23.15	11.80	32.22	16.76	8.54
38	25.23	13.12	6.69	44.75	23.27	11.86	32.97	17.15	8.74
39	26.11	13.58	6.92	45.00	23.40	11.93	33.76	17.56	8.95
—40—	27.03	14.06	7.17	45.30	23.56	12.01	34.59	17.99	9.17
41	28.01	14.57	7.43	45.62	23.73	12.09	35.46	18.44	9.40
42	29.05	15.11	7.70	45.99	23.92	12.19	36.38	18.92	9.64
43	30.16	15.69	8.00	46.40	24.13	12.30	37.35	19.43	9.90
44	31.35	16.31	8.31	46.87	24.38	12.42	38.37	19.96	10.17
—45—	32.60	16.96	8.64	47.39	24.65	12.56	39.45	20.52	12.17
46	33.94	17.65	9.00	47.97	24.95	12.72	40.59	21.11	10.46
47	35.36	18.39	9.37	48.63	25.29	12.89	41.81	21.75	10.76
48	36.88	19.18	9.78	49.37	25.68	13.09	43.10	22.42	11.08
49	38.50	20.02	10.21	50.19	26.10	13.30	44.47	23.13	11.43
—50—	40.24	20.93	10.67	51.11	26.58	13.55	45.92	23.88	11.79
51	42.08	21.89	11.16	52.13	27.11	13.82	47.48	24.69	12.59
52	44.03	22.90	11.67	53.25	27.69	14.12	49.13	25.55	13.02
53	46.13	23.99	12.23	54.51	28.35	14.45	50.88	26.46	13.49
54	48.37	25.16	12.82	55.89	29.07	14.81	52.77	27.44	13.99
—55—	50.75	26.39	13.45	57.43	29.87	15.22	54.79	28.49	14.52
56	53.29	27.71	14.13	59.13	30.75	15.67	56.96	29.62	15.10
57	56.02	29.13	14.85	61.00	31.72	16.17	59.28	30.83	15.71
58	58.91	30.64	15.62	63.05	32.79	16.71	61.76	32.12	16.37
59	62.03	32.26	16.44	65.32	33.97	17.31	64.44	33.51	17.08
—60—	65.41	34.02	17.34	67.82	35.27	17.98	67.33	35.02	17.85

692. The *Endowment Policy* requires premiums to be paid for a stated number of years or until the death of the insured, the benefit to be paid at the end of the stated time or upon the death of the insured.

693. *Mutual Policies* are those issued by mutual insurance companies which permit the insured to participate in the profits of the business, thereby reducing the rate of premium.

694. The *Surrender Value* is the amount that the company will pay upon surrender of the policy.

695. To find the *Annual Premium* on $1000 consult the preceeding table.

EXAMPLE: A man 29 years of age takes out a 20 annual payment policy for $5000.   What annual premium does he pay?

29 yrs. and 20 annual payments = $27.27 premium.
$27.27 × 5 = $136.35, annual premium on $5000.

PRACTICAL PROBLEMS

696. Solve the following:

1.   What will be the annual premium on an ordinary life policy for $2000 at the age of 42 years?

2.   A man takes out a 20 year endowment policy at the age of 30 years for $4000.   What annual rate will he pay?

3.   What will a limited 20 payment life policy for $6000 cost me annually if taken at the age of 25 years?

4.   A, at the age of 32 years, had his life insured for $1000 under the ordinary life plan.   If he had died at the age of 54 years, how much more would his heirs receive than had been paid in?

5.   Wishing to take out insurance at the age of 27 years, I decided to adopt the 20 year endowment plan.   If the face of the policy was $2500, what would the total insurance cost me?

6.   What will be the excess received over that paid to the heirs of one who at the age of 40 takes out a limited 20 payment life policy for $10000, and dies at the age of 70?

7.   What is the difference in cost of a 20 year endowment policy for $3000 at the age of 37 years, and a 20 payment policy for the same amount, at the same age?

8.   The Metropolitan Life Insurance Company issues an ordinary life policy for John Jones, aged 22 years, for $5000.   If the heirs received $4433.35 more than had been paid in, how old was the insured at the time of his death?

9.   The New York Life Insurance Company issued a 20 year endowment policy to a man aged 45 years.   If he dies at the age of 57 years and his heirs receive $1431.32 more than has been paid to the company, what was the face of the policy?

10.   The Equitable Life Insurance Company issues a 20 payment life policy for $25000 to a person who lived long enough to pay 15 annual premiums amounting to $17220.   What was the age of the insured at the time of his death?

Outline for Review

V. *Stocks and Bonds:*
1. Corporation.
2. Articles of Incorporation.
3. Capital Stock.
4. Stocks, Certificates.
5. Par Value, Market Value.
6. Premium, Discount.
7. Installment, Assessment, Dividend.
8. Bonds, Registered Bonds, Coupon Bonds.
9. Treasury Stock, Preferred Stock, Watered Stock.
10. Cases.

VI. *Taxes:*
1. Definitions.
2. Property Tax, Poll Tax.
3. Real Estate, Personal Property.
4. Assessor, Tax Colector.
5. Collection.
6. Assessment Roll.

VII. *U. S. Customs or Duties:*
1. Definitions.
2. Custom House, Port of Entry.
3. Manifest, Clearance.
4. Advalorem Duty, Specific Duty.
5. Tare, Leakage, Breakage.
6. Gross Weight, or Gross Value.
7. Net Weight, or Net Value.

VIII. *Insurance:*
1. Definitions.
2. Fire, Marine, Accident, Health.
3. Insurer, Insured.
4. Policy, Premium.
5. Mutual and Non-Mutual Companies.
6. Life Insurance.
7. Beneficiary.
8. Kinds of Policies.
9. Surrender Value.

INTEREST

697. *Interest* is the sum paid for the use of money or other value.

698. There are *three* methods of computing interest:

      1. By Simple Interest.

      2. By Periodic Interest.

      3. By Compound Interest.

699. All of these methods require the element of *time* in addition to the regular elements of Percentage.

700. The **Principal** is the money or value for which interest is paid.

701. The **Rate of Interest** is the amount paid for the use of $1 for 1 year.

702. The **Time** is the period for which the interest is computed.

703. The **Amount** is the sum of the principal and interest.

704. **Legal Interest** is the rate of interest established by law.

705. **Usury** is a higher rate than the law allows.

706. Since interest is computed at a certain rate per cent., the cases of Percentage apply, and the additional element of time is added.

707. The elements are as follows:

      1. The *Principal = Base.*

      2. The *Interest = Percentage.*

      3. The *Rate of Interest = Rate.*

      4. The *Amount = Principal + Interest.*

      5. The *Time.*

In computing *Common Interest*, 360 days are considered a year, and 30 days a month. In computing *Exact Interest*, 365 days are considered a year.

Simple Interest

708. *Simple Interest* is interest on the principal only for the given time and rate.

CASE I

709. Given, the **Principal, Time, and Rate** to find the *Interest.*

710. *Three Methods* of finding simple interest are given in this work. 1. Cancellation Method. 2. Six Per Cent. Method. 3. Bankers' Method.

For *Cancellation Method* turn to page 55 of this book.

Six Per Cent. Method

711. In the **Six Per Cent. Method,** 12 months of 30 days each, or 360 days constitute a year. The analysis of the method is as follows :

FOR YEARS :

The interest on \$1 for 1 year or 12 months at $6\% = \$.06$.
Therefore, to find the interest on \$1 for years, multiply \$.06 by the number of years.

FOR MONTHS :

The interest on \$1 for 2 months $= \frac{1}{6}$ of \$.06 or \$.01.
Therefore, to find the interest in cents on \$1 for months, divide the number of months by 2.

FOR DAYS :

The interest on \$1 for 1 month or 30 days $= \frac{1}{2}$ of \$.01 or \$.005.
The interest on \$1 for 6 days $= \frac{1}{5}$ of \$.005 or \$.001.
Therefore, to find the interest in mills on \$1 for days, divide the number of days by 6.

SUMMARY :

\$.06 $\times$ No. of years $=$ Int. on \$1 expressed in cents.
No. of months $\div$ 2 $=$ Int. on \$1 expressed in cents.
No. of days $\div$ 6 $=$ Int. on \$1 expressed in mills.

EXAMPLE: Find the interest on $200 for 4 years 8 months 12 days at 6%.

$.06 × 4, number of years = $.24   int. on $1 for 4 years.
8 months ÷ 2   =   .04   int. on $1 for 8 months.
12 days ÷ 6   =   .002 int. on $1 for 12 days.
                              $.282 int. on $1 for whole time.

$.282 × $200 = $56.40 total interest.

712. If the rate per cent. is other than 6% take ⅙ of the interest at 6% and multiply by the rate required.

PRACTICAL PROBLEMS

713. Solve the following by 6% method:

1. Find the interest on $1 for 2 yrs. 10 mo. 15 ds. at 6%.

2. Find the interest on $400 for 1 yr. 6 mo. 24 ds. at 6%.

3. Find the interest on $750 for 5 yrs. 4 mo. 27 ds. at 6%.

4. Find the interest on $960 for 3 yrs. 3 mo. 3 ds. at 6%.

5. Find the interest on $1500 for 4 yrs. 11 mo. 23 ds. at 6%.

6. Find the interest on $3000 for 3 yrs. 8 mo. 21 ds. at 7%.

7. Find the interest on $5000 for 7 yrs. 7 mo. 7 ds. at 7%.

8. Find the amount of $720 on interest for 2 yrs. 5 mo. 12 ds. at 6%.

9. A note for $540 draws interest for 9 mo. 18 ds. at 8%. What is the amount due?

10. My note for $1000 at 9% has been running 1 yr. 10 mo. 21 ds. If I have already paid the interest for 6 months, what amount will now be due?

Bankers' Method

714. The **Bankers' Method** of computing interest is based upon the fact that by pointing off two places (dividing by 100) in the principal, the result will be the interest at any rate for as many days as the rate is contained in 360, the number of days in a year.

715. By pointing off two places the interest on any principal is found :

> At 2% for 180 days, the basis of time at 2%.
> At 3% for 120 days, the basis of time at 3%.
> At 4% for 90 days, the basis of time at 4%.
> At 5% for 72 days, the basis of time at 5%.
> At 6% for 60 days, the basis of time at 6%.
> At 8% for 45 days, the basis of time at 8%.
> At 9% for 40 days, the basis of time at 9%.
> At 10% for 36 days, the basis of time at 10%.
> At 12% for 30 days, the basis of time at 12%.
> At 15% for 24 days, the basis of time at 15%.
> At 18% for 20 days, the basis of time at 18%.
> At 20% for 18 days, the basis of time at 20%.
> At 24% for 15 days, the basis of time at 24%.

716. To find the interest at 7%, increase the interest at 6% by $\frac{1}{6}$ of itself. To find the interest at 11%, increase the interest at 10% by $\frac{1}{10}$ of itself.

717. To find the interest for any number of days, *increase* or *decrease* the interest for the *basis* of time by using aliquot parts.

718. The *Bankers' Method* is particularly adapted to short periods of time, and is not recommended except when the time is expressed in days.

EXAMPLE : Find the interest on $450 for 36 days at 6%.

Pointing off two places = $4.50 interest for 60 days at 6%.

> $\frac{1}{2}$ of $4.50 = $2.25 interest for 30 days.
> $\frac{1}{5}$ of $2.25 = ___.45 interest for 6 days.
> $2.70 interest for 36 days.

EXAMPLE : Find the interest on $960 for 108 days at 8%.

Pointing off two places = $9.60 interest for 45 days at 8%.

> Multiplying $9.60 by 2 = $19.20 interest for 90 days.
> $\frac{1}{3}$ of $9.60 = 3.20 interest for 15 days.
> $\frac{1}{5}$ of $3.20 = ___.64 interest for 3 days.
> $23.04 interest for 108 days.

NOTE--Notice that Aliquot parts are prominent in much of the above work.

719. Solve the following by Bankers' Method;

1. Find the interest on $342 for 33 days at 6%.
2. Find the interest on $175 for 27 days at 6%.
3. Find the interest on $924 for 54 days at 8%.
4. Find the interest on $3000 for 78 days at 5%.
5. Find the interest on $2150 for 126 days at 9%.
6. Find the interest on $215.60 for 88 days at 10%.
7. Find the interest on $321.75 for 37 days at 12%.
8. Find the interest on $810 for 76 days at 7%.
9. Find the interest on $1350 for 111 days at 11%.
10. Find the interest on $427.20 for 48 days at 4½%.

CASE II

720. Given, the **Interest, Rate,** and **Time** to find the *Principal.*

Use the cancellation method as indicated below. The Interest will be the dividend and the Time multiplied by the Rate the divisor.

FORMULA: Interest ÷ Rate × Time expressed in years = Principal.

EXAMPLE: The interest is $2.80, the time 35 days, and the rate 6%. What is the principal?

$$\begin{array}{c|c} & (\$\ \ ),\ \text{principal} \\ \overset{60}{\cancel{360}}\ \text{ds.} & \overset{}{\cancel{35}}\ \text{ds., time} \\ \text{Int.,}\ \overset{8}{\cancel{\$2.80}} & \cancel{.06},\quad \text{rate} \\ \end{array}$$
$$60 \times \$8 = \$480 = \text{Principal.}$$

721. Solve the following by cancellation method:

1. What principal will produce an interest of $300 in 48 ds., at 6%?

2. An interest of $8.26 in 59 ds. at 7%?

3. An interest of $29.10 in 97 ds. at 9%?

4. An interest of $8.55 in 114 ds. at 5%?

5. An interest of $4.62 in 3 mo. 9 ds. at 6%?

6. An interest of $58 in 1 yr. 2 mo. 15 ds. at 8%?
7. An interest of $214.20 in 2 yrs. 6 mo. 18 ds. at 7%?
8. An interest of $43.08⅓ in 1 yr. 5 mo. 7 ds. at 6%?
9. An interest of $84.50 in 39 ds. at 4%?
10. An interest of $2133.60 in 320 ds. at 10%?

CASE III

722. Given the **Interest, Principal,** and **Time** to find the *Rate.*

Use the cancellation method as indicated below. The Interest will be the dividend, and the Principal multiplied by the Time the divisor.

FORMULA: Int. ÷ Prin. × Time expressed in yrs. = Rate.

EXAMPLE: At what rate will $450 gain $26.25 in 10 mo.?

$$
\begin{array}{r|l}
\cancel{2} & \cancel{75} \\
\cancel{12} & \$\cancel{4.50} \\
^7\,\cancel{5.25} & \cancel{5} \\
\$\cancel{26.25} & \cancel{10} \\
\end{array}
$$

7%, Ans.

723. Solve the following:

1. At what rate per cent. will $540 gain $3.15 in 35 ds.?
2. Will $1170 gain $54.60 in 7 mo.?
3. Will $510 gain $61.20 in 1 yr. 6 mo.?
4. Will $825 gain $9.90 in 1 mo. 24 ds.?
5. Will $1260 gain $52.92 in 7 mo. 6 days?
6. Will $47.50 gain $4.94 in 1 yr. 3 mo. 18 ds.?
7. Will $325.50 gain $24.52 in 11 mo. 9 ds.?
8. Will $1350 gain $36.45 in 216 ds.?
9. Will $2500 gain $475 in 171 ds.?
10. Will $8000 gain $810 in 1 yr. 4 mo. 6 ds.?

CASE IV

724. Given, the **Interest, Principal,** and **Rate** to find the *Time.*

Use the cancellation method as indicated in the following solution. The Interest will be the dividend and the Principal multiplied by the Rate the divisor.

FORMULA: Int. ÷ Prin. × Rate = Time.

EXAMPLE: In what time will \$720 produce \$7.92 interest at 6%?

$$\begin{array}{r|l}
 & 2 \\
360 \text{ ds.} & \$720 \\
66 & (\quad) \\
132 & \\
\text{Int., }\$7.92 & .06 \\
\hline
\end{array}$$
66 ds., Ans.

Also:
$$\begin{array}{r|l}
 & 10 \\
12 \text{ mo.} & 60 \\
2.2 & \$720 \\
1.32 & (\quad) \\
\$7.92 & .06 \\
\hline
\end{array}$$
2.2 mo., or 2 mo. 6 ds., Ans.

725. Solve the following:

1.   In what time will \$320 earn \$12.80 interest at 6%?
2.   Will \$480 earn \$6.16 interest at 6%?
3.   Will \$580 earn \$5.80 interest at 8%?
4.   Will \$780 earn \$32.76 interest at 7%?
5.   Will \$960 earn \$18.80 interest at 5%?
6.   Will \$1200 earn \$139.50 interest at 9%?
7.   Will \$1400 earn \$119.70 interest at 6%?
8.   Will \$2100 earn \$338.10 interest at 7%?
9.   Will \$4500 earn \$175.50 interest at 4½%?
10.   Will \$18680 earn \$700.50 interest at 7½%?

CASE V

726. Given, the **Amount, Rate,** and **Time** to find the *Principal.*

Divide the given Amount by the amount of \$1 for the given Time and Rate.

FORMULA: Amt. ÷ \$1 + (Rate × Time) = Prin.

EXAMPLE: What principal will amount to \$430.50 in 5 mo. at 6%?

\$1.00 × .06 × 5/12 yr. = .02½, Int. on \$1 for 5 mo.
\$1.00 + .02½ = \$1.025, Amt. of \$1 for 5 mo.
\$430.50 ÷ \$1.025 = \$420, Prin., Ans.

727. Solve the following:

1.   What principal will amount to \$250.80 in 9 mo. at 6%?
2.   Will amount to \$333.25 in 1 yr. 3 mo. at 6%?
3.   Will amount to \$520.53 in 2 yr. 5 mo. at 8%?
4.   Will amount to \$675.08 in 33 ds. at 5%?

5. Will amount to 4113.90 in 71 ds. at 8%?
6. Will amount to $1313.27 in 3 mo. 22 ds. at 9%?
7. Will amount to $2374.50 in 1 yr. 4 mo. 18 ds. at 4%?
8. Will amount to $5262.60 in 2 yr. 1 mo. 21 ds. at 4½%?
9. Will amount to $7656.25 in 75 ds. at 10%?
10. Will amount to 12977.50 in 1 yr. 1 mo. 1 da. at 7½%?

Exact Interest

728. Exact Interest is the interest on any sum when the time is computed on the basis of 365 days to the year, or the *exact* year. In leap years 366 days is the basis of *exact interest*.

729. The interest for whole years is the same as in common interest, therefore the exact method applies only when the time is less than a year expressed in days.

730. In ordinary business transactions this method is seldom used but is strictly legal.

731. The cancellation method of computing *exact interest* is recommended, but it can also be found by deducting $\frac{1}{73}$ from the common interest, as the 5 days difference in the exact and common years is $\frac{5}{365}$ or $\frac{1}{73}$.

EXAMPLE: Find the exact interest on $540 for 146 days at 6%.

$$\begin{array}{r} 9 \\ \$5\cancel{4}\cancel{0} \\ \cancel{6} \quad 146 \\ 3\cancel{60} \quad .\cancel{0}6 \\ \hline 73)\,\$13.14 \text{ Common Int.} \\ .18 \\ \hline \$12.96 \text{ Exact Int.} \end{array}$$

Or,

$$\begin{array}{r} 108 \\ \$5\cancel{4}\cancel{0} \\ 3\cancel{65} \quad 1\cancel{46}\,^2 \\ \cancel{73} \quad .06 \\ \hline \text{Ext. Int., } \$12.96, \text{ Ans.} \end{array}$$

732. Solve the following:

1. Find the exact interest of $730 for 33 ds. at 6%.
2. Of $1095 for 42 ds. at 7%.
3. Of $292 for 45 ds. at 8%.
4. Of $80.30 for 77 ds. at 5%.
5. Of $500 for 90 ds. at 6%.
6. Of $1200 for 110 ds. at 9%.
7. Of $1800 for 132 ds. at 4%.

8.   Of \$3000 for 219 ds. at $4\frac{1}{2}\%$.

9.   Of \$4380 for 134 ds. at 10%.

10.   Of \$549 for 256 days of a leap year at $7\frac{1}{2}\%$.

Annual, Semi-Annual, and Quarterly Interest

733.   **Annual Interest** is the simple yearly interest on the principal, and the simple interest on such interest remaining unpaid.

734.   **Semi-Annual Interest** is the simple half-yearly interest on the principal, and the simple interest on such interest remaining unpaid.

735.   **Quarterly Interest** is the simple quarterly interest on the principal, and the simple interest on such interest remaining unpaid.

736.   Given, the **Principal, Rate,** and **Time** to find the *Annual, Semi-Annual*, and *Quarterly Interest*.

1.   Find the interest on the principal for the whole time.

2.   Find the interest on the interest for the year, half year, or quarter for the total time that the interest payments are delinquent.

3.   The interest due will be the sum of the interest on the principal and the interest on the unpaid interest.

EXAMPLE: Find the amount due on a note for \$1200 dated July 10, 1904 and paid October 25, 1907, at 6%, interest to be paid annually.

	Yr.	Mo.	Da.
October 25, 1907 =	1907	10	25
July 10, 1905 =	1904	7	10
Dif. in time =	3	3	15

a. Simple int. on \$1200 for 3 yr. 3 mo. 15 ds. at 6% = \$237.

b. Simple annual int. on \$1200 at 6% = \$72.

	Yr.	Mo.	Ds.
Int. on \$72 due end of 1st yr. runs	2 yr.	3 mo.	15 ds.
Int. on \$72 due end of 2d yr. runs	1 yr.	3 mo.	15 ds.
Int. on \$72 due end of 3d yr. runs		3 mo.	15 ds.
Total int. on \$72 runs	3 yr.	10 mo.	15 ds.

c. Int. on \$72 for 3 yr. 10 mo. 15 ds. = \$16.74.

d. Int. on Prin. \$237 + \$16.74 = \$253.74 total annual int.

e. Prin., \$1200 + Int., \$253.74 = Amt. due, \$1453.74, Ans.

737. Solve the following :

1. Find the total interest, payable annually, on $900 for 4 yrs. 6 mo. at 6%.

2. Annually, on $1500 for 5 yrs. 4 mo. at 6%.

3. Annually, on $1800 for 3 yrs. 7 mo. 12 ds. at 6%.

4. Annually, on $2400 for 5 yrs. 9 mo. 27 ds. at 8%.

5. Semi-annually, on $600 for 2 yrs. at 8%.

6. Semi-annually, on $1050 for 1 yr. 9 mo. at 8%.

7. Semi-annually, on $4500 for 3 yrs. 2 mo. 10 ds. at 6%.

8. Quarterly, on $300 for 1 yr. 5 mo. at 8%.

9. Quarterly, on $2000 for 2 yrs. 1 mo. 15 ds. at 10%.

10. Quarterly, on $4200 for 3 yrs. 3 mo. 3 ds. at 7%.

Questions for Review

1. Define Interest. Principal. Rate. Time. Amount.

2. What three methods are used in computing Interest?

3. What is Legal Interest? Usury?

4. What is Simple Interest?

5. Explain the Six Per Cent. Method of finding interest.

6. Explain the Bankers' Method of finding interest?

7. Write the formulæ for finding the different elements in the problems of Interest.

8. What is Exact Interest? How much less is it than Common Interest? Why?

9. What is meant by Annual, Semi-Annual, and Quarterly Interest?

10. Describe the correct method of finding Annual, Semi-Annual, and Quarterly Interest?

Compound Interest

738. *Compound Interest* is the interest on the principal and also upon the unpaid interest when due.

739. In computing compound interest the interest for a certain period when due is added to the principal, and this amount is the new principal for the next period.

740. The *Period* of computation may be yearly, semi-annually, or quarterly as agreed upon. Compound interest is not lawful except upon specific contract.

741. Given, the *Principal, Rate,* and *Time* to find the *Compound Interest.*

Find the amount of the principal for the first period; this amount will be the principal for the second period; continue in like manner for the full time. The final amount less the first principal will be the compound interest.

EXAMPLE: Find the interest of $400 for 3 yr. 4 mo. 24 ds. at 6%, compounded annually.

$$
\begin{array}{rl}
\$400.00 = & \text{Principal.} \\
\underline{24.00} = & \text{Int. on \$400 for 1 yr. at 6\%.} \\
424.00 = & \text{Amt. at close of first year.} \\
\underline{25.44} = & \text{Int. on \$424 for 2d year.} \\
449.44 = & \text{Amt. at close of 2d year.} \\
\underline{26.97} = & \text{Int. on 3d principal.} \\
476.41 = & \text{Amt. at close of 3d year.} \\
\underline{11.43} = & \text{Int. for 4 mo. 24 ds.} \\
487.84 = & \text{Amt. at close of time.} \\
\underline{400.00} = & \text{First principal.} \\
\$87.84 = & \text{Compound interest, Ans.}
\end{array}
$$

742. Solve the following:

1. Find the interest compounded annually on $600 for 2 yrs. at 6%.

2. Annually on $1000 for 4 yrs. at 6%.

3. Annually on $1200 for 6 yrs. at 8%.

4. Annually on $2100 for 10 yrs. at 10%.

5. Semi-annually on $1500 for 2 yrs. 6 mo. at 6%.
6. Semi-annually on $5400 for 4 yrs. 9 mo. at 7%.
7. Semi-annually on $7200 for 8 yrs. 8 mo. 15 ds. at 6%.
8. Quarterly on $900 for 1 yr. 8 mo. 12 ds. at 8%.
9. Quarterly on $1300 for 2 yrs. 2 mo. 3 ds. at 10%.
10. Quarterly on $2000 for 5 yrs. 5 mo. 6 ds. at 6%.

743. The computation of compound interest is greatly abbreviated by using the following table :

744. To use the table, multiply the amount of $1 for the number of periods at the given rate, by the given principal ; the result will be the amount of the principal for the whole periods. Interest for additional time is added as usual.

NOTE—For semi-annual interest, double the years and take half the annual rate. For quarterly interest, take four times the years and one-fourth the annual rate.

COMPOUND INTEREST TABLE

Showing the amount of $1 at compound interest at various rates of interest for specified periods.

Yr	2½ per ct.	3 per ct.	3½ per ct.	4 per ct.	5 per ct.	6 per ct.
1	1.025000	1.030000	1.035000	1.040000	1.050000	1.060000
2	1.050625	1.060900	1.071225	1.081600	1.102500	1.123600
3	1.076891	1.092727	1.108718	1.124864	1.157625	1.191016
4	1.103813	1.125509	1.147523	1.169859	1.215506	1.262477
5	1.131408	1.159274	1.187686	1.216653	1.276282	1.338226
6	1.159693	1.194052	1.229255	1.265319	1.340096	1.418519
7	1.188686	1.229874	1.272279	1.315932	1.407100	1.503630
8	1.218403	1.266770	1.316809	1.368569	1.477455	1.593848
9	1.248863	1.304773	1.362897	1.423312	1.551328	1.689479
10	1.280085	1.343916	1.410599	1.480244	1.628895	1.790848
11	1.312087	1.384234	1.459970	1.539454	1.710339	1.898299
12	1.344889	1.425761	1.511069	1.601032	1.795856	2.012197
13	1.378511	1.469534	1.563956	1.665074	1.885649	2.132928
14	1.412974	1.512590	1.618695	1.731676	1.979932	2.260904
15	1.448298	1.557967	1.675349	1.800944	2.078928	2.396558
16	1.484506	1.604706	1.733986	1.872981	2.182875	2.540352
17	1.521618	1.652848	1.794676	1.947901	2.292018	2.692773
18	1.559659	1.702433	1.857489	2.025817	2.406619	2.854339
19	1.598650	1.753506	1.922501	2.106849	2.526950	3.025600
20	1.638616	1.806111	1.989789	2.191123	2.653298	3.207136

Yr	7 per ct.	8 per ct.	9 per ct.	10 per ct.	11 per ct.	12 per ct.
1	1.070000	1.080000	1.090000	1.100000	1.110000	1.120000
2	1.144900	1.166400	1.188100	1.210000	1.232100	1.254400
3	1.225043	1.259712	1.295029	1.331000	1.367631	1.404908
4	1.310796	1.360489	1.411582	1.464100	1.518070	1.573519
5	1.402552	1.469328	1.538624	1.610510	1.585058	1.762342
6	1.500730	1.586874	1.677100	1.771561	1.870414	1.973822
7	1.605781	1.713824	1.828039	1.948717	2.076160	2.210681
8	1.718186	1.850930	1.992563	2.143589	2.304537	2.475963
9	1.838459	1.999005	2.171893	2.357948	2.558036	2.773028
10	1.967151	2.158925	2.367364	2.593742	2.839420	3.105848
11	2.104852	2.331639	2.580426	2.853117	3.151757	3.478549
12	2.252192	2.518170	2.812665	3.138428	3.498450	3.895975
13	2.409845	2.719624	3.065805	3.452271	3.883279	4.363492
14	2.578534	2.937194	3.341727	3.797498	4.310440	4.887111
15	2.759031	3.172169	3.642482	4.177248	4.784588	5.473565
16	2.952164	3.425943	3.970306	4.594973	5.310893	6.130392
17	3.158815	3.700018	4.327633	5.054470	5.895091	6.866040
18	3.379932	3.996019	4.717120	5.559917	6.543551	7.689964
19	3.616527	4.315701	5.141661	6.115909	7.263342	8.612760
20	3.869684	4.660957	5.604411	6.727500	8.062309	9.646291

PRACTICAL PROBLEMS

1.   Find, by using the table, the compound interest of $1050 for 1 yr. 5 mo. 24 ds. at 10%, interest payable quarterly.

2.   Of $1500 for 7 yrs. 3 mo. 15 ds., interest at 6%, payable semi-annually.

3.   Of $2700 for 17 yrs. 7 mo. 7 ds., interest at 7%, payable annually.

4.   Of $5400 for 24 yrs. 11 mo. 11 ds., at 11%, interest payable annually.

5.   Of $12000 for 18 yrs. 8 mo. 6 ds., at 10%, interest payable semi-annually.

Commercial Paper

745. *Commercial Paper* is the written promise or request to pay money.

746. There are *two classes* of Commercial Paper, viz:

I. PROMISE TO PAY:
    1. Promissory Notes.
    2. Bonds.
    3. Paper Currency.

II. REQUESTS TO PAY:
    1. Orders.
    2. Personal Drafts.
    3. Bank Checks.
    4. Bank Drafts.
    5. Bills of Exchange.
    6. Letters of Credit.

747. A *Promissory Note* is the written promise of one or more individuals to pay a certain sum at a specified time.

Promissory Note Payable on Demand.

Promissory Note Payable in Gold Coin

Promissory Firm Note Payable at Bank.

Promissory Joint Note Payable at Bank.

748. A **Bond** is the promissory note of a government, state, or corporation.

749. Paper Currency is the promissory notes of the government, or of a national bank, to pay to *bearer* on demand the sum specified, and is of four kinds, viz:

1. National Treasury Notes (Greenbacks).
2. National Bank Notes.
3. Government Silver Certificates.
4. Government Gold Certificates.

750. An **Order** is the informal written request of one person upon another to pay a third party a certain sum.

751. A **Personal Draft** is a formal *order* and is definite in time, amount, and other conditions.
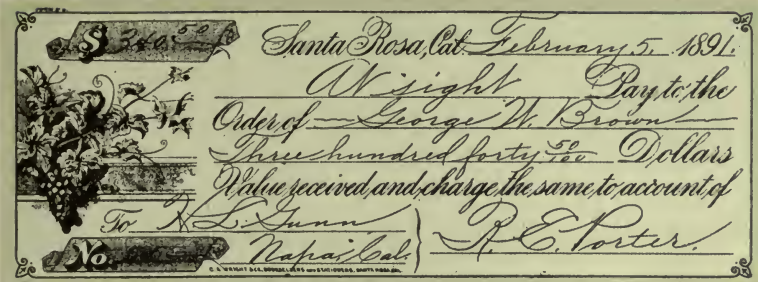
Personal Sight Draft.
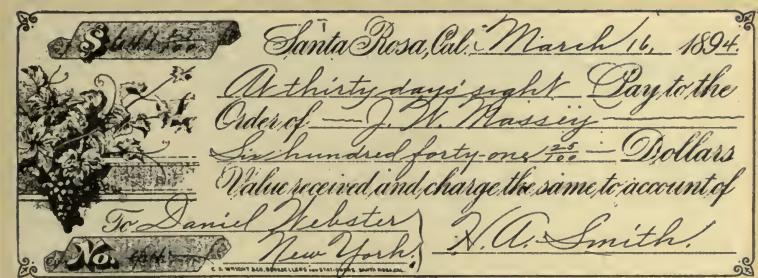
Personal Time Draft

NOTE—DRAFTS are sometimes called "Domestic Bills of Exchange" to distinguish from Foreign Bills of Exchange

752. A **Bank Check** is an order on a bank to pay a certain sum at sight.
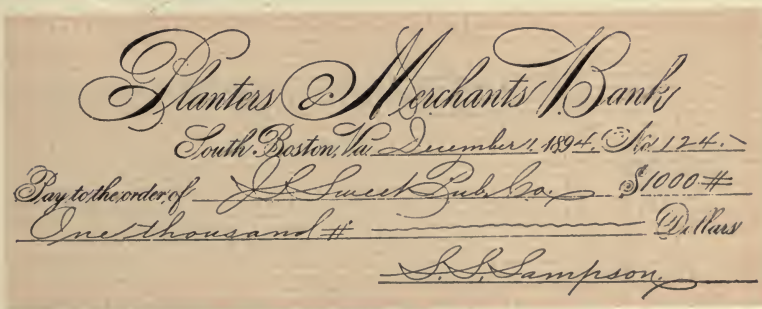
Bank Check
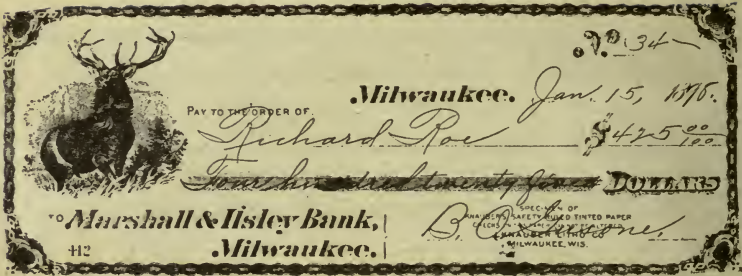
Draft Form of a Bank Check

753. A **Bank Draft** is the order of one bank on another bank to pay a certain sum either at sight or at a specified time.
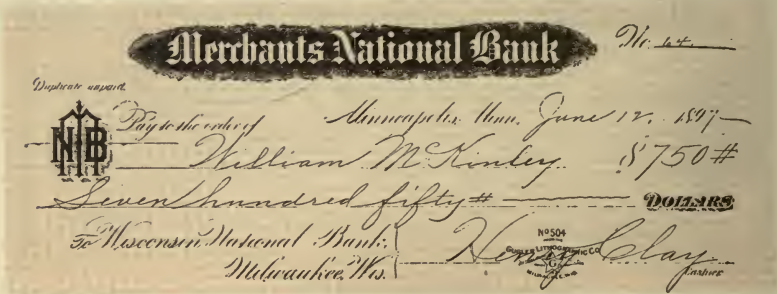
Bank Draft

754. A **Bill of Exchange** is a bank draft on a bank located in a foreign country.

755. A **Letter of Credit** is a bill of exchange authorizing certain banks to pay to the holder any sum not exceeding a certain amount.
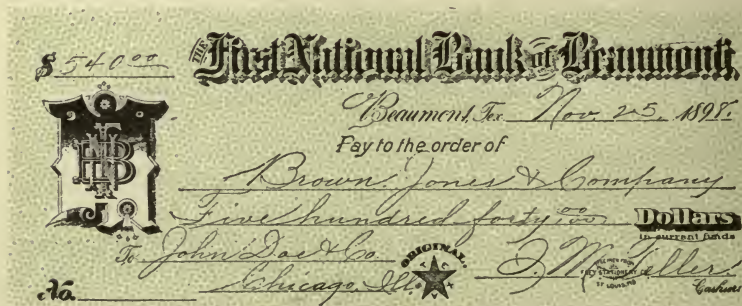
A Bank Draft on a Business House

756. A *Cashier's Check* is the check of the cashier of a bank, and when desired, is given instead of currency.

Cashier's Check.
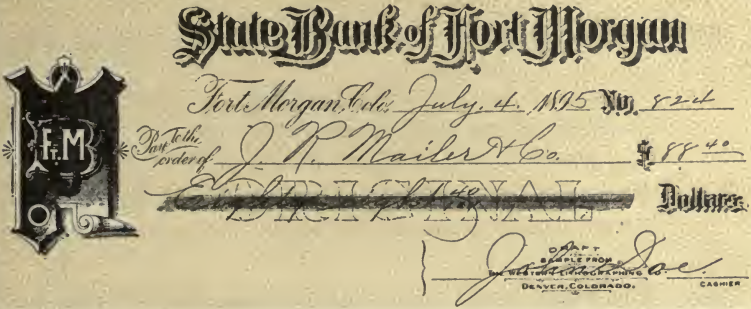
Another Form of Cashiers Check.

757. A *Certificate of Deposit* states that the depositor has a certain amount of cash in the bank which he may draw out upon conforming with the requirements of the certificate.

Certificate of Deposit.

758. A **Receipt** is the written acknowledgment of the payment of a debt or of the delivery of goods.
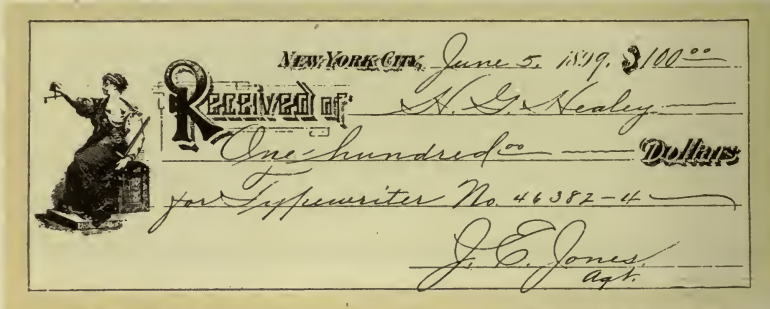
Form of Receipt.

759. An **Indorsement** is a writing on the back of commercial paper for the purpose of:

    1.   Acknowledging a partial payment.
    2.   Making the paper transferable.
    3.   Guaranteeing its payment.

760. **Negotiable Paper** is commercial paper that can be transferred and usually contains the words ''to order,'' or ''to bearer.''

761. The **Face** of the note or draft is the sum for which it is written.

762. The **Maker** of a note is the one who promises to pay; the one who signs it.

763. The **Drawer** of a note is the one who orders another to pay; the one who signs it.

764. The **Payee** is the one to whom the money is to be paid.

765. The **Drawee** of a draft is the one who is ordered to pay.

766. The **Indorser** is the one who writes his name on the back of the paper.

767. Commercial paper *matures* upon the day it legally becomes due. If it becomes due upon Sunday or any other legal holiday, it matures on the next business day following.

768. Three **Days of Grace** were once granted by law, but in most states are not now allowed.

769. To **Accept** a draft is to write the word ''*accepted*'' with date and signature of drawee across the face of it. It then becomes his written promise to pay.

770. An **Acceptance** is a draft that has been *accepted*.

771. **Sight Drafts** are payable on demand, and *time drafts* are payable at a specified time *after sight*.

772. To **Honor** a draft is to pay it or to accept it.

773. *Promissory Notes* may be payable on demand or at a specified time. They may be individual or joint notes, and may or may not bear interest.

774. The **Legal Rate** of the state prevails when a note is '' *with interest*,'' and no rate specified, and *all* notes bear interest after maturity.

775. To Find the Amount Due on Commercial Paper.

Find the interest on the face of the paper for the given time and rate. The sum of the interest and face of the paper will be the amount due.

NOTE—To find the time a note WITH INTEREST has to run, compute the time from the date of the note to the date of settlement. If the note is WITHOUT INTEREST, compute the time from maturity to the date of settlement.

EXAMPLE: Find the amount June 25, 1908, of the following note:

$720 ※   *Chicago, Ill., January 10, 1907.*

Nine months after date I promise to pay Henry H. Howe, or order, Seven hundred twenty Dollars, with interest at six per cent. per annum.

                                         D. M. COOK.

```
          June 25, 1908 = 1908 yr.   6 mo.   25 ds.
          Jan. 10, 1907 = 1907 yr.   1 mo.   10 ds.
Time note has to run =       1 yr.   5 mo.   15 ds.

       $.0875  = Int. on $1.00 for 1 yr. 5 mo. 15 ds.
         720
         63.00 = Int. on $720 for 1 yr. 5 mo. 15 ds.
        720.00 = Face of Paper.
       $783.00 = Amt. due, Ans.
```

776. Find the amount due at settlement of the following :

1.

> $810 ※   *New York, N. Y., Apr. 20, 1907.*
>
>   *One year after date I promise to pay J. E. Olson Eight hundred ten Dollars, with interest at seven per cent.*
>
>   *G. H. MOORE.*

Settlement made July 1, 1908.

2.

> $1080 ※   *Los Angeles, Cal., Oct. 26, 1905.*
>
>   *Six months after date I promise to pay Henry Brayton, or order, Ten hundred eighty Dollars, with interest.*
>
>   *BYRON R. MARSH.*

Settlement made May 5, 1908.   Legal rate, 7%.

3.

> $420 ※   *San Francisco, Cal., Apr. 14, 1907.*
>
>   *One day after date I promise to pay E. P. Heald, or order, Four hundred twenty Dollars.*
>
>   *JOHN H. DOE.*

Settlement made July 1, 1908.

4.

> $2000 ※   *Milwaukee, Wis., Nov. 10, 1906.*
>
>   *Three months after date I promise to pay Geo. W. Peck, or order, Two thousand Dollars, without interest.*
>
>   *W. C. ROBERTS.*

Settlement made December 31, 1907.   Legal rate, 7%.

5.

> $642.60   *Detroit Mich , September 1, 1907.*
>
>   *Sixty days after date we promise to pay Arland & Co. Six hundred forty-two $\frac{60}{100}$ Dollars, with interest at eight per cent. per annum.*
>
>   *F. O. GARDINER & CO.*

Settlement made at maturity.

6.

$500 ※   *Cincinnati, Ohio., Feb. 4, 1905.*

One year after date I promise to pay P. R. Spencer, or order,
Five hundred Dollars, with interest at six per cent. per annum,
to be paid semi-annually, and if not so paid to draw interest until
settlement.

                              H. A. REID.

Settlement made October 25, 1907.

7.

$3000 ※   *Santa Rosa, Cal., Jan. 15, 1906.*

Two years after date I promise to pay the

SAVINGS BANK OF SANTA ROSA

Three thousand Dollars, with interest at eight per cent. per an-
num, payable quarterly, and if not so paid to bear interest until
settlement.

                              R. G. BRACKETT.

Settlement made at Maturity.

8.

$2400 ※   *Cedar Rapids, Iowa, June 10, 1906.*

Two years after date I promise to pay A. N. Palmer, or order,
Twenty-four hundred Dollars, with interest at six per cent., com-
pounded semi-annually.

                              E. Z. MARK.

Settlement made at maturity.

9.

$1000 ※   *Stockton, Cal., June 17, 1907.*

On demand after date, at three o'clock p. m., of that day, for
value received I promise to pay the order of the

Stockton National Bank, of Stockton, Cal.

One thousand Dollars, with interest from date at the rate of seven
per cent. per annum until paid, interest to be paid quarterly,
and if not so paid, to be added to the principal and bear the same
rate of interest until paid; both principal and interest payable in
Gold Coin of the United States.

                              G. L. GILMORE.

Settlement made December 5, 1908.

10.

$962\frac{75}{100}$ Chicago, Ill. Jan. 5, 1908.

January 5, 1909, without grace, for value received; I promise to pay to the order of   Ream & Bundle   the sum of Nine hundred sixty-two $\frac{75}{100}$ Dollars; with interest at the rate of six per cent. per annum, from date until paid, said Interest payable   quarterly   and if not paid as it becomes due, to bear the same rate of interest as the principal, until such interest is paid, both principal and interest payable in U. S. Gold Coin, and if suit is instituted to collect any part of the principal, or interest of this Note I agree that ten per cent. of the amount then due shall be added for attorney's fees.

No. 44   Robinson Crusoe.

What is due on the above note at maturity, the interest for the first quarter having been paid?

Questions for Review

1. Define Commercial Paper and classify its subdivisions.

2. What is a Promissory Note? Write one.

3. How does a Bond differ from a Promissory Note.

4. Describe and classify the different kinds of Paper Currency.

5. Describe the following: Order. Personal Draft. Bank Check. Bank Draft. Bill of Exchange. Letter of Credit.

6. How does a Cashier's Check differ from a Certificate of Deposit?

7. What are Indorsements, and for what purposes are they made?

8. Define: Negotiable Paper. Maker. Drawer. Payee. Drawee.

9. What is meant by ''Accepting a Draft,'' and what is an *accepted* draft called?

10. What is meant by '' Honoring a Draft ''? By Legal Rate?

Partial Payments

777. Partial Payments are payments in part on a note, bond, or other obligation to pay.

778. The **Acknowledgment** of a partial payment is usually made by a writing on the back of the note and is called an *Indorsement*. Acknowledgments of payments may also be written on a separate sheet of paper.

779. There are *two methods* in regular use in computing interest when partial payments have been made, viz: The "United States Method," and the "Merchants Method."

780. The **United States Method** is taken from the decision of the Supreme Court of the United States and prevails when appeal is made to the courts.

781. The **Merchants' Method** is in more common use as it is briefer and the interest more readily computed.

United States Method

782. In computing interest by the United States method, the following points must be observed :

1. *In computing time, find the time by compound subtraction from the date interest begins to the time of the first payment.*

2. *If the payment equals or exceeds the interest due, subtract the payment from the amount of the note and treat this difference as a new principal.*

3. *If the interest due is greater than the payment, continue the interest on the former principal until such time as the sum of the payments exceeds the interest due, then subtract the sum of the payments from the amount, and treat the result thus obtained as a new principal.*

4. *Find the amount of the last principal to the date of settlement.*

EXAMPLE: Find the amount due July 1, 1908:

Indorsed as follows:

SOLUTION:

Face of note, first principal	$600.00
Int. to Oct. 16, 1907, 3 mo. 15 ds.	10.50
Amount	610.50
Payment	40.50
Second principal	$570.00
Int. on 2d prin. to Jan. 10, 1908, 2 mo. 24 ds.	7.98
Amount	577.98
Payment	77.98
Third principal	$500.00
Int. on 3d prin. to Apr. 1, 1908, 2 mo. 21 ds. $6.75	
Int. on 3d prin. to June 1, 1908, 2 mo. 5.00	
	11.75
Amount.	511.75
Sum of payments $5.00 + $26.75	31.75
Fourth principal	$480.00
Int. to July 1, 1908, 1 mo.	2.40
Amount due	$482.40

783.   Find the amount due at settlement of the following, the indorsements of each note will be found on page 220 :
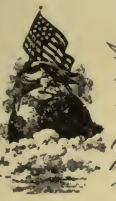
1.

$1200.00   Fresno, Cal. April 10, 1907.

One year after date, without grace, I promise to pay to the order of A. G. Healey

Twelve hundred & ———— Dollars for value received with interest at six per cent per annum from April 10, 1907, until paid, both principal and interest payable, only in UNITED STATES GOLD COIN.

No. 5   Payable Apr. 10 '08.   A. B. Chapin.

Settlement made at maturity.

2.

$1800.00   Santa Rosa, Cal. October 5, 1907.

Two years after date, without grace, we promise to pay to the order of J. J. Sweet & Co.

Eighteen hundred & ———— Dollars for value received with interest at six per cent per annum from October 5, 1907, until paid, both principal and interest payable, only in UNITED STATES GOLD COIN.

No. 6   Payable Oct. 5, 1909.   D. E. Finley.

What was due at maturity?

3.

$450   Fergus Falls, Minn. July 1, 1907.

Eighteen months after date we promise to pay to the order of John R. Gregg

Four hundred fifty ———— Dollars with interest at eight per cent per annum

Value received

No. 16   Due Jan. 1, '09.   G. H. Ennis & Co.

What was due January 1, 1608?

Paid on this note
Sept. 19, 1907, $230—
Oct. 10, 1907, $105—
Dec. 31, 1907, $212.15

Paid on this note:
Jan. 29, 1908, $334.20
June 17, 1908, $334.50
Sept. 1, 1908, $214.80
Jan. 10, 1908, $9.20—
July 25, 1908, $30—

Rec'd on this note:
Dec. 22, 1907, $17.10
Feb. 20, 1908, $5.80
July 1, 1908, $10.10
Aug. 16, 1908, $57.50
Nov. 12, 1908, $107.44

4.

$720.00   Oakland, Cal., Jan. 2, 1907.

Six months after date (without grace) I promise to pay to the order of — C. N. Palmer — Seven hundred twenty # — Dollars for value received with interest at seven per cent per annum from Jan. 2, 1907. until paid, both principal and interest payable only in UNITED STATES GOLD COIN.

No. 7.   Payable July 2, '07.   U. B. Ware.

What was due July 2, 1907?
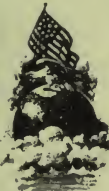
5.

$500.00   Spokane, Wash. May 1, 1907.

Thirty days after date I promise to pay to the order of — T. O. Gardiner — Five hundred # — Dollars at Stockton, Cal.

Value received

No. 8. Due May 31, '07. — J. A. Landis

What was due Feburary 29, 1908?

Merchants' Method

1.

$2150.00   Leadville, Colo. June 16, 1907.

Six months after date (without grace) I promise to pay to the order of — E. P. Heald — Twenty-one hundred fifty # Dollars for value received with interest at six per cent per annum from June 16, 1907 until paid, both principal and interest payable only in UNITED STATES GOLD COIN.

No. 9. Payable Dec. 16, '07.   M. N. Oliver.

What was due March 10, 1908?

Rec'd on this note:
Feb. 19, 1907, $65.32
Mar. 25, 1907, $65.78
May 1, 1907, $42.—

Rec'd on this note:
May 31, 1907, $50 —
June 25, 1907, $51.75
July 31, 1907, $28.11
Nov. 28, 1907, $6.00
Jan. 4, 1908, $20.16

Rec'd on this note:
Sept. 19, 1907, $40 —
Mar. 19, 1908, $100 —
July 1, 1908, $300 —
Dec. 13, 1908, $200 —
Jan. 23, 1909, $1000 —

784. The **Merchants' Method** of computing interest when partial payments have been made is the one used by most banks when the time to run is less than a year.

1. Find the amount of the note or debt from its date to the time of settlement.

2. Find the amount of each payment from its date to the time of settlement.

3. From the amount of the note or debt take the sum of the amounts of the payments, the difference will be the amount due.

2. What was due July 1, 1908 on a note for $600 bearing 6% dated July 1, 1907, and having the following indorsements:

<div style="text-align:center">

Sept. 16, 1907, $100.00
Nov. 13, 1907,   75.00
Jan. 10, 1908,   125.00
April 19, 1908, $200.00

</div>

3. What was due on a twelve months' note for $900 dated May 10, 1906, bearing 8% interest, and having the following indorsements:

<div style="text-align:center">

July 1, 1906, $240.00
Sept. 10, 1906,   324.00
Jan. 1, 1907,   180.00
Mar. 10, 1907,   120.00

</div>

4. A note for $1200 dated Sept. 1, 1907, payable in six months with interest at 7% had the following endorsements:

<div style="text-align:center">

October 25, 1907, $150.00
Nov. 30, 1907,   300.00
Jan. 2, 1908,   450.00
Feb. 12, 1908,   210.00

</div>

What was due at maturity, interest on payments computed for the exact number of days and 360 days to the year?

5. Payments were made on an interest bearing debt of $3300 due in one year from June 1, 1906 with interest at 9% as follows:

<div style="text-align:center">

Sept. 12, 1906, $300.00
Jan. 2, 1907,   1000.00
March 25, 1907,   1000.00
May 5, 1907,   1000.00

</div>

What was due at maturity?

HOME WORK—No. 22

785. Solve the following by Merchants' Method:

1. Find the amount due December 31, 1907, on a note for $600 drawing 7% interest, dated Feb. 15, 1907, and indorsed as follows: March 25, 1907, $150; June 1, 1907, $75; Oct. 10, 1907, $100.

2. Find the amount due at maturity of a note for $720 dated Jan. 25, 1908, payable in 9 months, with interest at 7%, and indorsed as follows: March 2, 1908, $225; May 5, 1908, $175; June 29, 1908, $220; Aug. 1, 1908, $75.

3. A debt of $2100 due April 5, 1907, was paid off as follows: $180 on May 10, 1907; $240 on July 1, 1907; $645 on Aug. 5, 1907; $375 on Oct. 1, 1907. What was due December 31, 1907, interest at 6%?

4. What is the amount due on a note for $855 dated July 5, 1908, due in one year, and bearing interest at 8%, and indorsed as follows: Nov. 10, 1908, $210; Jan. 2, 1909, $150; March 25, 1909, $120; May 15,1909, $120; May 15, 1909, $100?

5. A bought a farm and gave his note for $4500 dated Sept. 7, 1907, with interest at 7½%, payable one year after date.   If the following endorsements were made, what was due at maturity: Oct. 17, 1907, $500; Nov. 27, 1907, $500: Feb. 29, 1908, $500; April 11, 1908, $500; June 15, 1908, $500?

DISCOUNT

786. *Discount* is an allowance made for the payment of a debt before it becomes due.

787. The *Present Worth* of a debt is such a sum as placed on interest for the term of discount at the given rate will amount to the debt.

788. The *True Discount* is the difference between the present worth and the face of the debt.

789. A *Bank* is an institution organized for the purpose of receiving money on deposit, making loans, discounting commercial paper, selling and cashing bills of exchange, making collections, and in the case of national banks, issuing a paper currency.

790. *Bank Discount* is a deduction made by a bank in buying commercial paper.

791. *Days of Grace* in states allowing the same are always considered when computing bank discount.

NOTE—In this work no days of grace are used except when especially mentioned.

792. The *Term of Discount* is the time from the day of discount to maturity.

793. The *Collection* is a sum charged by a bank for making collections on commercial paper. It is always charged on the *face* of the paper.

794. The *Face* of the debt is the total amount due at the end of the Term of Discount.

795. The *Proceeds* of a collection is the amount collected less the discount, collection, protest, or other charges.

796. A *Protest* is a formal statement in writing made by a Notary Public giving legal notice to an indorser or maker that a note or draft has not been paid when due.

797. Given, the **Face of the Debt,** the **Time,** and the **Rate** to find the *true discount.*

FORMULA :   Face ÷ $1.00 + (Rate × Time) = Pres. Worth.
Face — Pres. Worth = True Discount.

EXAMPLE :   What is the true discount on a bill of $284.90 due in 90 days, money worth 7% ?

$284.90 ÷ $1.0175 = $280, Pres. Worth.
$284.90 — $280 = $4.90, True Discount.

798. Given, the **Face of the Debt,** the **Time,** and the **Rate** to find the *bank discount.*

FORMULA :   Face × Rate × Time = Bank Discount.

EXAMPLE :   What is the discount on a note for $600 due in 1 year, with interest at 6%, discounted at bank for 7 mo. 21 ds. at 10% ?

$600 × .06 = $36, Int. $600 + $36 $636, Face of Debt.
Int. on $636 for 7 mo. 21 ds. at 10% = $40.81, Bank Dis.

PRACTICAL PROBLEMS

799.   Solve the following :

1.   What is the present worth of a debt of $245.04 due in 3 mo. 18 ds., money worth 7% ?

2.   What is the true discount of a bill of mdse. amounting to $684.90 due in 2 mo. 6 ds. discounted at 8% ?

3.   What is the bank discount of a note for $475 without interest, due in 4 mo. 24 ds., discounted at 6% ?

4.   What are the net proceeds of a note for $1150 due in 1 yr. 3 mo. 18 ds., without interest, discounted at bank at 7% ?

5.   What is the difference between the true and the bank discount of a note for $1007.60 due in 11 mo. 27 ds., money worth 5% ?

6.   A merchant bought a bill of goods for $1350 on 90 days time, or a cash discount of 2%. Which was preferable and how much, if money at true discount is worth 7% ?

7.   An invoice of structural steel for $22500 was billed on 6 months time, or a discount of 3% for cash in 30 days.   Which would be preferable and how much, to let the bill run, or borrow money at the bank at 8%, and pay cash?

8.   On Nov. 10. 1907, I sold at bank the following note at 8% discount:

$3000 ※   *Oakland, Cal., July 1, 1907.*
   One year after date I promise to pay W. E. Gibson, or order,
Three thousand Dollars with interest at six per cent. per annum.
                              L. W. WATSON.

   Find net proceeds.

9.   I have an account for $890.12 that must be settled.   If I borrow the money at the bank, for how much must my note be drawn if it is to run 5 mo. 15 ds. discounted at 8%?

10.   Find the proceeds of the following note discounted at bank December 24, 1906, at 9% for time yet to run, paying collection ¼%:

$5400 ※   *Sacramento, Cal., April 1, 1906.*
   Two years after date I promise to pay Edw'd Howe, or order,
Fifty-four hundred Dollars with interest at six per cent. per annum.
                              S. J. ROBERTSON.

Banking and Exchange

800. A **Bank** is an institution chartered by law to receive deposits, loan money, discount commercial paper, sell and cash bills of exchange, make collections, and in the case of national banks, to issue bank bills, or national bank currency.

801. There are *two* classes of banks, viz: *National Banks* and *State Banks*.

802. A **National Bank** is one that is chartered under the laws of the United States and has certain privileges not granted to state banks.

803. A **State Bank** is one that is chartered under the laws of the state in which it is located.

804. A **Savings Bank** is a bank which makes a specialty of receiving deposits, large or small, on which it pays interest. Banks of savings only, do not do regular commercial business, but loan their money only on the best real and chattel security.

NOTE—The methods of CREDITING INTEREST on deposits in savings banks are so various that it is needless to discuss the subject in this work except in a general way.

805. *Interest on Savings* is credited *monthly*, *quarterly*, or *semi-annually* according to the custom of the bank.

806. *Interest on Withdrawals* is charged for the remainder of the term on the amount withdrawn.

EXAMPLE: A deposits $600, Jan. 1, 1908, in a savings bank which pays 4% interest on all deposits. Feb. 1, 1908, he draws out $150, and on March 1, 1908, $150. Find amount in bank at end of the first quarterly period.

SOLUTION :

January 1, A's deposit	$600.00	
January 1, 3 month's interest to April 1	6.00	
Total amount of deposit and interest		$606.00
February 1, 1st withdrawal	$150.00	
February 1, interest to April 1	1.00	
March 1, 2d withdrawal	150.00	
March 1, interest to April 1	.50	
Total withdrawals and interest		301.50
Balance in bank		$304.50

NOTE—The foregoing method is only one of several but is considered one of the latest and best in computing interest on savings accounts.

807. *To find the amount due on a savings account, subtract the sum of the amounts of the withdrawals at the end of the term from the sum of the amounts of the deposits to the same time.*

808. **Overdrafts** are allowed by some banks to special patrons who are charged a higher rate of interest than on ordinary loans.

809. Most banks charge ten or twelve per cent. on overdrafts, the charge being made on the average amount checked out.

Example: A's overdraft was $3000 on July 1st, and for 5 days thereafter. On the 7th he deposited $1000. On the 12th checks came in against him for $2400. On the 21st $4500 more was checked out. On the 27th he put in $2900. Charging 12%, what will be the interest on his overdrafts for July?

$3000 for 6 days $=$ $18000 for 1 day
2000 for 5 days $=$ 10000 for 1 day
4400 for 9 days $=$ 39600 for 1 day
8900 for 6 days $=$ 53400 for 1 day
6000 for 5 days $=$ 30000 for 1 day
Total overdraft, $151000 for 1 day

30 360 | $151000   Or,
        | 1 day $\frac{\$151000}{100}$ ÷ 30 = $50.33, Int.
        | .12%
    Int., $50.33

810. *To find the interest on overdrafts, divide 1% of the total amount of the daily overdrafts by 30 if for 12%, by 36 if for 10%, by 40 if for 9%, and by 45 if for 8%, etc.*

811. The **Profits** of a bank are distributed to three different accounts:

    1. To the Surplus Fund.
    2. To the Dividend Account.
    3. To the Undivided Profits.

812. **National Banks,** before declaring their regular semi-annual dividends, are required to place 10% of their profits in the Reserve Fund until it equals 20% of their capital stock.

EXAMPLE: If the net profits of a National Bank whose capital stock is $100000 are $5280, they may be divided as follows:

10% of $5280   = $528, carried to Surplus Fund.
4% on Cap. Stock = 4000, carried to Dividend Account.
     Remainder   =   750, carried to Undivided Profits.
                   $5278, Total Profits.

813. **Exchange** is the process of making payments at a distance without actually sending the money.

814. *Exchange* is one of the functions of a bank in receiving the money to be paid and by issuing a Draft or Bill of Exchange on its correspondent in the distant city.

815. **Collection** and **Exchange** are the charges made by a bank for making collections on Commercial Paper, and for issuing Drafts and Bills of Exchange.

816. **Domestic Exchange** is the exchange between cities of the same county.

817. **Foreign Exchange** is the exchange between cities of different countries.

818. The **Charges** on *domestic exchange* are usually computed at a certain rate per cent. on the face of the draft, and that on *foreign exchange* depends upon the market quotations which may be either above or below the intrinsic value.

NOTE—The intrinsic value of the £ is $4.8665; of the franc, $.193; of the mark, $.2385.

French quotations at 5.20 means that 5⅕ francs equal $1 in United States money.

German quotations at 95 means that 4 marks equal $.95 in United States money.

PRACTICAL PROBLEMS

819. Solve the following:

1. Find the exchange on a draft on New York for $1244 at ¼%.

2. A bank charged ⅛% on a draft for $760. What was the cost of the draft?

3. The exchange on a draft on Boston was $9.15. If the rate was ⅛%, what was the cost of the draft?

4. I paid my banker $256.64 for a draft on San Francisco. If the rate of exchange was ¼ %, what was the face of the draft?

5. What will a £600 draft on London cost if the quotation is 4.87 and ¼ % exchange is added?

6. Find the cost of a draft on Paris for 1573.20 francs if the market quotation is 5.17½.

7. I bought a draft on Berlin for 840 marks, when the market quotation was 96. What did it cost me?

8. A national bank has a capital of $100000. If its net profits are $7325.40, and it declares a dividend of 5%, what amounts should be placed in the Surplus Fund, in the Dividend Account, and in the Undivided Profits Account?

9. A bank with a Capital Stock of $150000, a Surplus Fund of $12500, an uncollected Subscription Account of $30000, and whose net profits at the close of the year are $18345.20, declares the highest whole rate per cent. dividend possible on paid up stock after placing 10% of the profits in the Surplus Fund. What are the total Surplus Fund, the Rate of Dividend, and the Undivided Profits?

10. What will be A's balance at the end of a year in a savings bank that allows 4% interest on all balances and deposits, and which charges interest on all withdrawals for the remainder of each quarter? July 1, 1907, deposited $800; August 16, deposited $400; September 1, withdrew $200; November 1, deposited $500; December 24, deposited $1000. February 5, 1908, withdrew $450; April 1, deposited $300; April 18, withdrew $100; May 10, withdrew $150; June 1, deposited $120.

HOME WORK—No. 23

1.   Bought a draft on New York for $2320, paying exchange at ¼%.   What did the draft cost me?

2.   A Chicago merchant bought a draft on San Francisco, paying exchange $3.78 at ⅛%.   What was the face of the draft?

3.   A draft on Chicago cost me $430.11.   If the exchange was $1.71, what was the rate charged?

4.   I paid $8502.30 for a draft on St. Louis.   If the rate of exchange was ½%, what was the face of the draft?

5.   What will a draft on Liverpool, England, for £720 cost when the exchange is the intrinsic value plus ⅛%?

6.   What should a draft on Berlin for 2500 marks cost if the rate of exchange is 95?

7.   A traveler bought a draft on Berlin for 6228 marks, paying $1200 for the same.   What was the market quotation?

8.   The net profits of a National Bank are $14255.60.   If the capital stock is $150000, and the subscription $50000, what should be the undivided profits after allowing for surplus fund and declaring a dividend of 10%?

9.   Jan. 1, 1907, A deposits $1200; Jan. 21, $400; Feb. 10, $200; March 15, $150.   If he withdraws $500 Feb. 1, and $600 Mar. 1, what will be his balance Apr. 1, in a savings bank that pays 4% interest?

10.   What would be the balance of the above Apr. 1, 1907, if simple interest was allowed on the exact amount in the bank for the number of days it remained unchanged?

Equation of Payments

820. *Equation of Payments* is the process of finding the time when several sums due at different times may be paid without loss to payer or payee.

821. The *quantities* considered are :

    1.   The *Items Charged*.
    2.   The *Focal Date*.
    3.   The *Terms of Credit*.
    4.   The *Products* for a unit of time.
    5.   The *Average* term of credit.
    6.   The *Equated Date*.

822. The **Items Charged** are the several amounts to be paid.

823. The **Focal Date** is a fixed date from which time is reckoned. The *earliest* or *latest* date is most convenient, although any date may be used for the focal date.

824. The **Terms of Credit** are the intervals of time from the *focal date* to the date each item is due.

825. The **Products** are found by multiplying each *item* by its *term of credit*.

826. The **Average Term of Credit** is found by dividing the sum of the *products* by the sum of the *items*.

827. The **Equated Date** is the date when all the bills may be paid in equity to both debtor and creditor. It is found by computing the *average term of credit* from the focal date.

828. An **Account** is a written statement of charges and credits together with the date and time of credit allowed each item.

829. To **Average an Account** is to find the time when an account may be settled in equity to both debtor and creditor.

830. *Equation of payments* and *averaging accounts* are used only by wholesalers, jobbers, manufacturers, and large concerns

where the amounts are large and interest on overdue balances is demanded.

CASE I

831. To find the *Average Term of Credit* and the *Equated Date.*

1. *Multiply each item by its term of Credit, and divide the sum of the products by the sum of the items. The quotient is the average term of credit.*

2. *Compute the average term of credit from the focal date to find the equated date.*

EXAMPLE: I bought goods Jan. 1, 1907, as follows: $400 on 2 mo., $600 on 3 mo., and $800 on 4 mo. What is the average term of credit and the equated date?

$$\text{The use of } \$400 \text{ for 2 mo.} = \$800 \text{ for 1 mo.}$$
$$600 \text{ for 3 mo.} = 1800 \text{ for 1 mo.}$$
$$\underline{800} \text{ for 4 mo.} = \underline{3200} \text{ for 1 mo.}$$

Total Items, $1800　　　　　　$5800, Total Products.

$5800 ÷ $1800 = 3⅔ mo., Average term of Credit.

3⅔ mo. after Jan. 1, 1907 = Apr. 8, 1907, Equated Date.

832. Solve the following:

1. The interest on $50 for 8 mo. equals the interest on $1 for how many months? On how many dollars for 2 mo.? Analyze carefully.

2. The interest on $200 for 6 mo., and on $400 for 4 mo. equals the interest on $1 for how many months? On how many dollars for 7 mo.?

3. If I borrow $300 for 4 mo., for how many months shall I lend $200 to equalize the interest?

4. If John borrows from James $800 for 7 mo., what sum should John lend James for 4 mo. to equalize the obligation?

5. Find the average term of credit of $500 due in 4 mo., $750 due in 3 mo., and $1000 due in 2½ mo.

6. I owe $140 due in 2 mo., $240 due in 3 mo., $240 due in 1 mo. When can I pay them all in equity with a single check?

7. On a debt of $2800 due in 6 mo. from Feb. 1, the following payments were made: May 1, $500; July 1, $600; Sept. 1, $1200. When is the balance due?

8. Find the average term of credit and the equated date of payment from July 1, 1908, of $450 due in 30 ds., $300 due in 60 ds., and $750 due in 90 ds.

9. Sold A. J. Rutherford goods as follows: June 1, 1908, $250 on 2 mo. credit; July 15, $300 on 3 mo. credit; Aug. 10, $400 on 4 mo. credit; September 12, $600 on 2 mo. credit. What is the average term of credit and the equated date?

10. I bought merchandise as follows: Sept. 15, 1907, $100 on 30 ds.; Oct. 10, 1907, $275 on 2 mo.; Nov. 15, 1907, $750 on 90 ds.; Dec. 20, 1907, $240 on 60 ds.; and Jan. 15, 1908, $300 on 30 ds. What was due on this account March 1, 1908, if no payments had been made? Money worth 8%.

CASE II

833. To find the **Equated Date** and the **Cash Balance** of an *Account Current*, or of an *Account Sales*.

PRODUCT METHOD

1. *Find the date each item is due, both debits and credits.*

2. *Multiply each item by the number of days from the focal date to the date it is due.*

3. *Divide the difference of the sums of the products by the balance of the items, the result is the average term of credit.*

4. *If the balances of items and products are both debits or both credits, the equated date is found by reckoning forward from the focal date; if one is a debit and the other a credit, the equated date is found by reckoning backward from the focal date.*

EXAMPLE: Find the *equated date* of paying the balance of the following account.

Dr.						*B. L. Trowbridge*		*Cr.*	
1908					1908				
Jan.	10	Mdse. net	800	00	Feb.	15	Draft 30 ds.	400	00
Feb.	2	Mdse. 2 mo.	500	00	Mar.	5	Note 60 ds. (int.)	600	00
Mar.	12	Mdse. 3 mo.	1200	00	Apr.	10	Note 90 ds.		
May	4	Mdse. 4 mo.	800	00			(no int.)	900	00

Jan. 10 $800 × — = ——— Mar. 16 $400 × 66 = 26400
Apr. 2   500 × 83 = 41500 Mar. 5   600 × 55 = 33000
June 12 1200 × 154 = 184800 July 9   900 × 181 = 162900
Sept. 4   800 × 238 = 190400 $1900   222300
         $3300   416700
         1900   222300
         $1400   ) 194400 (139 ds.

Balance, $1400, due 139 days from January 10, 1908. May 28, 1908, equated date.

834. The **Interest Method** may be used in finding the *equated date* and *cash balance* as follows :

1. *Find the time of each item from the focal date, as in the product method, and compute the interest at 1% per month on each item.*

2. *Divide the balance of the total debit and the total credit interests by the interest on the balance of items for one month at 1%. The result will be the average term of credit.*

NOTE—When a time draft or a note without interest is an item of an account, the time of such credit ends with the maturity of the draft or note. If the note draws interest, no time of credit is allowed on that item.

PRACTICAL PROBLEMS

835. Find the equated date of the following :

1.

Dr.						A. C. Jones			Cr.	
1907						1907				
June	1	Mdse.	900	00	Aug.	1	Cash		500	00
July	1	Mdse.	400	00	Sept.	1	Cash-		700	00
Sept.	1	Mdse.	1200	00	Nov.	1	Cash		1000	00
Oct.	1	Mdse.	1600	00						

2.

Dr.						S. A. Mills			Cr.	
1908						1908				
Jan.	10	Mdse. 60 ds.	800	00	Feb.	1	Cash		500	00
Jan.	30	Mdse. 60 ds.	600	00	Feb.	29	Cash		500	00
Mar.	5	Mdse. 60 ds.	400	00	Apr.	1	Cash		500	00
Mar.	25	Mdse. 60 ds.	700	00						

3.

Dr.			W. W. Willis			Cr.	
1907				1907			
Aug.	1	Mdse. net	240|00	Sept. |15| Cash	300|00
Sept.	1	Mdse. 60 ds.	180|00	Oct. |15| Cash	200|00
Oct.	1	Mdse. 30 ds.	450|00				

4.

Dr.			B. F. Strong			Cr.	
1908				1908			
Mar.	15	Mdse. 3 mo.	800|00	May |10| Cash	400|00
Apr.	3	Mdse. 4 mo.	900|00	July	1| Note (with int.)	500|00
May	10	Mdse. 6 mo.	1200|00	Aug. |15| Cash	600|00

5.

Dr.			M. I. Pronini			Cr.	
1907				1907			
Aug.	5	Mdse. 90 ds.	650|00	Oct.	1| Cash	500|00
Sept.	10	Mdse. 30 ds.	437|50	Nov.	1| Cash	400|00
Nov.	1	Mdse. 60 ds.	277	50	Dec.	15	Note 60 ds.	
Dec.	1	Mdse. 30 ds.	320|00			(no int.)	600|00

HOME WORK—No. 24

1. Find the equated date and cash balance Dec. 3, 1908, of the following, allowing interest at 8% :

Dr.			Robison & Shirley			Cr.	
1908				1908			
Jan.	5	Mdse. 4 mo.	1500|00	Feb.	5| Mdse. 4 mo.	600|00
Jan.	15	Mdse. 3 mo.	1200|00	Mar.	1| Cash	1500|00
Apr.	1	Mdse. 60 ds.	2800|00	Mar. |24| Draft 30 ds.	3000|00
Apr.	30	Mdse. 30 ds.	2000|00	Apr. |15| Cash	1000|00

2. Average the following, and find the amount due Nov. 7, 1908, interest at 6% :

Dr.			Hawes & Gilmore			Cr.	
1908				1908			
Apr.	1	Cash advanced	250|00	Mar. |10| Mdse. 4 mo.	500|00
Apr.	15	Freight charges	42|25	Apr.	1| Mdse. 90 ds.	400|00
May	10	Freight charges	25|75	May |15| Mdse. 60 ds.	600|00

3. Find the amount due Aug. 23, 1908, bank discount allowed on balance at 7%.

Dr.			L. W. Scarlett & Son				Cr.	
1908					1908			
June	1	Mdse. 30 ds.	150	00	June	15	Cash	200	00
"	10	Mdse. net	312	50	July	1	Draft 30 ds.	300	00
"	21	Mdse. 60 ds.	475	50	"	15	Cash	250	00
July	1	Mdse. 60 ds.	321	75	Aug.	1	Note 60 ds. on int.	500	00
"	15	Mdse. 30 ds.	462	25					

4. Average the following *Account Sales*; find when the net proceeds will be due, and find the amount required to liquidate the account on June 30, 1908, money being worth 8%.

TALBOT J. POWERS COMPANY

Produce and Commission

San Francisco, Cal.,   June 21, 1908

E. C. ATKINSON & COMPANY,
          Sacramento, Cal.

We render you an Account Sales of your consignment of:

2412 doz. Eggs

Received   May 1, 1908.

1908		SALES:					
May	3	720 doz. Eggs	.20				
"	18	540 " "	.22				
June	12	360 " "	.23				
"	20	792 " "	.21				
		CHARGES:					
May	1	Freight	41	20			
"	1	Cartage	14	30			
"	21	Storage and Insurance	13	50			
		Commission, 10% on sales	**	**			
		Net Proceeds			***	**	

NOTE--The date of the commission is found by averaging the sales.

5. Average the following *Account Sales*, find when the net proceeds will be due, and find the amount required to liquidate the account on June 10, 1908, money being worth 8% :

Hollman, Kinnard & Company

COMMISSION MERCHANTS

Chicago, Ill., April 21, 1908.

C. WESTON CLARK,
       Los Angeles, Cal.

Dear Sir :   We render you an Account Sales of your consignment of :

600 boxes of Oranges

Shipped via S. P. and C. B. & Q. R'y.   *Received* March 2, '08.

1908			SALES:						
Mar.	3	80	bxs. Wash. Navels 90's	2	—				
"	4	45	" " " 126's	2	25				
"	5	36	" " " 150's	2	50				
"	12	120	" Merced Sweets 176's	2	50				
"	15	204	" do.(on 60 days) 200's	2	40				
"	20	204	" Tangerines (on 30 days)	1	75			—	—
			CHARGES:						
Mar.	2		Freight			124	75		
"	20		Storage and Insurance			33	50		
"	18		Guaranty			31	65		
"	12		Cash advanced			500	—	—	—
			Commission, 8%						
								——	?

Statements and Balance Sheets

836. A **Statement** is an itemized schedule of the resources and liabilities of any firm or corporation.

Statement

Resources				
Cash on hand	1875	50		
Mdse. inventory	4624	—		
Furniture & Fixtures	725	50		
Bank Stock	1000	—		
Real Estate	6780	—		
Chattels	421	75		
Notes Receivable	815	25		
L. Slater	240	—		
G. E. Locke	1188	40		
Frederic Blanck	66	35		
William Bones	491	70	18228	45
Liabilities				
Notes Payable	1425	50		
F. M. Boyd	324	15		
P. E. Northrop	2000	—		
W. Matthews	187	75		
G. L. Gilmore	32	80	3970	20
Present Worth			14258	25

837. By **Resources** is meant all available properties or values.

838. By *Liabilities* is meant the debts or obligations to pay.

839. A *Trial Balance* is a schedule showing the debit and the credit footings of the ledger accounts of a business.

Trial Balance

Account	Debit	Credit
Pierce Cromwell Prop.		12153 90
Cash in bank $ 2425.10		
" on hand 340.25	2765 35	
Merchandise	17325 80	15842 50
Bills Receivable	1246 35	528 10
Bills Payable	326 75	954 25
Real Estate	5000 —	
Stocks & Bonds	800 —	300 —
Premium	120 —	75 —
Expense	287 50	21 30
Interest & Discount	112 40	213 65
M Hawes & Co.	1506 40	
M. Cassani	888 —	792 —
M Maroni	1224 —	1278 50
Walter S. Tutt		116 50
Commercial Exchange	6935 80	11375 75
P. Snow & Co.	1580 —	
C. E. Lyons Mfg. Co.	3247 20	876 35
Lasher & Ripley	1297 50	135 25
	44663 05	44663 .05

NOTE—It will be noticed in the above that the sum of the resources equals the sum of the liabilities.

840. A **Balance Sheet** consists of a *Trial Balance* together with a detailed statement showing the *Loss or Gain*, the *Inventories*, and the *Present Worth* of a business.

Students Balance Sheet. January 7. 19—

	Accounts		Trial Balance			Loss or Gain		Resources		Liabilities
				Balance		Loss	Gain		Resources	Liabilities
1	Student	6442.50		5000.00						1405.00
2	Cash	5659.50		4467.50					1974.74	
3	Merchandise	105.00		2427.50		105.00	545.00	545.00	3777.00	
3	Expense	326.00				326.00				
2	Collection + Ex.	1062.50		3125.00					750.00	1155.00
4	Bills Receivable	300.00		1455.00					225.00	
4	Bills Payable	250.00		750.00		25.00				250.00
5	Furniture + Fix.	500.00		230.00					90.00	
5	J. Q. King	320.00		1450.00						
6	W. M. Long	1450.00								
6	J. S. Smith	16092.76		16092.76		133.26	545.00	545.00	6816.74	1405.00
	Students Net Gain			5000.00		411.74				5411.74
	Net Credit			411.74		545.00				
	" Gain								6816.74	6816.74
	Present Worth									

841. The **Present Worth** of a business is the difference between the sums of its *Resources* and *Liabilities*.

842. The **Net Investment** or *Working Caital* is the amount invested.

843. An **Inventory** is a list of goods or chattels on hand. The word *inventory* is also applied to a class of unpaid items; as, unpaid rent, interest payable, etc., called *liability inventories*.

844. **Capital Stock** is the total sum which a concern *may* invest as its working capital.

845. **Subscriptions** are the amounts promised by the subscribers to make up the working capital.

846. **Treasury Stock** is the unsubscribed capital stock of a company. It is the difference between the *entire capital stock* and the *total subscriptions*.

847. To find the **Present Worth,** the **Loss or Gain,** or any **Resource** or **Liability** required.

1. *From the sum of the Resources subtract the sum of the Liabilities, the result is the Present Worth.*

2. *The difference between the Net Investment and the Present Worth is the Loss or Gain.*

3. *The difference between the Resources and the Liabilities, including the Present Worth, will be the missing Resource or Liability.*

4. *To find the Gain or Loss on merchandise, or any other property account, take the difference between the total debits and the sum of the inventory and the total credits of the account.*

PRACTICAL PROBLEMS

848. Solve the following :

1. Separate A's resources from his liabilities, and find his present worth from the following : Cash on hand, $1974.74 ; Merchandise, $3777 ; Bills Receivable, $750 ; Bills Payable, $1155 ; Furniture and Fixture inventory, $225. A owes I. J. King on account $250. M. N. Long owes A on account $90.

2.   If A's merchandise purchases amounted to $5659.50, his sales, $2427.50, and his unsold stock, $3777, what was the gain on his merchandise?

3.   Briggs's net investment was $19000.   His resources at the close of the year were as follows: Merchandise, $1840.20; Cash, $4250; Bills Receivable, $520; Real Estate, $12000; Store Fixtures, $580.25; Accounts Receivable, $3849.75.   His liabilities were: Bills Payable, $275.25; Accounts Payable, $1942.60. Find his present worth and net gain.

4.   Anderson's statement of losses and gains is as follows: MERCHANDISE: Sales, $4967.20.   Inventory, $1825.60.   Purchases, $5435.40.   STOCKS: Cost, $884.   Sales, $928.   None on hand.   REAL ESTATE: Cost, $12000.   Income, $450.   Inventory, $12200.   FURNITURE AND FIXTURES: Cost, $320; Inventory, $280.   EXPENSE: General, $320.   INTEREST: Paid, $122.40.   Received, $245.80.   What was his net loss or net gain?

5.   E. Wyckoff & Co.'s statement at the close of the year is as follows: Cash on hand, $84500; Merchandise inventory, $7246.50; Bills Receivable, $1200; Bills Payable, $320; Mortgages Payable, $1000; Interest Receivable, $15.80; Interest Payable, $35.40; Accounts due the firm, $2765.75; Accounts due others, $875; due E. Wyckoff, private account, $750; Rent unpaid, $200; Insurance, prepaid $27.50.   Find the firm's present worth.

HOME WORK—No. 25

1.   The following are the assets and liabilities of Heitman & Hadrich at the close of the year: Cash overdraft, $1250; Cash in safe, $245.50; Merchandise inventory, subject to 10% discount, $7324; Notes Receivable, subject to 4% discount, $796.25; Notes Payable, $600; Doubtful Accounts Receivable, subject to 40% discount, $480; Real Estate, $12450; Mortgage on same, $5000; Books, Stationery, etc., $184.50; Fuel and Feed on hand, $97.50; Teams and Wagons, $685; Accounts Receivable, $9450;

Accounts Payable, $4155.65.   What is the present worth of each if Heitman's share is double that of Hadrich?

2.   Find the loss or gain of the L. Kelch Company from the following: Merchandise inventory, Jan. 1, 1907, $5840; Merchandise purchases, $22764.25, less rebates and returns, $324.10; present Merchandise inventory, Jan. 1, 1908, $8354.25; total sales, $25498.69, less rebates and returns, 171.40; Furniture and Fixtures bought, $276.80; Furniture and Fixtures inventory, $260; Clerks' Salaries, $1225; Advertising, $400.

3.   F. B. Bill & Co.'s trial balance is as follows: Cash debits, $21465.40; Cash credits, $19326.10; Merchandise debits, $34596.50; Merchandise credits, $28976.15; Accounts Receivable, debits, $16350; Accounts Receivable, credits, $14366.25; Accounts Payable, debits, $ 2854.10; Accounts Payable, credits, $5820; Interest and Discount, debit balance, $426.30; Store, lot, and building, $3000; Mortgage on same, $1000; Insurance paid, $46.80; Expenses paid, $1640.   If 10% discount is allowed on net balances due the firm, and the merchandise on hand amounts to $11438.90, what is the net loss or gain, and what is the firm's present worth?

4.   A is employed by a firm to sell sewing machines at a weekly salary of $25.   He is given $32 in cash, and $312.40 in merchandise to start with.   His sales for the week amounted to $288.60, and he buys and receives merchandise valued at $128.75. If he returns $244.45 worth of merchandise to the firm, did the firm gain or lose on his week's work, and how much?

5.   I engaged with the Wiley B. Allen Piano Company to sell pianos at a monthly salary of $175 and expenses.   They gave me pianos valued at $5240, cost price, and $100 expense money to start with.   My report at the end of the first month was as follows: Piano sales for cash, $2160; piano sales on account, $1860; second-hand pianos taken in trade valued at $490; additional new pianos received from the firm, $1200; rent paid in cash, $50; stenographer's service, $15; hauling, freight, and express, $27.25; pianos in stock unsold, valued at $3450.   Did the firm gain or lose, and how much?

PARTNERSHIP

849. *Partnership* is the association of individuals for the purpose of transacting business.

850. The **Firm Name** is the title by which any *firm*, *company*, *house*, or *concern* is known.

851. The **Capital** is the money, property, or other assets invested.

852. **Net Capital,** or *present worth*, is the excess of the assets over the liabilities.

853. **Net Insolvency** is the excess of the liabilities over the assets.

854. **Partners** are the individuals composing the firm or company.

855. *Partners* are of *four* kinds, viz :

      1. Actual and known partners.
      2. Limited partners.
      3. Silent partners.
      4. Nominal partners.

856. **Actual Partners** are those who contribute to the capital stock and whose names are made known to the public generally.

857. **Limited Partners** are those whose liabilities are restricted to the value of the shares which they hold.

858. **Silent Partners** are those whose names do not appear in the firm title but who share in the profits of the concern.

859. **Nominal Partners** are those whose names appear in the firm title, but who do not share in the profits of the business.

860. The **Net Gain** or **Net Loss** is the difference between the *total gain* and the *total loss*.

861. *Four Cases* are possible in finding the loss or gain of the several partners, viz :

CASE I.   When the *investments* of each partner are *equal* and the *periods* of investment are the *same*, the losses or gains should be divided equally.

EXAMPLE : A and B each invest $2500 for 2 years and gain $4000. The shares of the gain should be equal, or $2000 each.

CASE II.   When the *investments* are *equal* and the *periods* of investment are *different*, the losses or gains should be divided in proportion to the periods of investment.

EXAMPLE : A invests $2500 for three years, and B invests $2500 for 1 year, and their gain is $4000.   A should receive $3000 and B $1000.

CASE III.   When the *investments* are *unequal* and the *periods* of investment are the *same*, the profits or losses should be divided in proportion to the investments.

EXAMPLE : A invests $1500 for 2 years, and B invests $2500 for 2 years, and the gain is $2000.   A's share of the gain should be $\frac{3}{8}$ of $2000, or $750, and B's share should be $\frac{5}{8}$ of $2000, or $1250.

CASE IV.   When *both investments* and *periods* of investment are *different*, the losses or gains should be divided in proportion to the *products* of the periods and the investments.

EXAMPLE : A invests $1500 for 2 years, and B invests $2500 for 4 years, and their gain is $2600.

A's $1500 for 2 years $=$ $3000 for 1 year.
B's $2500 for 4 years $=$ 10000 for 1 year.
A's and B's $=$ $13000 for 1 year.
A's share is $\frac{3}{13}$ of $2600, or $600.
B's share is $\frac{10}{13}$ of $2600, or $2000.

NOTE—Salaries of partners may be allowed, and interest given and received on deficiency or surplus of stated capital furnished, and the profits or losses shared according to special agreement.

PRACTICAL PROBLEMS

862.   Solve the following :

1.   A invests $5000 ; B, $4000 ; C, $2000.   If their gain is $2200, what is the share of each?

2.   Jan. 1, 1907, A puts in $1500 ; Mar. 1, B puts in $2000 ; June 1, C puts in $2500.   At the end of the year the total gain is $1665.   What is the share of each?

3.   Brown, Green, and Black each invest $2000 in a property that rents for $1200 per year.   If Brown sells out to Green at the end of six months, what should be the share of each in the year's income?

4.   A, B, C, and D invest in a manufacturing plant.   At the close of the year, A's share of the gain was $3240; B's, $2700; C's, $2430, and D's, $1890.   What was the investment of each, if the total capital was $38000?

5.   Adams, Brown, and Cook formed a partnership Jan. 1, 1908, and invested and withdrew as follows: Jan. 1, 1908, Adams invested $800; Brown invested $600, and Cook invested $400.   April 1, Adams invested $1000; July 1, $400; and Oct. 1, withdrew $500.   May 1, Brown invested $1200; Sept. 1, $600, and Nov. 1, withdrew $1000.   June 1, Cook invested $400; Aug. 1, $400; Oct. 1, $400; Dec. 1, $400.   If their total gain is $2395, what should be the share of each partner?

HOME WORK—(Final)

1.   Kelch, Mize, and Holmes were associated in business for 3 years.   Kelch invested $8000; Mize, $10000, and Holmes, $12000.   They agreed to organize on a basis of $10000 each, and to pay 6% interest on deficiencies, and accept 6% interest on surplus.   At the beginning of the second year, Kelch puts in $3000; Mize, $2000, and Holmes, $5000.   At the beginning of the third year Kelch puts in $2000; Mize, $1000, and Holmes draws out $1000.   If the total gain of the firm is $4980, what is the present worth of each partner at the end of 3 years?

2.   Wheeler, Wyckoff, and Willis are partners.   Wheeler invested $2000 in cash and $4500 in merchandise.   Wyckoff invested a note for $6000 due in one year with interest at 8%, and cash, $1000.   Willis invested merchandise valued at $5000 and furnished the store building for which he was to receive $75 per month rent.   Wheeler's salary as manager was $1500, Wyckoff's $1200, and Willis's $1000 per year.   After all expenses were paid they agreed to share the gains or bear the losses equally. Find the present worth of each partner at the end of the year if the total gain was $10030.

3. Snow invests as follows: Cash, $1200; Merchandise, $2200: Bills Receivable, $840; Bank Stock, $1000; Interest Receivable, $260, and is to receive $600 per year salary. Frost invests: Cash, $500; Store and Fixtures, $3000, subject to a mortgage of $1000 at 6% interest; Merchandise, $1800; Notes Receivable, $1300; Accounts Receivable valued at $1250, subject to a 20% discount for bad debts; and is to receive a salary of $800. They agree that the one investing the least amount of capital shall pay the other 6% on one-half his surplus. Find the present worth of each at the end of the year, if the total gain of the business is $3800 and they divide the net gain equally.

4. R. L. and L. S. Goodyear are partners under the firm name of Goodyear Bros., and are dealers in rubber materials of all kinds. R. L. invests $12000, cash, and L. S. invests the entire contents of his store, valued at $10000. They agree that each partner shall receive 7% per annum on his investment, and that all withdrawals in excess of $100 per month salary shall be charged to private account of the partner withdrawing the same. At the end of the year, their statement is as follows: Merchandise sales, $78450; Merchandise purchases, including original stock, $87300; Merchandise on hand, $15550; Sundries losses, $320; Expenses, not including salaries, $750. R. L. Goodyear has $580, and L. S. Goodyear has $340 charged to his account. Find the net gain, which is divided equally, and present worth of each partner at the end of the year.

5. Heald and Ingram form a co-partnership. Heald invests store and lot, $22000, subject to a mortgage of $7000 bearing 6% interest; accounts against H. E. Cox for $2400, J. H. Janson for $1525.75, and H. L. Gunn for $834.40; Cash $1840. He also owes W. E. Gibson on account, $524.50, and an unpaid note in favor of First National Bank for $6000 bearing 7% interest, on which there is accrued interest, $75.65, which liabilities the firm assumes. Ingram invests Merchandise, $8425.60; Notes Receivable, $3271.90, on which there is $148.20 accrued interest; accounts against O. B. Parkinson for $380.40, Edw'd Howe for $1135.50, J. R. Humphreys for $576.75, and L. W. Zinn $650; and cash sufficient to equalize their investments.

Before opening the store for business, L. A. Jordon offers to buy a one-third interest in the firm by giving to each of the partners his note for a sufficient sum to equalize their investments, which offer is accepted.   At the end of the year the sales of Merchandise amounted to $135420, the purchases were $142375.50, and the inventory of goods on hand was $23245.60.   After paying running expenses $1245, interest on mortgage and on note held by the First National Bank, what was each partner's present worth at the end of the year?

ANSWERS

Article 49

1. $5155.11
2. 231851 mi.
3. $41135.60
4. 751045 ft.
5. 7373736#
6. $543811.50

Article 50

1. $161416.75
2. $92774.50
3. $148198.84
4. $88684.20
5. $5480316.50

Article 64

1. $5881.30
2. $9580.95
3. $1028.50
4. $6494
5. $2800.50

Article 95

1. $5330
2. $155.66
3. $93.75
4. $7198.75
5. $81.25 lost
6. $29103.75
7. $382.44
8. $4500
9. $61766
10. $264.60

Article 107

1. 58¢
2. $115

3. $1806
4. $2668
5. $435 $315
6. 13 boxes
7. $1408 A's
   $704 B's
   $352 C's
8. 706 acres
9. 205000
10. $208

Article 129

1. 72
2. 1056
3. 12
4. 1785
5. 13 ft.
   5892
6. $227.50
7. $126
   5   9   11
8. 140 ft.
9. 3696 gal.
10. 57 gal.
    37   59   67

Article 131

1. 11 tons
2. 64 brls.
3. 13 crates
4. $2.80
5. 144 bu.
6. 160 bu.
7. 7 chests
8. 49 yrs.   98 yrs.
9. 410#
10. 50 yds.
    100 yds.
    200 yds.

Article 163

1. $217\frac{1}{2}$ yds.
2. $672\frac{1}{10}$ acres
3. $226\frac{1}{2}$ yds.
4. $16\frac{7}{8}$ and $11\frac{5}{8}$
5. $42\frac{97}{117}$
6. $71\frac{1}{20}$
7. $130\frac{3}{8}$
8. $3785\frac{7}{20}$
9. $1009\frac{1}{2}$
10. $2771\frac{1}{4}$ B's
    $3845\frac{3}{4}$ C's
    $8962\frac{3}{4}$ total
11. $5\frac{7}{20}$
12. $34\frac{4}{5}$
13. $63\frac{1}{20}$
14. $151646\frac{7}{10}$
15. $7251\frac{9}{40}$

Article 174

1. $2100 $2800
2. $9600
3. $1500
4. ⅓ of estate
5. $420 Jones
   $1260 Brown
   $3150 Green
6. $600
7. $3600
8. $240 Muir
   $320 Nunn
   $360 Hakes
9. 46½ doz.
10. $16080
    $6432 shoes
    $3920 groceries
    $2880 tea
    $2260 hay

Article 198

1. 196 acres
2. 789.15 chains
3. 339.05 acres
4. $922.92¾
5. 606.66¼ acres
6. $70.43¾
7. 107 bu.
8. 135 lbs.
9. 309 bu.
10. 330.925 mi.

Article 222

1. $290.94
2. $535.75
3. $3220.39
4. $1595.35
5. 1951.20

Article 224

1. $183.80
2. $724
3. $750
4. $4468.75
5. 110 bu. barley
   220 bu. wheat
   440 bu. corn.

Article 232

1. $51.98
2. $412.65
3. $49.28
4. $705.30
5. $582.25
6. $614.80
7. $1144.50
8. $1006.21
9. $983.25
10. $537.86

Article 247

1. $132
2. $27
3. $67.50
4. 10½ ds.
5. 3 ds.
6. 6 weeks
7. 2½ ds.
8. 2976 mi.
9. 9 men
10. 16200 lbs.

Article 248

1. 32 marbles
2. $2
3. $100
4. $4.95
5. $39.60
6. 81
7. 15 yrs.
8. 14 and 21
9. $\frac{4}{9}$
10. 360 ft.

Article 249

1. $60 A's
   $150 B's
2. $210 A's
   $280 B's
   $350 C's
3. $135 Jones
   $144 Brown
   $126 Smith
4. $294 White
   $336 Green
   $140 Black
5. $140   3 mo.
   $900

Article 250

1. 1⅞ ds.
2. 2⅔ ds.
3. 37½ ds.
4. 7⅕ ds.
5. 2⅓ ds.

Article 251

1. 3 p. m.
2. 4 a. m.
3. 6 p. m.
4. 4:48 p. m.
5. 9 a. m.

Article 252

1. 55
2. $5\frac{5}{11}$ past 1
3. $27\frac{3}{11}$ past 5
4. $49\frac{1}{11}$ past 3
5. $21\frac{9}{11}$ past 4

Article 253

1. 72 in.
2. 54 in.
3. 80 ft.
4. 32 ft.
5. 120 ft.

Article 254

1. 16 yrs.
2. 16 yrs.   36 yrs.
3. 42 yrs.   70 yrs.
4. 5 yrs.   15 yrs.
5. 18 yrs.   36 yrs.

Article 255

1. 25¢ A
   10¢ B
2. 40 mi.
3. 300 yds.
4. $135
5. $5.09¾ A
   $2.90⅝ B

Article 381

1. 1027s.
2. 13958 far.

3. £3 1d.
4. 45164 far.
5. £38 19s. 8d. 1f.
6. 100d.
7. 696 far.
8. £3 10s. 5d. 3 f.
9. $245.88
10. £1172 10s.

Article 382

1. 32.4 francs
2. 4200 centimes
3. $409.74
4. 11000 fr.
5. 5043.05 fr.
6. 42.8 marks
7. 7500 pf.
8. $62.13
9. 11000 marks
10. 386 marks

Article 383

1. 1340 pwt.
2. 19570 gr.
3. 98374 gr.
4. 12 oz.
5. 37 lbs.
6. 6 lb. 1 oz. 5 pwt. 19 gr.
7. $14
8. 40 spoons
9. $85
10. $1189.02

Article 384

1. 9212 oz.
2. 5648 lbs.
3. 1.6 cwt.
4. 18 T. 7 cwt. 28 lbs. 2 oz.
5. 13 T.

6. $864
7. $3220
8. $55.38
9. 16800#
   336 bu. barley
   300 bu. flaxseed
   280 bu. wheat
   525 bu. oats
10. $945

Article 385

1. 357 drams.
2. 9355 gr.
3. ℨ8 ℨ6 ℈2 gr.5
4. 43 lbs. ℥7 ℨ2 ℈2
5. 280 capsules
6. 3 lbs. ℥7 ℨ6
7. $43.75
8. $184.80
9. 4800 doses
10. $52.68

Article 386

1. $8\frac{8}{35}$ lbs.
2. $12\frac{1}{12}$ lbs.
3. 12 lbs. ℥1 ℨ6 ℈2
4. 10 lbs. 10℥ 4ℨ 10 gr.
5. 21 lbs. 6 oz. 16 pwt. 26 gr.
6. Feathers 1240 gr.
7. Gold $42\frac{1}{2}$ gr.
8. Lost $106.25
9. $85.83
10. $5.17 $6.20

Article 387

1. 47 pts.
2. 3745 gi.
3. 8964 gi.
4. 9 bbls.

5. 14 bbls. 4 gal. 3 qt. 1 pt. 3 gi.
6. $33\frac{1}{2}$ bbls.
7. 240 bottles
8. 144 bottles
9. $33
10. 90¢

Article 388

1. f℥ 7904
2. m26385
3. m1109315
4. O5 f℥10 fℨ4 m16
5. Cong.15 O7 f℥15 fℨ6
6. 1408 bottles
7. Cong. 23 O2
8. $1.05
9. $44
10. 4032 bottles

Article 389

1. 189 qts.
2. 1111 pts.
3. 1102 pts.
4. 2 bu.
5. 900 bu. 1 pk. 7 qt. 1 pt.
6. $11.52
7. $3
8. 18 bu.
9. $5.72
10. $4.65

Article 390

1. 1795 in.
2. 67082.4 in.
3. 942636 in.
4. 1 mi. 1 fur. 2 yd. 1 ft.
5. 4 mi. 38 ch. 24 l.

6. $11200
7. 10725 ft.
8. 2610 mi.
9. $382.80
10. 306662.4 times

Article 391

1. 7128 sq. in.
2. 59553 sq. yd.
3. 104684 sq. ft.
4. 11 sq. yd. 29 sq. in.
5. 45.21875 acres
6. $1642.67
7. $240
8. $177.78
9. $6050
10. $452.60

Article 392

1. 2560 acres
2. 10 acres
3. 257500 sq. l.
4. 1 sq. ch. 11 sq. rd. 467 sq. l.
5. 360 sq. ch.
6. 64⅝ acres
7. 40 acres
8. $2800
9. $10000
10. $156.25

Article 393

1. 29508 cu. in.
2. 697 cu. ft.
3. 1536 cu. ft.
4. 30 cu. ft.
5. 497664 cu. in.
6. $76.80
7. 9 cords
8. $39.27
9. 123354 bricks
10. $84270

Article 394

1. 4545 ds.
2. 72740 min.
3. 67 ds. 12 hrs.
4. 15 ds. 12 hr. 59 min. 42 sec.
5. 41760 min.
6. 86400 sec.
7. 161 ds.
8. 129600 times
9. 2 yrs. 6 mo. 18 ds.
10. 6 mo. 10 ds.

Article 395

1. 26670"
2. 165054"
3. 358° 5'
4. 127° 11' 4"
5. 10028.2 mi.
6. 2665180 sec.
7. 2903¾ mi.
8. 40°
9. 24897.6 mi
10. 66° 7' 30"

Article 396

1. $43.20
2. $36
3. $6.375
4. 40 yrs. A
   60 yrs. B
   20 yrs. C
5. 36 yrs. James
   48 yrs. Henry
6. 960 sheets
7. $27
8. $1.92
9. 10000 sheets
10. 5000 booklets
    16 pp. each

Article 410

1. 1 hr. 6 min. 17 sec.
2. 51 min. 32¼⁴⁄₁₅ sec.
3. 8 hr. 58 min. 14 sec. a. m.
4. 5 hrs. 9 min. 56⅕ sec. p. m.
5. 10 hrs. 12 min. 25 sec a. m.
6. 121° 30' 15"
7. East 23° 11' 15"
8. East, Cincinnati
9. 8 hr. 36 min. 56 sec., or 15 hr. 23 min. 4 sec.
10. Gain 10 hr. 58 min. 37 sec.
    Also one whole day in calendar caused by crossing the International Date Line.

Article 413

1. 5s. 7d. 2 far.
2. 7s. 4d. 2 far.
3. 3 yd. 7½ in.
4. 1 fur. 38 rds. 2 yds. 7.2 in.
5. 6 oz. 10 pwt. 12 gr.
6. 7 cwt. 30 lb. 12 oz.
7. 240 acres
8. 14 gi.
9. $1.25
10. 1234.5 sq. links

Article 415

1. $\frac{1}{12}$ gal.
2. $\frac{7}{24}$ yd.
3. $\frac{5}{192}$ bu.
4. $\frac{1}{768}$ mi.
5. .0225 ton

6. .0075 ds.
7. $\frac{1}{160}$ mark
8. £.016$\frac{2}{3}$
9. $\frac{1}{80}$
10. 12 yrs.   27 yrs.

Article 417

1. $\frac{17}{33}$ rd.
2. .8775 cwt.
3. .671875 bu.
4. .3125 sq. yd.
5. $\frac{17}{96}$
6. $\frac{1}{8}$ hhd.
7. $\frac{7}{10}$f$\mathfrak{z}$
8. .0325 cwt.
9. .05009375
10. .6375

Article 420

1. 20 cwt. 2 lb. 14 oz.
2. 11 da. 23 min. 5 sec.
3. 27 yd. 1 ft.
4. 3 hhd. 1 bbl. 23 gal. 1 pt. 1 gi.
5. 29 lb. 3$\mathfrak{z}$ 5$\mathfrak{z}$ 11 gr.

Article 423

1. 10 rd. 3 yd. 2 ft. 2 in.
2. 3 pk. 2 qt. $\frac{4}{5}$ pt.
3. 25 cd. 5 cd. ft. 12 cu. ft.
4. 31 gal. 3 gi.
5. 135 A 4 sq. ch.

Article 427

1. 1 mi. 3 rd. 1 yd. 1 ft. 8 in.
2. 44 bu. 5 qt.

3. 174 gal. 2 qt.
4. 5752 bu. 2 pk.
5. $75.26

Article 428

1. 35 A 90 sq. rds. 9 sq. yds. 6 sq. ft. 57 sq. in.
2. £5 11s. 1d. 1 far.
3. 7 gal. 2 qt. 1 pt. $\frac{2\cdot3}{4\cdot2}$ gi.
4. 243 bxs.
5. 150 farms

Article 457

1. 116$\frac{1}{4}$ sq. rds.
2. 850 sq. ft.
3. 3$\frac{1}{3}$ sq yd.
4. 316 sq. yd.
5. 1100 sq. yd.

Article 459

1. 102 sq. ft.
2. 400 sq. ft.
3. 80 sq. ft.
4. 2$\frac{13}{16}$ acres
5. $14832.28

Article 461

1. 336 sq. ft.
2. 147 sq. ft.
3. 125 A
4. 682 sq. ft.
5. 378 sq. ft.

Article 463

1. 7854 sq. ft.
2. 314.16 sq. yd.

3. 32206.30$\frac{7}{8}$ sq. ft.
4. 50.93 acres.
5. 12880.56 sq. ft.

Article 468

1. 624 sq. ft.
2. 263.9 sq. in.
3. 3.1416 sq. ft.
4. 706.86 sq. in.
5. $14137.20

Article 480

1. 48 cu. ft.
2. 35937 cu. in.
3. 1331 cu. in.
4. 216 gal.
5. 384 bu.

Article 482

1. 100 cu. ft.
2. 16200 cu. ft. $5103
3. $4640
4. 150 cu. in.
5. 11309.76 cu. in.

Article 484

1. 75 cu. ft.
2. 20800 cu. ft.
3. 2261.952 cu. ft.
4. 9629$\frac{1}{2}\frac{7}{5}$ cu. ft.
5. 93$\frac{1}{3}$ board ft.

Article 485

1. 33.5104 cu in.
2. 523.6 cu. ft.
3. 65.45 cu. in.
4. 268,083,200,000 cu. mi.
5. 202.1096 cu. in.

Article 486

1. 16 tons
2. 108 sq. rd.
3. 16 lbs.
4. $6\frac{3}{4}$ hrs.
5. $259\frac{1}{5}$ lbs.

Article 489

1. $24.60
2. $30.49
3. $80.75
4. $92.11
5. $74.08
6. $68.04
7. $139.01
8. $28.33
9. $40
10. $363.33 or $356.53 by cutting strips

Article 494

1. $51
2. $40.50
3. 8280 bricks
4. $131.71
5. $269.64
6. $86.40
7. $57.82
8. $112.48
9. $466.22
10. $836.14

Article 499

1. $4\frac{1}{2}$ cords
2. $7\frac{1}{4}$ cords
3. $13\frac{1}{3}$ ft.
4. 560 ft.
5. $25\frac{1}{2}$ feet
6. $408.24
7. $121.50
8. $219.28
9. $198
10. 26280 shingles

Article 504

1. 186.01 bu.
2. 3456 bu.
3. 3 ft. 2 in.
4. 10 ft. 3 in.
5. $1440
6. $628\frac{4}{11}$ gal.
7. 68.39 bbls.
8. 270 gal.
9. 50.49 bbls.
10. 20 ft.

Article 513

1. 6　8
2. 36
3. $\frac{1}{9}$
4. 9
5. 245
6. 10
7. $1\frac{1}{3}$
8. $21\frac{7}{8}$
9. $\frac{2}{105}$
10. $\frac{7}{80}$

Article 521

1. 30
2. 30
3. 84
4. 76
5. 8
6. 119 lbs.
7. $5\frac{5}{8}$ bu.
8. 4 ds.
9. 2 men
10. 20 men

Article 525

1. $4.50
2. 96 horses
3. 96 sheep
4. $47.50
5. 8 mo.
6. 220 rods
7. 1600 books
8. 21504 bricks
9. 10 men
10. 8 men

Article 543

1. $24　108 lbs.
2. 180 bu.
　　280 tons
3. 117 hrs.　$259
4. $129\frac{1}{5}$
5. $2700
6. $4140
7. $800
8. $2250
9. $625
10. $18000

Article 545

1. 50%　25%
2. $2\frac{1}{2}$%　20%
3. 400%　300%
4. 80%　90%
5. $2\frac{1}{2}$%
6. $29\frac{1}{6}$%
7. $41\frac{2}{3}$%
8. $1584　32%
9. 20%
10. 75%

Article 547

1. 576　429
2. $2520　$1372
3. 192 ft.
4. $1101.82
5. $7500
6. $355
7. $1500
8. $50000
9. 42 gal.
10. 700 head

Article 549

1. 80   96
2. $200 $360
3. 546 sheep
4. 75 marbles
5. $800
6. $13500
7. 700 acres
8. $570
9. $35
10. 11000

Article 559

1. $100
2. 15¢ per bu.
3. $250
4. $240.63
5. $208.25
6. $54
7. $1875
8. $2385
9. $39.90
10. $1745.05

Article 561

1. 25%
2. 25%
3. 18%
4. $43\frac{1}{3}$%
5. 30%
6. $11\frac{1}{9}$%
7. 25%
8. $47\frac{1}{12}$%
9. 20%
10. 100%

Article 563

1. $50
2. $700
3. $3240
4. $1960
5. $4900

6. $20
7. $1927.50
8. $270
9. $2000
10. $100000

Article 565

1. $25
2. $336
3. $13333\frac{1}{3}$
4. $106.66\frac{2}{3}$
5. $1480
6. $560
7. $6
8. $32 lost
9. $2835
10. 60%

Article 576

1. $375
2. $735
3. $900
4. $2700
5. $540
6. $1120
7. $576
   $480
   $432
   $384
   $288
8. $1157.62
9. $495.72, 8 ds.
   $523.26, 20 ds.
   $550.80, 40 ds.
10. 50, 20, and 10,
    better by $1\frac{1}{2}$%

Article 579

1. $350
2. $735
3. $840
4. $1337.50

5. $2225
6. $24
7. $437.50
8. $580
9. $18\frac{4}{7}$%
10. 16%

Article 600

1. $36
2. $106.50
3. $57.50
4. $1347.84
5. $152.77
6. $425.36
7. $3229.20
8. $876.02
9. $422.60
10. $1872

Article 602

1. 2%
2. 6%
3. $2\frac{1}{2}$%
4. $12\frac{1}{2}$%
5. $2\frac{3}{4}$%
6. 3%
7. 5%
8. 4%
9. $4\frac{1}{4}$%
10. 6% $212

Article 604

1. $7000
2. $4940
3. $223.10
4. $1420
5. $1450
6. $2569.75
   $3208.40
7. $601.60
8. $692.23
9. 48225 lbs.
10. $2850

Article 606

1. $540
2. $17240
3. $922.40
4. $20.70
5. $12560
6. $1973.79
7. $32.85 gain
8. 1550 lbs.
9. 204347# Island
   235600# Ala.
10. $5200 $4750

Article 634

1. $600
2. $20.50
3. $1024
4. $392
5. $4500 $75
6. $345
7. $8352
8. $308
9. $560
10. $5500 $495

Article 636

1. $7\frac{1}{2}\%$
2. 11%
3. $\frac{1}{4}\%$
4. $4\frac{1}{2}\%$
5. $\frac{1}{8}\%$
6. $8\frac{1}{4}\%$
7. 7% $3750
8. $15\frac{3}{4}\%$
9. 12% $1210.68
10. 7%

Article 638

1. 320 shares
2. $29835
3. $8883.75

4. $6\frac{1}{4}\%$
5. 120 shares
6. $7515
7. 6's at 120,
   $180
8. $195 increase
   $82.75 surplus
9. $4 decrease
   $8.75 surplus
10. $17820 Mich. 6's
    $35640 Ohio 5's

Article 651

1. $160200
2. $325000
3. $36800
4. $189
5. $45.80
6. $209.75
7. $562400
8. $385952.85
9. $126.40

Article 669

1. $460
2. $974.50
3. $128
4. $604.45
5. $2394.33
6. $17374.85
7. 20%
8. $4151.66
9. $1116
10. $2160
    $4320

Article 686

1. $15
2. $37.50
3. $31.50
4. $1928
5. $4500

6. $1750
7. $1485240
8. $209.50
   .0115+
9. $859.04
10. $10000

Article 696

1. $58.10
2. $173.84
3. $152.10
4. 540.76
5. $2160
6. $3082
7. $246
8. 27 yrs.
9. $2000
10. 65 yrs.

Article 713

1. $.1725
2. $37.60
3. $243.38
4. $187.68
5. $448.25
6. $782.25
7. $2660.97
8. $825.84
9. $574.56
10. $1125.25

Article 719

1. $1.88
2. $.79
3. $11.09
4. $32.50
5. $67.73
6. $5.27
7. $3.97
8. $11.97
9. $45.79
10. $2.56

Article 721

1. $37500
2. $720
3. $1200
4. $540
5. $280
6. $600
7. $1200
8. $500
9. $19500
10. $24003

Article 723

1. 6%
2. 8%
3. 8%
4. 8%
5. 7%
6. 8%
7. 8%
8. 4½%
9. 4%
10. 7½%

Article 725

1. 8 mo.
2. 77 ds.
3. 45 ds.
4. 7 mo. 6 ds.
5. 4 mo. 21 ds.
6. 1 yr. 3 mo. 15 ds.
7. 1 yr. 5 mo. 3 ds.
8. 2 yr. 3 mo. 18 ds.
9. 312 ds.
10. 6 mo.

Article 727

1. $240
2. $310
3. $436.20

4. $672
5. $4050
6. $1277.50
7. $2250
8. $4800
9. $7500
10. $12000

Article 732

1. $3.96
2. $8.82
3. $2.88
4. $8.47
5. $7.40
6. $32.55
7. $26.04
8. $81
9. $160.80
10. $28.80

Article 737

1. $268.92
2. $543
3. $422.03
4. $1335.36
5. $101.76
6. $164.56
7. $931.35
8. $35.28
9. $465
10. $1058.83

Article 742

1. $74.16
2. $262.48
3. $704.25
4. $1256.86
5. $238.91
6. $2088.44
7. $4850.45
8. $129.76
9. $311.64

10. $764.19

Article 776

1. $878.04
2. $1270.89
3. $455.77
4. $2124.83
5. $651.17
6. $587.26
7. $3513.60
8. $2701.22
9. $1107.17
10. $1006.72

Article 783

1. $711.55
2. $1376.08
3. $303.27
4. $568.87
5. $363.85

Article 784

1. $701.80
2. $122.44
3. $67.48
4. $117
5. $216.10

Article 799

1. $240
2. $9.90
3. $11.40
4. $1045.35
5. $2.36
6. Cash discount $3.78
7. Let bill run $52.50
8. $3016.76
9. $924
10. $5342

Article 819

1. $3.11
2. $760.95
3. $7329.15
4. $256
5. $2929.31
6. $304
7. $201.60
8. $732.54
   $5000
   $1592.86
9. $14334.52 13%
   $910.68
10. $2288.75

Article 832

1. 400 mo. $200
2. 2800 mo. $400
3. 6 mo.
4. $1400
5. 3 mo.

6. In 2 mo.
7. 7 mo. 24 ds. after Feb. 1, or on Sept. 25th.
8. 66 ds. Sept. 5
9. 88 ds. Oct. 28, 1908
10. $1677.58

Article 835

1. July 7, '07
2. June 18, '08
3. Oct. 18, '07
4. Oct. 30, '08
5. July 19, '07

Article 848

1. $5411.74
2. $545
3. $21812.35
   $2812.35

4. $1814.80 gain
5. $8909.65

Article 862

1. $1000 A
   $800 B
   $400 C
2. $12000 A
   $10000 B
   $9000 C
   $7000 D
3. $200 Brown
   $600 Green
   $400 Black
4. $540 A
   $600 B
   $525 C
5. $975 A
   $860 B
   $560 C

236567

Sweet