GRADED LESSONS IN ARITHMETIC

BY

W·F·Nichols

BOOK VI

THOMPSON·BROWN·&·CO.
·BOSTON·

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IN

ARITHMETIC

BOOK VI.

BY

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GENERAL INTRODUCTION.

1. These lessons have been prepared in the belief that it is a mistake to assume that one topic is to be finished before another is begun. The elements of many topics are here given in lower grades in explanations, illustrations, and examples easily understood by the younger pupils; and then the work in each topic is made more and more difficult through the various grades until it is finished. These examples have stood the test of the school-room, and in no case have they been found too difficult.

2. The arrangement of the topics is such that pupils in passing into a new grade find but few new topics, and many pupils are prepared for promotion from grade to grade at various times during the year, and are not obliged to wait for the annual promotions.

3. Such practical subjects as Percentage and Interest are introduced in the lower grades, where many pupils are found who are obliged to leave school before they reach the more advanced grades.

4. Clear conceptions of geometric forms and mensuration are introduced at an early period, that principles thus developed may be applied to many practical problems.

5. One or more lessons are given to the developing of a new topic; then the following lessons are so arranged as to give the pupils practice in applying the new topic in

connection with all the other topics previously learned. This constant review will be found very beneficial.

6. Few teachers will find the need of supplementary work, as so large a number of problems are given. On the other hand, few pupils should be required to solve all the problems. It is a good way to assign for required work for all the class that number of examples which even the slowest child can do, and then allow any child to work the remaining examples of the lesson as optional work.

7. The large amount of oral or mental examples will be appreciated by those who believe that ten minutes each day should be given to work of this kind. These are not mental gymnastics, but plain, practical, every-day questions.

8. The introduction of Algebra and Geometry in the higher grades will be found beneficial.

9. The methods here advocated are the shorter methods found in daily use among bankers, mechanics, and merchants.

The author desires to express his acknowledgments for many valuable suggestions to Mr. C. H. Morss, Superintendent of Schools of Medford, Mass.

WILBUR F. NICHOLS.

HOLYOKE, *September*, 1897.

INTRODUCTION TO BOOK VI.

THE plan of development pursued in the previous books of this series is continued. The topics in Book V. are reviewed in this book. Some topics, as Fractions, are completed, as special subjects; and others, like Percentage, enlarged.

Compound Numbers are completed, and Ratio introduced. The latter subject will be found helpful in much of the higher work in Percentage, and it has been introduced a little earlier than usual.

Two or three topics are placed at the end of the book so that they may be more easily omitted unless the course of study demands that they shall be taught.

A thorough mastery of any subject comes only from repetition; hence many review exercises are given so that the pupil may be able to rely upon himself and learn to work absolutely without assistance. Principles are taught, and not rules; and the work is made practical, so that the pupil can be prepared for the affairs of every-day life.

TABLES OF WEIGHTS AND MEASURES

FOR REFERENCE.

LINEAR MEASURE.

12 inches (in.)	= 1 foot (ft.).	$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	= 1 rod (rd.).
3 feet	= 1 yard (yd.).	320 rods, or 5280 feet	= 1 mile (m.).

SQUARE MEASURE.

144 square inches (sq. in.)	= 1 square foot (sq. ft.).
9 square feet	= 1 square yard (sq. yd.).
$30\frac{1}{4}$ square yards, or $272\frac{1}{4}$ square feet	= 1 square rod (sq. rd.).
160 square rods	= 1 acre (a.).
640 acres	= 1 square mile (sq. m.).

SOLID OR CUBIC MEASURE.

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.).
27 cubic feet	= 1 cubic yard (cu. yd.).

WOOD MEASURE.

16 cubic feet	= 1 cord foot (cd. ft.).
8 cord feet, or 128 cubic feet	= 1 cord (cd.).

LIQUID MEASURE.

4 gills (gi.)	= 1 pint (pt.).
2 pints	= 1 quart (qt.).
4 quarts	= 1 gallon (gal.).
1 gal.	= 231 cubic inches.

DRY MEASURE.

2 pints (pt.)	= 1 quart (qt.).
8 quarts	= 1 peck (pk.).
4 pecks	= 1 bushel (bush.).
1 bushel	= 2150.42 cubic inches.

AVOIRDUPOIS WEIGHT

16 ounces (oz.)	= 1 pound (lb.).
2000 pounds	= 1 ton (t.).
2240 pounds	= 1 long ton

CIRCULAR MEASURE.

60 seconds (″)	= 1 minute (′).
60 minutes	= 1 degree (°).
360 degrees	= 1 circumference (circ.).

MISCELLANEOUS TABLE

12 units	= 1 dozen.
12 dozen	= 1 gross.
12 gross	= 1 great gross.
20 units	= 1 score.
24 sheets	= 1 quire.
20 quires	= 1 ream.

TIME MEASURE.

60 seconds (sec.)	= 1 minute (m.).
60 minutes	= 1 hour (h.).
24 hours	= 1 day (d.).
7 days	= 1 week (wk.).
365 days	= 1 common year (c. yr.).
366 days	= 1 leap year (l. yr.).
100 years	= 1 century (C.).

TABLE OF CONTENTS.

MEASUREMENTS.

PERCENTAGE.

GRADED LESSONS IN ARITHMETIC.

BOOK VI.

LESSON 1.

1. Find $33\frac{1}{3}\%$ of \$28.80. $6\frac{1}{4}\%$ of \$25.60.

2. \$174.04 is 95% of how many dollars?

3. Find the gain per cent when the cost is \$600, and the selling-price \$618.

4. Find the cost when the selling-price is \$73.84, and the loss 80%.

5. A man owns a rectangular lot 132 ft. long and 110 ft. wide. A fence runs from the northeast to the southwest corner. How many square feet in each part?

6. My garden is 100 ft. long and 25 ft. wide. How many boards, each 12 ft. long, 6 in. wide, will it take to build a tight board fence 6 ft. high across one end and two sides of this garden?

7. The selling-price is \$175. Find the gain per cent, if the cost is \$150.

8. Find the interest of \$464.75 at 6% for 1 yr. 8 mo. 12 da.

9. Make and solve an example illustrating how to find the number of cords in a pile of wood.

10. Add: Two thousand and four thousandths; three hundred-thousandths; six millionths; two million forty-five; ten thousandths.

CANCELLATION.

Cancellation is a method of shortening the work in problems involving only multiplication and division. Dividing any one of a series of factors by any number divides their product by that number. Dividing dividend and divisor by the same number does not change the quotient.

1. $\frac{4 \times 3 \times 6 \times 12}{2 \times 3 \times 4 \times 6}$. This is an example in division in which the dividend and divisor are partially factored. We shorten the operation by canceling the 3's; i.e., by dividing both dividend and divisor by three. We further shorten the work by canceling the 4's and 6's. The dividend is now 12 and the divisor 2; hence the result is 6.

2. Multiply 44 by 8 and the product by 7; then divide it by $11 \times 16 \times 7$.

3. Divide $40 \times 18 \times 13 \times 8$ by $10 \times 13 \times 16$.

4. Divide $15 \times 4 \times 8 \times 9$ by $30 \times 2 \times 6 \times 12$.

5. Divide $108 \times 17 \times 9 \times 4$ by $27 \times 3 \times 16 \times 17$.

6. Divide $5 \times 25 \times 874$ by $2 \times 437 \times 5 \times 5 \times 5$.

7. Divide $376 \times 14 \times 21$ by $7 \times 7 \times 16 \times 3$.

8. Divide $10 \times 5 \times 25$ by $2 \times 5 \times 5 \times 5$.

9. Divide $120 \times 4 \times 9$ by $3 \times 40 \times 4 \times 3$.

10. Divide $60 \times 3 \times 7 \times 21$ by $20 \times 14 \times 3 \times 9$.

11. Divide $15 \times 18 \times 21 \times 25$ by $9 \times 3 \times 7 \times 15$.

12. Divide $44 \times 8 \times 7$ by $11 \times 16 \times 7$.

13. Divide $15 \times 4 \times 8 \times 9$ by $30 \times 2 \times 6 \times 12$.

14. Divide $5 \times 25 \times 874$ by $2 \times 437 \times 5 \times 5 \times 5$.

15. Divide $11 \times 39 \times 14 \times 96$ by $44 \times 18 \times 26 \times 14$.

16. Divide $125 \times 60 \times 24 \times 42$ by $25 \times 120 \times 36 \times 5$.

17. Divide $36 \times 21 \times 14$ by $27 \times 7 \times 6$.

18. Divide $109 \times 105 \times 11$ by $35 \times 33 \times 5 \times 5$.

19. Divide $54 \times 3 \times 4 \times 15$ by $18 \times 12 \times 10$.

20. Divide $25 \times 160 \times 13 \times 90$ by $51 \times 30 \times 8 \times 15$.

21. Divide $400 \times 124 \times 64 \times 72$ by $36 \times 75 \times 18 \times 24$.

To find a part of a fraction or to divide a fraction by a fraction.

1. Divide $\frac{2}{3}$ by $\frac{3}{4}$.

(*a*) $\frac{2}{3} = \frac{8}{12}$ $\quad \frac{3}{4} = \frac{9}{12}$ $\quad \frac{8}{12} \div \frac{9}{12} = 8 \div 9 = \frac{8}{9}$.

(*b*) $\frac{2}{3} \div 1 = \frac{2}{3}$.

$\frac{2}{3} \div \frac{1}{4} = 4 \times \frac{2}{3}$.

$\frac{2}{3} \div \frac{3}{4} = \frac{1}{3}$ of $4 \times \frac{2}{3}$, or

$\frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$.

$\frac{2}{3}$ divided by 1 is $\frac{2}{3}$. $\frac{2}{3}$ divided by $\frac{1}{4}$ must be 4 times $\frac{2}{3}$; hence $\frac{2}{3}$ divided by $\frac{3}{4}$ must be $\frac{1}{3}$ of 4 times $\frac{2}{3}$, or $4 \times \frac{2}{3}$.

Therefore, dividing $\frac{2}{3}$ by $\frac{3}{4}$ is the same as multiplying $\frac{2}{3}$ by $\frac{4}{3}$, the divisor inverted.

NOTE. — In multiplying or dividing fractions, cancel when possible.

2. Divide:

$\frac{5}{9}$ by $\frac{2}{3}$ $\quad \frac{12}{15}$ by $\frac{5}{3}$ $\quad \frac{8}{15}$ by $\frac{6}{30}$ $\quad \frac{3}{5}$ by $\frac{4}{15}$

$\frac{5}{12}$ by $\frac{3}{4}$ $\quad \frac{6}{12}$ by $\frac{3}{4}$ $\quad \frac{2}{9}$ by $\frac{2}{27}$ $\quad \frac{4}{15}$ by $\frac{2}{3}$

$\frac{18}{30}$ by $\frac{9}{4}$ $\quad \frac{3}{8}$ by $\frac{7}{12}$ $\quad \frac{4}{9}$ by $\frac{2}{3}$ $\quad \frac{6}{7}$ by $\frac{3}{4}$

MULTIPLICATION OF FRACTIONS.

3. Multiply $\frac{4}{8}$ by 2.

1) $\frac{4}{8} \times 2 = \frac{4 \times 2}{8} = \frac{8}{8} = 1$, or $\frac{\overset{1}{\cancel{4}}}{\underset{2}{\cancel{8}}} \times \frac{\overset{1}{\cancel{2}}}{1} = 1$.

2) $\frac{4}{8} \times 2 = \frac{4}{8 \div 2} = \frac{4}{4} = 1$.

By the first method do you change the size of the parts? What do you do to the number of parts? By the second method what do you do to the size of the parts? What to the number of parts? Take the disks and illustrate both methods.

4. Multiply:

$\frac{1}{8}$ by $\frac{4}{3}$ $\quad \frac{7}{10}$ by $\frac{5}{3}$ $\quad \frac{7}{9}$ by $\frac{3}{8}$ $\quad \frac{7}{12}$ by $\frac{6}{3}$ $\quad \frac{5}{6}$ by $\frac{6}{10}$

$\frac{8}{15}$ by $\frac{5}{4}$ $\quad \frac{11}{20}$ by $\frac{10}{7}$ $\quad \frac{6}{18}$ by $\frac{9}{2}$ $\quad \frac{6}{3}$ by $\frac{3}{4}$ $\quad \frac{3}{4}$ by $\frac{2}{3}$

$\frac{16}{24}$ by $\frac{6}{8}$ $\quad \frac{8}{15}$ by $\frac{3}{4}$ $\quad \frac{5}{10}$ by $\frac{5}{2}$ $\quad \frac{18}{24}$ by $\frac{8}{9}$ $\quad \frac{17}{21}$ by $\frac{7}{8}$

NOTE. — $\frac{3}{8} \div \frac{5}{7}$ may be written $\frac{\frac{3}{8}}{\frac{5}{7}}$. When written in this form it is called a complex fraction. A complex fraction is a fraction having a fraction or mixed number for one or both of its terms.

5. Simplify: $\quad \frac{12\frac{1}{2}}{37\frac{1}{2}}$ $\quad \frac{2\frac{4}{5}}{1\frac{3}{4}}$ $\quad \frac{1\frac{1}{5}}{2\frac{1}{3}}$ $\quad \frac{33\frac{4}{9}}{7\frac{3}{4}}$ $\quad \frac{37\frac{2}{9}}{6\frac{2}{3}}$ $\quad \frac{9\frac{3}{5}}{4\frac{2}{7}}$

6. Simplify: $\quad \frac{37\frac{5}{44}}{51\frac{1}{12}}$ $\quad \frac{37\frac{1}{7}}{4\frac{8}{11}}$ $\quad \frac{17\frac{6}{9}}{3\frac{1}{3}}$ $\quad \frac{80\frac{5}{12}}{8\frac{1}{3}}$ $\quad \frac{17\frac{5}{6}}{5\frac{2}{18}}$ $\quad \frac{49\frac{4}{7}}{8\frac{6}{28}}$

APPLICATION OF MULTIPLICATION AND DIVISION OF FRACTIONS.

1. If $\frac{4}{5}$ of an acre of land cost \$60, what will $\frac{7}{15}$ of an acre cost?

SOLUTION.

$$\overset{5}{\cancel{\$60}} \times \frac{\cancel{5}}{\cancel{4}} \times \frac{7}{\cancel{15}_{3}} = \$35.$$

If $\frac{4}{5}$ of an acre cost \$60, one acre will cost as many dollars as $\frac{4}{5}$ is contained times in \$60, or $\$60 \times \frac{5}{4}$. If one acre costs $\$60 \times \frac{5}{4}$, $\frac{7}{15}$ acres will cost $\$60 \times \frac{5}{4} \times \frac{7}{15}$.

2. If $7\frac{1}{2}$ lb. of raisins cost 85 cents, what will $4\frac{1}{2}$ lb. cost?

3. If 9 oranges cost $22\frac{1}{2}$ cents, what will 16 oranges cost?

SOLUTION.

$$\overset{5}{\cancel{45}}\not{\text{¢} } \times \frac{1}{\cancel{9}} \times \frac{\overset{8}{\cancel{16}}}{1} = 40 \text{ cents.}$$

4. What will $4\frac{1}{3}$ tons of coal cost, if $10\frac{1}{2}$ tons cost \$75.48?

5. What is the cost of a pile of wood 12 feet long, 4 feet wide, and 6 feet high, at $5\frac{1}{2}$ a cord?

SOLUTION.

$$\frac{\overset{3}{\cancel{12}} \times 4 \times \overset{3}{\cancel{6}}}{\underset{8}{\cancel{128}}_{32}} \times \frac{\$11}{\cancel{2}} = \frac{\$99}{8} = \$12\tfrac{3}{8}.$$

The solution explains itself. The work is all indicated, and cancellation is then used to lessen the number of figures required.

6. Find the cost at $3\frac{1}{2}$ a cord of wood which fills a shed 24 ft. long, 20 ft. wide, and 16 ft. high.

7. How many gallons of molasses at $37\frac{1}{2}$¢ a gallon are worth as much as $12\frac{3}{4}$ bu. of potatoes at 40¢ a bushel?

8. If $6\frac{7}{8}$ cd. of wood cost $\$36\frac{1}{2}$, what will $2\frac{1}{2}$ cd. cost?

9. The perimeter of a room is 56 ft. 8 in., and its height 8 ft. 9 in. Find the area of the 4 walls.

10. Find the volume of a rectangular solid whose dimensions are $2\frac{3}{5}$ ft., $2\frac{2}{3}$ ft., and $4\frac{1}{2}$ ft.

11. What must I pay for $37\frac{2}{3}$ tons of coal, if $12\frac{1}{3}$ tons cost \$74?

12. If $13\frac{1}{3}$ lb. of sugar cost $81\frac{2}{3}$ cents, what will $8\frac{3}{4}$ lb. cost?

ORAL.

1. In 96 oz. how many half-pounds?

2. When milk is $.05 a quart, what will 5 gallons cost?

3. Find the cost of $\frac{3}{4}$ of a pound of tea at $1.00 a pound, and 1 pound of butter at 25¢ a pound.

4. If you can buy 6 cards for a cent, how many can you buy for $1?

5. What will $\frac{1}{3}$ of a ton of coal cost at $6.30 a ton? At $5.10?

6. Find the cost of 7 chairs at $3 each, 12 at $2 each, and a table at $15.

7. A man spent $24 out of $36. What per cent of his money had he left?

8. If you should put 320 oz. of cloves into quarter pound packages, how many packages would you have?

9. How many pint bottles will be required to hold 5 gal. 2 qt. of syrup?

10. Find the cost of 4 lb. 8 oz. of cheese at 8 cents a half-pound.

11. How many quarts will it take to fill a bag holding $2\frac{1}{2}$ pk.?

12. If $18 is $\frac{1}{3}$ of my money, how much money have I?

13. If you gather $\frac{1}{2}$ bu. of walnuts, and sell 1 pk. for 50 cents and the rest at 10 cents a quart, how much will you receive?

14. Find the cost of $6\frac{1}{2}$ lb. of sugar at 6¢ a pound.

15. Find the cost of $6\frac{1}{3}$ lb. of meat at 9 cents a pound.

16. Paid 5 cents a pound for 2 packages of buckwheat, each package containing $3\frac{1}{2}$ lb. Find the cost.

17. What is the cost of 4 pk. 4 qt. of nuts at 20¢ a peck?

18. What 4 equal numbers make 36?

19. Nellie had 36 peaches. After eating $\frac{1}{4}$ of them, and giving away $\frac{1}{2}$ of them, how many had she left?

20. What is meant by $\frac{5}{6}$ of anything?

21. What part of 8 is 3? What per cent of it?

1. A man owns a rectangular garden plot 320 ft. long, 210 ft. wide. Around the outside is a walk 6 ft. wide. Find the square yards in the garden and in the walk. (Illustrate.)

2. If 5 men mow 15 acres of grass in 6 days, in how many days can 12 men mow the same number of acres?

3. Write in Roman numerals 1894.

4. Multiply seventy-three hundred thousandths by one thousand.

5. $\frac{.035 \times .0056}{.00007} = ?$

6. What is the cost of sawing a pile of wood 20 ft. long, 4 ft. wide, and 6 ft. high, at $1.25 a cord?

7. A field contains 199½ sq. rd. It is 18¾ rd. long. How wide is it?

8. Divide five thousand fifty and five tenths by five hundredths, and subtract twenty-five hundredths from the quotient.

9. What part of an acre in a piece of land 120 ft. wide and 150 ft. long?

10. Find the amount of $550 for 2 yr. 5 mo. 12 da. at 6%.

NOTE. — Amount is the sum of the interest and principal.

11. What is the cost of carpeting a room 16½ ft. long, 12 ft. wide, with oil-cloth 1½ yd. wide, at 75¢ a yard?

NOTE. — Have the least waste.

12. Divide ⅓ of 4½ by ⅔ of ⅞.

13. What will it cost to carpet a room 18 ft. long, 13 ft. wide, with carpeting ¾ yd. wide, at $1.25 a yard, breadths to run lengthwise, and a waste on each breadth of 8 in. for matching the figures?

NOTE. — Sometimes, in order to have the figures in the carpet match, it is necessary to make each breadth longer than the room. This is called a waste, because it obliges the purchaser to buy more carpet than he needs for the room. Add the waste on each breadth to the length of the room when the carpet runs lengthwise, and to the width when it runs widthwise, to find the length of each breadth. Make a diagram to illustrate.

BOARD MEASURE.

All kinds of lumber are measured by board feet. A board foot is 1 ft. long, 1 ft. wide, and 1 in. thick. Boards less than one inch in thickness are reckoned as one inch thick. In this book, when no thickness is mentioned, one inch is understood.

1. How many feet of lumber are there in 24 boards, each 12 ft. long, 10 in. wide, and 1 in. thick?

10 in. $= \frac{5}{6}$ ft.
12 ft. $\times \frac{5}{6} = 10$ ft.
10 ft. $\times 24 = 240$ ft.

or, $\frac{24 \times 12 \times 5}{6}$

Cancel when possible.

If this board was 1 ft. wide, it would contain as many board feet as it has feet in length. Since it is only 10 in. ($\frac{5}{6}$ ft.) wide, it will contain only $\frac{5}{6}$ as many feet, or 10 ft. And 24 boards will contain 24 times 10 ft., or 240 ft.

2. How many feet of lumber in a plank 9 ft. long, 8 in. wide, and 2 in. thick?

$\frac{9 \times 2 \times 2}{3}$

Since a board is only 1 in. thick, a plank 2 in. thick will make 2 boards. Hence find the number of feet in one board as above, and then multiply by the thickness in inches.

Find the number of board feet in each of the following:

3. A board 16 ft. long, 12 in. wide, 1 in. thick.
4. A plank 16 ft. long, 9 in. wide, 2 in. thick.
5. 14 ft. long, 6 in. wide, 1 in. thick.
6. 14 ft. long, 6 in. wide, 3 in. thick.
7. 12 ft. long, 8 in. wide, 1 in. thick.
8. 18 ft. long, 9 in. wide, 3 in. thick.
9. 12 ft. long, 3 in. wide, 3 in. thick.
10. 14 ft. long, 12 in. wide, 2 in. thick.
11. 14 ft. long, 18 in. wide, 1 in. thick.
12. 15 ft. long, 8 in. wide, 1 in. thick.
13. 16 ft. long, 9 in. wide, 2 in. thick.
14. 18 ft. long, 18 in. wide, 3 in. thick.
15. 12 ft. long, 9 in. wide, 2 in. thick.
16. 9 ft. long, 10 in. wide, 2 in. thick.

1. Find the number of feet of lumber required to floor a barn 36 ft. long, 17 ft. 6 in. wide, the planks being $2\frac{1}{2}$ in. thick.

2. At $18 per M., what will be the cost of the boards to build a fence 4 boards high round a field 160 yd. long, 120 yd. wide, if each board is 6 in. wide?

3. How many feet of 6-in. boards are required to build 20 rd. of fence 4 boards high?

4. How many feet of lumber are required for 140 ft. of tight board fence $5\frac{1}{3}$ ft. high?

5. How many feet of boards will be necessary to cover both gables of a building 34 ft. wide, if the roof has a one-fourth pitch?

6. How many feet of boards will be needed to cover both gables of a building 27 ft. wide, if the roof has a one-third pitch?

7. A floor is 12 ft. by 16 ft. How many feet of lumber will be needed for this floor, if each plank is 2 in. thick?

8. In the 7th example, which way should the planks run, if each plank is 16 ft. long?

9. Find how many feet of planks will be needed if 12-foot planks of the same thickness are used.

10. At $16 per M., what is the cost of 42 16-ft. fence boards? Fence boards are 6 in. wide.

11. At $28 per M., find the cost of 750 boards, each 14 ft. long, 12 in. wide, and 1 in. thick.

12. What is the cost of 46,250 ft. of pine lumber at $28.40 per M.?

13. Find the number of board feet in 478 joists, each 24 ft. long, 10 in. wide, and 3 in. thick.

14. How many yards of carpet, $\frac{3}{4}$ of a yard wide, will be required for a room 20 ft. long, 17 ft. wide, if the breadths run across the room, and there is a waste of 1 ft. on each breadth for matching? How many yards if the breadths run lengthwise, and there is a loss of 6 in. on each breadth for matching?

1. Add $\frac{2}{3}$, $\frac{10}{14}$, $\frac{8}{12}$, $\frac{3}{7}$, and $\frac{30}{35}$. First reduce each to its lowest terms.

2. $78\frac{5}{6} - 49\frac{3}{4}$. $4\frac{1}{2} + 5\frac{2}{3} + 7\frac{5}{5}$.

3. Simplify $\dfrac{\frac{4}{5} \times \frac{1}{8} \times 4\frac{1}{4}}{6\frac{3}{8}}$.

4. What per cent of an acre is a rectangular piece of land 5 rd. long and 4 rd. wide?

5. Divide 73.8 by .0008. $1\frac{4}{5}$ by $\frac{7}{5}$.

6. Find the prime factors that are common to 1,155 and 2,205.

7. At $6.40 a ton, how much will 3,675 lb. of coal cost?

8. Add 7.46, 536, 73.76, 7.569, 165, and 46.78.

9. Divide $1\frac{5}{5}$ by $1\frac{2}{5}$. $\frac{1}{25}$ by $5\frac{1}{5}$.

10. $246 \times 8 - 169 \div 13 - (225 \div 15) \times 16 + 207 \div 3$.

11. Find the entire surface of a square pyramid whose slant height is 7 ft., and base a 3 ft. square.

12. What will it cost, at 65¢ a square yard, to paint a church spire whose base is an octagon 7 ft. on each side, and whose slant height is 95 ft.?

13. What is the area of a circle, if the distance around it is 314.16 ft.?

NOTE. — In finding the diameter or circumference, use 3.1416 in place of $3\frac{1}{7}$. It is more nearly correct.

14. What is the convex surface of a cone, the diameter of whose base is 6 feet, and whose slant height is 24 ft.?

15. Of another cone, the circumference of whose base is 16 ft., and whose slant height is 18 ft.?

16. Find the entire surface of a cylinder whose circumference is 16 ft., and whose altitude is 25 ft.

17. What will it cost, at $1.25 a square yard, to polish the convex surface of a cylinder 3 ft. in diameter and 12 ft. long?

18. How many acres are there in a circular field whose diameter is 22 rods?

ORAL.

1. How many feet in two boards 14 ft. long, 12 in. wide?

2. How long is it from 15 minutes of 7 o'clock in the morning till 15 minutes past 6 o'clock in the evening?

3. How many cubic feet of earth must be removed to dig a cellar 30 ft. long, 20 ft. wide, and 4 ft. deep?

4. How many square yards in 27 sq. ft.? In 54 sq. ft.? 72 sq. ft.?

5. How many inches in $4\frac{1}{2}$ ft.?

6. How many inches in $2\frac{1}{3}$ yd.?

7. How high is a horse that is $16\frac{1}{4}$ hands high?

NOTE. — A hand is 4 in., a term used only in speaking of the height of horses.

8. How many feet deep is water that is 8 fathoms deep?

9. If by selling a horse for \$160 I gain $\frac{1}{4}$ of the cost, what did he cost?

10. Read the 9th example, using the equivalent per cent in place of the fraction.

11. If two-thirds of a dozen oranges cost 16 cents, how much will $2\frac{1}{4}$ dozen cost?

12. $\frac{5}{6}$ of 72 is $\frac{3}{4}$ of how many?

13. $\frac{2}{3}$ of 48 is $\frac{4}{7}$ of how many?

14. A farmer sold $\frac{1}{4}$ of his tobacco crop to one man, and $\frac{1}{4}$ to another, and had 100 lb. remaining. How much had he at first?

15. If $3\frac{1}{8}$ lb. of meat cost 50 cents, how much will $2\frac{1}{2}$ lb. cost?

16. When $\frac{3}{7}$ of my monthly salary is \$9, how much do I earn in $\frac{2}{3}$ of a month?

17. What must I pay for $9\frac{1}{2}$ bbl. of apples, if $1\frac{1}{2}$ bbl. cost \$6?

18. If $\frac{1}{4}$ of 8 cords of wood costs \$12, how much will $\frac{1}{2}$ of 3 cords cost?

19. What will $8\frac{1}{4}$ bbl. of apples cost, if $2\frac{1}{4}$ bbl. cost \$9?

20. $\frac{3}{5}$ of 100 is $\frac{5}{12}$ of what number?

21. 8 is $\frac{2}{3}$ of what number? 14 is $\frac{7}{9}$ of what number?

1. How many square feet in a floor 28 ft. long and $19\frac{3}{4}$ ft. wide?

2. From the middle point of one side of an equilateral triangle to the vertex is 21 feet. The base is $24\frac{1}{2}$ ft. Required the area.

3. If 45 sheep cost \$540, what number will \$228 purchase?

4. If 12 cd. of wood cost \$54, what will $19\frac{5}{8}$ cords cost?

5. How much commission shall I pay an auctioneer for selling my house for \$5,600, at $2\frac{1}{2}\%$?

6. From a cask of rice containing 760 lb., 90 lb. were sold at one time, 60 lb. at another, and 40 lb. at another. What per cent was sold?

7. Add 7 rd. 4 yd. 2 ft. 7 in.; 19 rd. 3 yd. 2 ft. 9 in.; 5 rd. 3 yd. 1 ft. 6 in.; 3 rd. 4 yd. 2 ft. 5 in.; 1 rd. 3 yd. 1 ft. 11 in.

8. $646\frac{1}{2}$ pounds of sugar cost \$51.72. The merchant wishes to gain $\$3.23\frac{1}{4}$. How much must he ask a pound to do so?

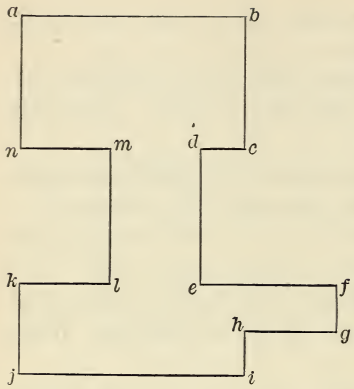
9. A rectangular block of marble is 7 ft. long, 4 ft. wide, and $3\frac{1}{2}$ ft. high. If it costs 60¢ a cubic foot, find its cost.

10. The perimeter of a rectangle is 124 rd., the width is 12 rd. Find the area.

11. A man built a barn 80 ft. long, 45 ft. wide, with 30 ft. posts. The roof has a one-third pitch, and the rafters are 28 ft. long. Find how many feet of inch boards will be needed for sides and ends, allowing for 2 double doors 14 ft. by 12 ft., and 2 single doors 9 ft. by 6 ft. Find the feet of lumber needed for floor, covered with 2-inch planks. Find the feet of roof-boards needed. Find the feet of lumber needed for doors, if $1\frac{1}{2}$ in. boards are used. Find the cost of lumber at \$16 per M.

12. A merchant paid \$10 for an article, and sold it at an advance of 20%. Find the selling-price.

13. Find the value of a pile of wood 40 ft. long, 4 ft. wide, and 4 ft. 6 in. high, at \$5.50 a cord.



This diagram represents a garden plot, drawn to a scale of $\frac{1}{2}$ in. to 8 ft.

1. Find the distance round the garden.

2. Find the area of the garden.

3. If *ml* is extended to *ji*, it will cut off on the left Mary's flower-bed. Find the area and perimeter of her bed.

4. If she sets out plants six inches apart, how many plants can she have in the garden?

5. Extend *ih* until it meets *ef*; you have cut off on the right Bessie's flower-bed. The area of Bessie's bed is what per cent of the area of Mary's bed?

6. The perimeter of Bessie's bed is what per cent of the perimeter of Mary's bed?

7. If Bessie and Mary both start from *a*, and walk round the garden in opposite directions with equal speed, where will they meet?

8. If *nm* and *cd* are extended until they meet, the part cut off above is the vegetable garden. The area of Bessie's and Mary's flower gardens will be what per cent of the area of the vegetable garden?

9. The perimeter of Bessie's garden is what per cent of the perimeter of the vegetable garden?

10. Find the area of the garden not belonging to Mary, Bessie, or the vegetable garden.

11. How much will it cost, at $18 per M., to build a fence 4 boards high round the entire garden, if the boards are 8 ft. long and 6 in. wide?

1. A man paid \$960 for a carriage and span of horses, paying three times as much for the horses as for the carriage. How much did he pay for each?

In examples like the above use the symbol x. This x stands for any unknown quantity.

Let x = the cost of the carriage.

then $3x$ = the cost of the horses.

$4x$ = the cost of all, which is \$960.

$4x = \$960$. $x = \$240$. $3x = \$720$.

2. A and B together had \$150, and B had four times as much money as A. How many dollars had each?

3. A man bought a harness and a robe for \$45. The harness cost 4 times as much as the robe. What was the price of each?

4. Three men, A, B, and C, form a company with a capital of \$6,000. C put in 2 times as much as A, and B 3 times as much as A. How many dollars did each put in?

5. 108 marbles are divided among 3 boys. A takes a certain sum, B takes 3 times as many as A, and C takes 5 times as many as A. What is each boy's share?

6. Divide \$81 among A, B, and C, so that B shall have 5 times as much as A, and C 3 times as much as A.

7. A horse and carriage are together worth \$450. The horse is worth twice as much as the carriage. What is each worth?

8. A man has 3 houses, which are together worth \$5,400. The second is worth twice as much as the first, and the third is worth as much as the other two. Find the cost of each.

9. Divide \$216 among A, B, and C, so that B may have 3 times as much as A, and C may have 5 times as much as A.

10. Divide the number 136 into three parts such that the second shall be 3 times the first and the third as much as the first and second.

1. A church steeple is in the form of a pyramid. Its base is a square 15 ft. on each side, and its slant height is 70 ft. What is the cost of painting it at 30¢ a square yard?

2. Find the difference in cost of painting this spire had the base been a hexagon having the same dimensions.

3. What is the area of a semicircle whose radius is 12 ft.?

4. Draw a circle with a radius of 5 in. This is a drawing to represent a lot of land. If the scale is $\frac{1}{4}$ in. to a rod, how many square rods in the field? How many acres?

5. A rectangular cistern is 8 ft. long, 6 ft. 6 in. wide, and $4\frac{1}{2}$ ft. deep. Find the expense of lining the sides and bottom with sheet lead weighing 9 lb. a square foot, at 5¢ a pound.

6. A pile of wood contains $6\frac{1}{2}$ cd. If the pile is 32 ft. long and $6\frac{1}{2}$ feet high, how wide is it?

7. A room is 15 ft. 3 in. long and 12 ft. 6 in. wide. The carpet is $\frac{3}{4}$ of a yard wide. There is a loss on each strip of 4 in. for matching. Which way should the breadths run to use the least number of yards of carpeting?

8. A barn is 80 ft. by 30 ft. and the roof has a one-half pitch. How many feet of inch boards will cover the gable ends? The floor is covered with 3-inch plank. Find its cost at $12 per M.

9. Find the area of a rectangle 15 yd. long, and 45 ft. wide.

10. Find the area of a rectangle 150 ft. long, 4 rd. wide.

11. Find the area of a rectangle 417 ft. 9 in. long and 604 in. wide.

12. Find the area of a triangle, base 40 ft. and altitude $8\frac{1}{2}$ ft.

13. Find $6\frac{1}{4}\%$ of 640. $62\frac{1}{2}\%$ of 380.

14. Find $87\frac{1}{2}\%$ of 560. $37\frac{1}{2}\%$ of 241.

15. The total length of the Union Pacific railroad is 1818 miles. If the total cost was $157,091,562, what was the average cost a mile?

ORAL.

1. If 1 yd. of cloth cost $5\frac{1}{4}$ what will $\frac{2}{3}$ yd. cost?

2. If 5 bbl. of beef cost $17\frac{1}{2}$, what will $1\frac{1}{2}$ bbl. cost?

3. $\frac{2}{3}$ of 15 is $\frac{5}{7}$ of how many times 2?

4. $\frac{7}{9}$ of 18 is $\frac{2}{9}$ of how many times 7?

5. $\frac{2}{3}$ of 24 is $1\frac{3}{5}$ times what number?

6. If $\frac{5}{6}$ of an acre of land is worth $15 what are $10\frac{1}{2}$ acres worth?

7. If you earn $\$\frac{7}{8}$ in a day and your brother $\$\frac{3}{8}$ in a day, how much will you both earn in 8 days?

8. If Nellie has twice as many plums as Mary, and both have 18 plums, how many has each?

9. 84 is $\frac{12}{5}$ of how many times $\frac{1}{5}$ of 25?

10. $7\frac{5}{7}$ are how many times 9?

11. Reduce to improper fractions: $6\frac{5}{6}$, $9\frac{3}{5}$, $7\frac{3}{7}$, $5\frac{3}{4}$, $4\frac{3}{8}$.

12. What will $\frac{1}{3}$ of a dozen of oranges cost at $\frac{3}{4}$ of a cent each?

13. What will 1 pt. of buckwheat cost if 3 pk. cost 48 cents?

14. Mr. C sold a farm for $1,200, which was $\frac{6}{7}$ of its cost. Find the loss.

15. How many cents will $\frac{4}{5}$ of 100 oranges cost at $\frac{1}{2}$ dime each?

16. How many times 8 are $\frac{1}{16}$ of 26?

17. If 7 bbl. of cider cost $28, what will 6 bbl. cost?

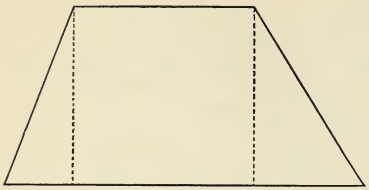
18. If a boy can do a piece of work in 30 min., how many hours will it take him to do 12 times as much work?

19. If 8 yd. of cloth are worth $40, and butter is $3 a box, how many boxes of butter will 9 yd. of cloth buy?

20. How much will 6 yd. of silk cost at $\$2\frac{1}{2}$ a yard?

21. Mr. Brown is 40 years old, and his son is $\frac{3}{5}$ as old. How old is the son?

22. A man sold $2\frac{3}{4}$ yd. of velvet from a piece containing $3\frac{1}{2}$ yd. How many yards had he left?

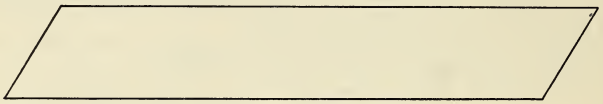


1. What figure is this?

2. Cut out of paper a trapezoid, twice as large as this figure.

3. Fold so that the two parallel edges will coincide. Crease. Cut on the crease. Place the two pieces so that what were the two parallel lines shall form one continuous line.

4. What new form have you?



5. How do you find the area of a parallelogram?

6. The base of the parallelogram is the sum of what two lines in the trapezoid?

7. The height of the parallelogram is what part of the height of the trapezoid?

8. Formulate a rule for finding the area of a trapezoid.

9. Instead of multiplying the sum of the two parallel sides by one-half of the altitude, can you find another way for finding the area of a trapezoid?

NOTE. — Into what figures can you divide the trapezoid?

10. Find the area of a trapezoid whose parallel sides measure 11 ft. and 16 ft., and the perpendicular distance between them 60 ft.

11. Find the area of a trapezoid whose parallel sides are 60 ft. and 130 ft., and altitude 40 ft.

12. One parallel side of a field in the shape of a trapezoid is 150 yd. The other is 200 yd. How many square yards in the field, the perpendicular distance between the sides being 50 yards?

1. Find the convex surface of a triangular prism, whose length is 12 ft. and each side of whose base is $2\frac{1}{2}$ ft.

2. Required the number of square feet in the surface of a square pyramidal roof, the length of whose sides is 20 ft., and whose slant height is 18 ft.

3. What length of tire will it take to band a cart-wheel 5 ft. in diameter?

4. What is the difference between the area of a floor 40 ft. square, and that of two other floors, each 20 ft. square?

5. The diameter of a circular grass-plot is 17.5 ft. What is its circumference?

6. If the circumference of a tree is 50 in., what is its diameter?

7. How many board ft. in a plank whose length is 20 ft., breadth 16 in., and thickness 3 in.?

8. Find the entire surface of a cylinder, whose height is 9 ft. and the circumference of whose base is 6 ft.?

9. Required the area of a pasture in the form of a trapezoid, whose parallel sides are 786 and 473 ft., and altitude 986 ft.

10. Bought 20 joists, each 18 ft. long, 5 in. wide, and 3 in. thick, at $30 a M. What did they cost me?

11. Find the board feet in a board 24 ft. long and 16 in. wide.

12. Multiply 47,200 by 3,400.

13. Add fifteen thousandths, eighty-one ten-thousandths, fifty-six millionths, seventeen ten-millionths, two hundred five hundred-thousandths.

14. Change to decimals and add: $1\frac{1}{2}$, $4\frac{3}{4}$, $5\frac{1}{8}$, $2\frac{3}{5}$, $1\frac{1}{125}$.

15. Multiply .032 by .005, and then divide .0512 by your product.

16. Take 27 and 28 thousandths from 97 and 7 tenths.

17. Reduce to common fractions: .055. .008.

18. Reduce to decimals: $\frac{1}{11}$, $\frac{2}{25}$, $\frac{8}{1000}$, $13\frac{17}{45}$.

1. Add vertically and horizontally:

	a	*b*	*c*	*d*	*e*	*f*	
g	\$4.76 +	\$3.87 +	\$5.64 +	\$7.12 +	\$6.05 +	\$8.17	=
h	3.41 +	8.39 +	9.12 +	1.97 +	5.56 +	7.62	=
i	9.26 +	5.65 +	6.85 +	3.58 +	4.19 +	4.74	=
j	7.68 +	4.98 +	9.57 +	4.89 +	3.68 +	9.15	=
k	4.45 +	2.76 +	2.44 +	6.15 +	7.77 +	1.48	=
l	1.07 +	5.72 +	5.36 +	7.34 +	9.75 +	3.49	=

2. Divide $7\frac{2}{3}$ by $1\frac{1}{2}$; $8\frac{1}{4}$ by $2\frac{3}{8}$; $3\frac{1}{2}$ by $1\frac{2}{3}$; $43\frac{1}{3}$ by $4\frac{1}{4}$.

3. If $\frac{3}{4}$ of a ton of hay cost \$12.30, what will 4 T. 500 lb. cost?

4. What will it cost at 16¢ a yard to fence a field $28\frac{3}{4}$ rd. square?

5. At \$1.25 a yard, find the cost of carpeting a room 18 ft. 3 in. long and 12 ft. 6 in. wide. The carpet is 30 in. wide, and the breadths run lengthwise. What would be the difference in expense if the breadths ran the other way?

6. How many board feet in 15 planks, each 15 ft. long, 16 in. wide, and 2 in. thick?

7. Draw, name, and describe 4 kinds of quadrilaterals.

8. A certain flower-bed is in the form of a trapezoid. The two parallel sides are 10 ft. and 12 ft. and the perpendicular distance between them is 8 ft. Find the area.

9. What is the floor measurement of a house built in the form of an octagon, whose side is 12 ft., and the perpendicular distance from the center to the middle of each side is 8 ft. 6 in.?

10. A wheel whose diameter is 3 ft. turns how many times in going a half-mile?

11. A cistern is in the form of a rectangular prism, 12 ft. 8 in. long, 8 ft. 6 in. wide, and 12 ft. deep. How many square feet are there in the sides and botton?

12. The dividend is 300; the divisor is 17. What is the remainder?

LEAST COMMON MULTIPLE.

1. Name a number that is divisible by 4.

2. A number that is divisible by another number is a multiple of it.

3. Name some numbers that are divisible by both 4 and 6.

4. A common multiple of two or more numbers is a number that is divisible by all of the given numbers.

5. What is the least common multiple of 3, 4, and 6?

6. The least common multiple of two or more numbers is the least number that is divisible by the given numbers.

7. A multiple of a number contains all the prime factors of that number.

8. A common multiple of two or more numbers contains *all the factors* of each of the numbers.

9. Find the least common multiple of 8, 12, 20, and 30.

2)	8	12	20	30
2)	4	6	10	15
3)	2	3	5	15
5)	2	1	5	5
	2	1	1	1

$2 \times 2 \times 2 \times 3 \times 5 = 120$

Arranging the numbers in a line, we notice that 2 is a factor of all the numbers, hence (8) it must be a factor of their multiple. Remove the factor 2 by division. We notice again that 2 is a factor of 4, 6, and 10. It must then be a factor of any number that can be divided by 4, 6, and 10. As at first, remove the factor 2 by dividing, and since 2 is not a factor of 15, place the 15 in the next line with the quotients. In the same way continue to remove any factor of two or more of the numbers. The continued product of these divisors and the last quotients will be the least common multiple.

10. Find the least common multiple of 8, 16, 30, 48, 60, and 75.

11. Of 28, 30, 40, 56, and 60.

12. Of 42, 58, 84, 91, and 98.

13. Of 2, 3, 4, 5, 6, 7, 8, and 9.

14. Of 14, 18, 22, and 24.

15. Of 15, 27, 35, 42, and 70.

16. Of 27, 36, 45, 90.

ORAL.

1. Find 125% of 12; 20; 80; 120; 240.

2. Find .66⅔ of 27. Find 66⅔% of 27.

3. Express in common fractions in the lowest terms: 10%; 75%; 150%; 37½%; 116⅔%.

4. Find 50% of $72; $8½; $12⅔; 40 books; .4; 50%; $500.

5. A man gained $26 by buying flour at $5 a barrel, and selling it at a gain of 20%. How many barrels did he sell?

6. What is 100% of $10? 4 oranges? 79 m.?

7. A regiment of 400 men went into battle, where 25% of them were killed. How many men were not killed?

8. A merchant paid $5.75 for an article, and sold it at a profit of 20%. How much did he gain? How much did he sell it for?

9. What part of 12 is 6? 16 is 4? 25 is 5? 12 is 2?

10. Substitute per cent for part in example 9, and give answer.

11. What part and what per cent of 10 is 5? 100 is 25? 500 is 50? 20 is 20? 120 is 40? 75 is 25? 40 is 32? 240 is 20?

12. A herd of 300 cattle was driven through a town. If the farmers bought 50 cows from the herd, what per cent of the herd did they buy?

13. I invested $540 and lost $90. What per cent did I lose?

14. I bought 5 dozen oranges, but threw away 6 because they were poor. What per cent did I throw away?

15. Of what number is 40, 20%? 12, 6%? 9, 100%?

16. 12 is ⅓ more than what number?

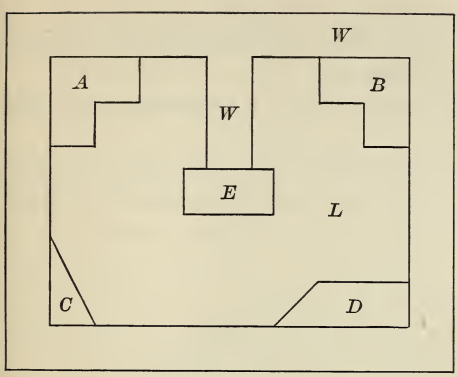
17. 12 is 133⅓% of what number?

18. 20 is ¼ more than what number?

19. 20 is 125% of what number?

20. 20 is 25% more than what number?

21. If it takes 6¾ days for 1 man to do a piece of work, how long will it take 3 men to do the same work?



This diagram represents a garden. A, B, C, D, and E are flower-beds. W is a walk; the rest is a grassy lawn. Scale $\frac{1}{4}$ in. to 4 ft.

1. Find the area of each flower-bed.

2. Find the area of the entire walk.

3. Find the area of the garden.

4. How many plants set out 1 ft. apart, and 1 ft. from the edge, can be placed in A? In E?

5. At $2\frac{1}{2}¢$ a square yard, what will it cost to spade the flower-beds?

6. At $37\frac{1}{2}¢$ a square foot, what will it cost to cover the lawn, L, with sod?

7. The area of the walks is what per cent of the area of the garden?

8. The area of each flower-bed is what per cent of the area of the garden?

9. If a boy can weed 4 sq. ft. in 15 min., how long will it take him to weed each flower-bed? All the flower-beds?

10. How many cubic feet of gravel will it take to raise the entire surface of the walks 2 inches in height?

11. The garden is surrounded by a picket fence. How many pickets will it take if each picket is 3 in. wide, and they are placed 3 in. apart?

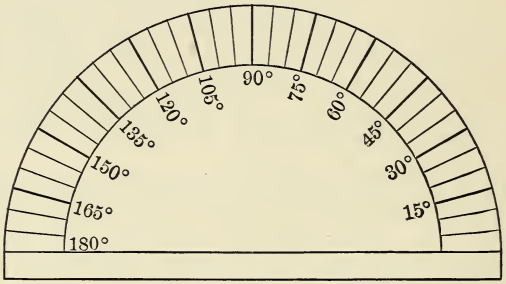
12. If 2 qt. of water are used on each square foot, how many gallons will it take for each flower-bed? For all the flower-beds? For the lawn?

MEASUREMENT OF ANGLES.

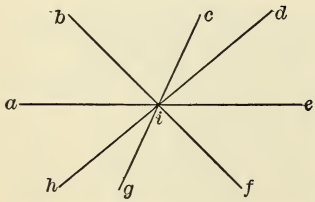
1. For convenience, every circle is supposed to be divided into 360 equal parts called degrees.

2. By means of an instrument called a protractor any angle can be measured.

3. From cardboard cut out a figure like this, and mark it in the same way. This is a protractor sufficiently accurate for all practical purposes.



4. Draw a circle and two diameters at right angles to each other. If there are 360 degrees in a circle, how many are there in $\frac{1}{4}$ of a circle? In $\frac{1}{2}$ of it?



5. Using your protractor, measure each of the angles in this figure. What is their sum?

6. In the wheel of my carriage there are 12 spokes. How many degrees between two spokes? Between the first and fifth?

7. Between the first and eighth? The third and seventh?

8. When the hour hand of the clock is at 12, where must the minute hand be that the two hands may be 30° apart? 15°? 150°? 75°? 45°?

1. How many square feet on the surface of a rectangular stone 6 ft. long, 4 ft. wide, and $1\frac{1}{2}$ ft. thick?

2. There is a circular field 40 rd. in diameter. How many acres does it contain?

3. Two men purchased a lot of wood for \$31. In dividing the wood one man took $6\frac{1}{2}$ cords, the other 9 cords. How much ought each man to pay?

4. A man bought a horse for \$72, and sold it for 25% more than it cost. For what did he sell it?

5. What is the value of a pile of wood 40 ft. long, 8 ft. wide, and $5\frac{1}{2}$ ft. high, at \$5.50 a cord?

6. If I purchase 50 boards, each 12 ft. long and $7\frac{1}{4}$ in. wide, for how many feet of lumber must I pay?

NOTE. — Fractions of an inch in the width of boards are never counted. Call it the nearest inch.

7. How many yards of carpeting, $\frac{3}{4}$ of a yard wide, will it take for a room $18\frac{1}{2}$ ft. long and 15 ft. wide?

8. Multiply 12 thousandths by 12 hundredths, and from the product take 12 millionths.

9. Multiply 160 by .016, and divide the product by .0025.

10. Divide $2\frac{1}{2}$ by $3\frac{1}{3}$, and multiply the quotient by $3\frac{1}{3}$.

11. A man owned $\frac{7}{8}$ of a ship, and sold $\frac{3}{5}$ of his share for \$16,800. Find the value of the whole ship.

12. Simplify $\dfrac{\frac{3}{5} \text{ of } 6\frac{1}{4}}{\frac{2}{3} \text{ of } 7\frac{1}{2}}$.

13. The quotient is 71, the divisor 42, and the remainder 15. What is the dividend?

14. Find the interest on \$457.60 for 1 yr. 9 mo. 18 da. at 6%.

15. Find the interest on \$125.25 for 1 yr. 4 mo. 12 da. at 6%.

16. Make out a bill for 10 pairs of men's shoes @ \$4.75; 4 pairs boys' shoes @ $\$1.47\frac{1}{2}$; 6 pr. slippers @ $\$.87\frac{1}{2}$; 9 pr. girls' shoes @ \$2.43; 8 pr. ladies' shoes @ $\$3.37\frac{1}{2}$.

17. Add 8.3, 2.576, 3.42, 1.5, 6.279, .003, 1.417.

FRACTIONS.

NOTE. — In addition and subtraction of fractions find the least common multiple of the denominators. This can often be found by inspection.

1. Add: $20\frac{2}{3}$, $128\frac{3}{7}$, $4\frac{1}{2}\frac{1}{1}$, $81\frac{5}{9}$.
2. Add: $71\frac{1}{3}$ $96\frac{7}{8}$, $17\frac{7}{1\,6}$, $9\frac{3}{4}$, $44\frac{2}{2}\frac{3}{4}$.
3. Add: $136\frac{3}{4}$, $7\frac{4}{7}$, $35\frac{5}{1\,4}$, $71\frac{1}{2}$.
4. From $145\frac{2}{3}$ take $76\frac{1}{4}$.
5. From $717\frac{3}{4}$ take $196\frac{5}{1\,6}$.
6. From $387\frac{3}{8}$ take $214\frac{3}{4}$.
7. Multiply: $875\frac{3}{8}$ by 234.
8. Multiply: $645\frac{7}{8}$ by 412.
9. Multiply: 215 by $41\frac{7}{8}$.
10. Multiply 575 by $69\frac{5}{6}$.
11. Find $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{8}{9}$.
12. Find $\frac{5}{6}$ of $\frac{1}{2}\frac{8}{3}$ of $4\frac{3}{4}$.
13. $(1\frac{5}{2} + \frac{3}{4}) \times (1\frac{5}{4} - \frac{1}{7})$.
14. Multiply $136\frac{3}{4}$ by $41\frac{5}{8}$.
15. Multiply $612\frac{1}{4}$ by $42\frac{5}{9}$.
16. Divide $6{,}345\frac{3}{5}$ by 16.
17. Divide $583\frac{1}{3}$ by $43\frac{3}{4}$.
18. Simplify: $\dfrac{18\frac{1}{2} \div 12\frac{1}{3}}{16\frac{1}{2} - 15\frac{5}{6}}$. $\dfrac{\frac{2}{3} \text{ of } \frac{3}{4}}{\frac{1}{9} \text{ of } 2\frac{1}{4}}$.
19. Simplify: $\dfrac{\frac{1}{4} + 3\frac{1}{2}}{5\frac{2}{3} - 3\frac{1}{6}}$. $\dfrac{12\frac{1}{2} \times 11\frac{1}{5}}{68\frac{3}{4} + 1\frac{1}{4}}$.
20. Simplify: $\dfrac{\frac{7}{8}}{\frac{3}{4}} \times \dfrac{\frac{5}{9}}{\frac{1}{1\,6}}$. $\dfrac{\frac{2}{9}}{\frac{3}{4}} \times \dfrac{\frac{3}{4}}{\frac{5}{9}}$.
21. Divide: $347\frac{5}{6}$ by 15. 692 by $19\frac{2}{9}$.
22. Divide: $19\frac{4}{9}$ by $16\frac{2}{3}$. $786\frac{1}{2}$ by $30\frac{1}{4}$.
23. Add: $2\frac{1}{1\,5}$, $8\frac{1}{6}$, $27\frac{2}{3}$, $9\frac{1}{5}$.
24. Add: $8\frac{3}{1\,0}$, $37\frac{3}{4}$, $28\frac{4}{5}$, $9\frac{9}{2\,0}$, $19\frac{1}{2}$.
25. From $27\frac{9}{4\,0}$ take $18\frac{3}{5}$. $12\frac{1}{6} - 9\frac{1}{4} = ?$
26. How many miles an hour does a man walk who walks $21\frac{3}{4}$ miles in $4\frac{5}{6}$ hours?

ORAL.

1. If one pipe will fill a cistern in 4 hours, and another in 6 hours, how long will it take to fill it when both pipes are running?

2. If water is running out of the second pipe while running in the first, how long then will it take to fill the cistern?

3. A man sold a watch for $90, and gained 50%. What did it cost?

4. A man bought a hat for $5, and sold it for $6. What per cent did he gain?

5. John lost $\frac{2}{5}$ of his money, and spent $\frac{1}{3}$ of the remainder, and then had only 10 cents. How much money had he at first?

6. How old are you if $\frac{3}{4}$ of 80 is 4 times your age?

7. How long will it take a man to save $60, if he earns $15 a week and spends $9?

8. If $\frac{1}{8}$ of a yard of cloth cost 63 cents, what will $\frac{5}{8}$ of a yard cost?

9. A man sold a watch for $120, which was $\frac{4}{5}$ of what it cost him. How much did it cost?

10. If 4 men can do a piece of work in 12 days, how long will it take 6 men to do it?

11. If 4 pipes will fill a cistern in 40 min., how many pipes will fill it in 10 minutes?

12. A house was insured for $3,200 at 1%. What was the premium?

13. An agent sold $300 worth of property, and charged 5% for so doing. Find his commission.

14. Given the cost and loss per cent, what can be found?

15. A watch costing $80 was sold at a loss of 10%. For how much was it sold?

16. What number increased by 12 equals 16?

17. 6 added to a number equals 14. Find the number.

18. What number diminished by 5 equals 9?

REVIEW OF PERCENTAGE.

1. A house which cost \$1,200 was sold at a gain of 25%. What was the selling-price?

2. Land which cost \$42 an acre was sold at a gain of $8\frac{1}{3}$%. Find the selling-price.

3. A fruit-dealer bought apples at \$1.75 a barrel, and sold them at \$2.25 a barrel. What per cent did he gain?

4. A man bought a chair for \$2.34, and afterwards sold it for \$2.73. What per cent did he gain?

5. What does a bill for \$2,478 become after a reduction of 5%?

6. What is the cost of insuring 640 bbl. of flour, worth \$4 a barrel, if the cost of insurance is $\frac{1}{2}$% of the value of the flour?

7. A horse was bought for \$175. At what must he be sold to gain 12%?

8. A merchant bought apples at \$1.20 a barrel, and sold them at a gain of 25%? Find the selling-price a barrel. How many barrels did he sell if he received altogether \$187.50?

9. The population of a certain city was 48,000 this year. If it increases at the rate of $2\frac{1}{2}$% each year, find its population 1, 2, and 3 years hence.

10. A person gave \$1,500 for a piece of land, and sold it at a gain of 20%. Find the selling-price.

11. A man built a house for \$3,500, and rented it for \$400 a year. For what per cent of its value did he rent it?

12. Turn to your geographies, and find the area of the basins of the principal rivers, and then find what per cent of the area of North America is drained by each river.

13. A quantity of goods was sold at an advance of $12\frac{1}{2}$%. If the gain was \$34, what was the cost?

14. When the cost is \$8,000 and the selling-price \$7,400, what is the rate of the loss?

1. Jos. Burkhardt bought of Benj. Robb & Co., Jan. 21, 1898, 18 lb. tea @ \$.85; 24 lb. coffee @ \$.32½. Jan. 30, he paid on account \$12. Feb. 5, he bought 15 lb. rice @ 7½¢; two boxes of raisins @ \$1.12½. Feb. 10, he paid \$5. Feb. 27, he bought 20 bbl. of flour @ \$5.75. Render an itemized bill Feb. 1. Render a statement and itemized bill March 1. Write a receipt for the two payments on account.

2. If 17½ lb. of tea cost \$12.60, what will 20¾ lb. cost?

3. If you buy ¾ of a peck of apples for 36¢, and sell them for 8¢ a quart, how much will you make on 4½ bushels?

4. At 3¢ a pint, what will 5 gal. 3 qt. 1 pt. of milk cost?

5. A fruit-dealer paid \$14.95 for 5 bu. 3 pk. of peaches. If he sold them for 75 cents a peck, how much did he make?

6. A box of butter weighed 15 lb. 10 oz. If the box weighed 3 lb. 4 oz., find the value of the butter at 30¢ a pound.

7. A farmer had 750 bu. 1 pk. of potatoes, and put them into barrels, each barrel holding 2 bu. 1 pk. How many barrels did it take? *Work fractionally.*

8. If freight is ¼¢ a pound from Holyoke to New York, how much will it cost to carry 5 T. 13 cwt. of paper?

9. If a rail is 16½ ft. long, how many rails will it take to lay a railroad track 2 m. 100 rd. long?

10. How many miles will a man walk in plowing a strip of land 80 rd. long and 36 ft. wide, if the plow turns a furrow 9 in. wide each time?

11. How many boards 10 ft. long and 12 in. wide will it take to build a tight board fence, 5 ft. high, round a lot 60 ft. by 120 ft.?

12. If it takes 8 screws to fasten each desk to the floor, how many gross are used to fasten the desks in your schoolroom?

13. A field was 30 rd. long and 24 rd. wide. How many square rods will be left in the field after a road 2 rd. wide has been cut lengthwise of the field?

1. Using your protractor, draw an angle of 36°.

2. Without your protractor draw an angle of 80°. Measure it. How many degrees out of the way?

3. A grocer bought 14 bags of coffee for $142.24, but finding it damaged, he sold it at a loss of $30.10. How much did he receive a bag?

4. After losing $7\frac{1}{4}$ and finding $5\frac{3}{4}$ of it, a man had $24\frac{3}{5}$. How much had he at first?

5. A grocer sold $5\frac{2}{3}$ lb. butter to one customer, $8\frac{7}{16}$ lb. to another, $7\frac{7}{8}$ lb. to another. How many pounds of butter did he sell?

6. Mr. Jones sold a span of horses for $396\frac{4}{5}$, losing $78\frac{1}{2}$. For how much should he have sold them to have gained $125\frac{9}{10}$?

7. My farm of 50 acres is worth $3,000. How much is $\frac{3}{4}$ of an acre worth?

8. Find the cost of the following articles: 7 lb. tea @ $62\frac{1}{2}¢$; 5 bags of flour @ $95¢$; $90\frac{1}{2}$ lb. sugar @ $\$.06\frac{3}{8}$; 5 lb. 8 oz. of cheese @ $13¢$; 7 lb. starch @ $6\frac{1}{4}¢$.

9. What is the area of a triangle that has a base line of 80 ft. and whose vertex is 35 ft. above the base line?

10. One of the parallel sides of a trapezoid is 180 ft. and the opposite side $\frac{5}{6}$ as long. The distance between the parallel sides is $\frac{2}{3}$ the shorter parallel side. Find the area of the trapezoid.

11. With a scale 1 inch to a foot, draw a figure to represent a square 4 ft. on a side. Inscribe within this a circle. Find the area of the circle. Find the area of that part not included in the circle.

12. A park 100 rd. long, 80 rd. wide is surrounded on the outside by a walk 15 ft. wide. How many square yards in the surface of the walk? If this walk is macadamized to a depth of 4 in., how many loads (1 cu. yd.) of material did it take?

13. If $7\frac{1}{2}$ tons of hay cost $120, how many tons can be bought for $78?

INTEREST FOR ANY NUMBER OF DAYS.

1. What is the interest of $600 for 6 days at 6%? How did you find it? Why?

2. 1 day is what part of 6 days? After finding the interest for 6 days, how then can you find it for 1 day?

3. Knowing the interest for 6 days and 1 day, how can you find the interest for 7 days?

4. 2 days is what part of 6 days? How can you find the interest for 2 days?

5. Find the interest of $600 for 2 days at 6%.

6. Knowing the interest for 6 days and 2 days, how can you find the interest for 8 days?

7. Find the interest for $600 for 8 days at 6%.

8. 3 days is what part of 6 days? How can you find the interest then for 3 days?

9. Find the interest of $600 for 3 days.

10. Find the interest on $600 for 4 days at 6%.

11. 10 days is how many days more than 6 days?

12. The following table will show the method of finding interest for any number of days:

1 day = $\frac{1}{6}$ of 6 days.	16 days = 12 da. + 3 da. + 1 da.
2 days = $\frac{1}{3}$ of 6 days.	17 days = 12 da. + 3 da. + 2 da.
3 days = $\frac{1}{2}$ of 6 days.	19 days = 18 da. + 1 da.
4 days = 3 da. + 1 da.	20 days = 18 da. + 2 da.
5 days = 3 da. + 2 da.	21 days = 18 da. + 3 da.
7 days = 6 da. + 1 da.	22 days = 18 da. + 3 da. + 1 da.
8 days = 6 da. + 2 da.	23 days = 18 da. + 3 da. + 2 da.
9 days = 6 da. + 3 da.	25 days = 24 da. + 1 da.
10 days = 6 da. + 3 da. + 1 da.	26 days = 24 da. + 2 da.
11 days = 6 da. + 3 da. + 2 da.	27 days = 24 da. + 3 da.
13 days = 12 da. + 1 da.	28 days = 24 da. + 3 da. + 1 da.
14 days = 12 da. + 2 da.	29 days = 24 da. + 3 da. + 2 da.
15 days = 12 da. + 3 da.	31 days = 30 da. + 1 da.

ORAL.

1. If 3 apples are worth one peach, and 3 peaches are worth one orange, how many oranges can be bought for 45 apples?

2. Name two factors of each of the following numbers:

10	12	14	15	16	18	20
22	24	25	26	27	28	30
32	33	35	36	40	42	44
45	48	49	50	54	55	56
60	63	64	66	70	72	77
81	88	96	108	121	132	144

3. What will 2 tons of iron cost if 1 lb. costs 10 cents?

4. How many inches in $\frac{1}{2}$ yd.? In $\frac{1}{4}$ yd.? In $\frac{1}{8}$ yd.? In $\frac{1}{3}$ yd.? In $\frac{1}{9}$ yd.?

5. What will 7 quarts of wheat cost at 128¢ a bushel?

6. If a coat and vest cost \$20, and a pair of trousers $\frac{1}{4}$ as much, how much will all cost?

7. If 1 pound of cheese costs 12 cents, what will $2\frac{2}{3}$ lb. cost?

8. Nellie has 45 cents, and Grace has $\frac{5}{9}$ as many. How many has Grace?

9. If I buy an article for \$60, and sell it for $\frac{7}{5}$ of what it cost, how much shall I gain?

10. A man's salary is \$120 a month. If he spends $\frac{1}{3}$ of it for a watch, $\frac{1}{4}$ of it for a suit of clothes, and $\frac{1}{5}$ of it for board, how much of his salary remains?

11. What will $\frac{3}{4}$ of a gallon of molasses cost at 10¢ a pint?

12. Bought a third of a barrel of sugar for \$3. What will $2\frac{2}{3}$ bbl. cost?

13. If $\frac{1}{4}$ of a yard of cloth cost \$2, what will $2\frac{1}{2}$ yd. cost?

14. If $\frac{1}{7}$ of a bushel of corn cost 10 cents, what will 2 bu. cost?

15. If $\frac{5}{8}$ of a pound of spice cost 15 cents, what will $3\frac{1}{5}$ lb. cost?

16. Find the interest on \$600 for 19 da. at 6%.

Interest for any number of days. Find the interest on the following sums of money at 6%:

1.	$475	for 5 days.	For 1 mo. 5 da.
2.	368	for 7 days.	For 2 mo. 7 da.
3.	694	for 8 days.	For 5 mo. 8 da.
4.	176.34	for 9 days.	For 3 mo. 9 da.
5.	25.60	for 10 days.	For 6 mo. 10 da.
6.	136.50	for 11 days.	For 4 mo. 11 da.
7.	97.50	for 13 days.	For 5 mo. 13 da.
8.	1,264	for 14 days.	For 3 mo. 14 da.
9.	1,478	for 15 days.	For 7 mo. 15 da.
10.	672	for 16 days.	For 4 mo. 16 da.
11.	47.95	for 17 days.	For 9 mo. 17 da.
12.	106.25	for 19 days.	For 3 mo. 19 da.
13.	16.48	for 20 days.	For 10 mo. 20 da.
14.	74.34	for 21 days.	For 2 mo. 21 da.
15.	1,497	for 22 days.	For 4 mo. 22 da.
16.	748.25	for 23 days.	For 8 mo. 23 da.
17.	1,200	for 25 days.	For 3 mo. 25 da.
18.	567	for 26 days.	For 1 mo. 26 da.
19.	1,463	for 27 days.	For 6 mo. 27 da.
20.	1,476.36	for 28 days.	For 10 mo. 28 da.
21.	1,472.40	for 29 days.	For 1 yr. 1 mo. 29 da.
22.	1,491.50	for 13 days.	For 1 yr. 3 mo. 17 da.
23.	2,468	for 26 days.	For 1 yr. 1 mo. 1 da.
24.	680.50	for 27 days.	For 1 yr. 5 mo. 16 da.
25.	746.30	for 11 days.	For 1 yr. 2 mo. 13 da.
26.	123.40	for 19 days.	For 1 yr. 3 mo. 15 da.
27.	567.80	for 21 days.	For 1 yr. 7 mo. 19 da.
28.	912.30	for 17 days.	For 1 yr. 2 mo. 21 da.
29.	987.60	for 15 days.	For 1 yr. 3 mo. 24 da.
30.	876.50	for 16 days.	For 1 yr. 4 mo. 25 da.
31.	765.40	for 19 days.	For 1 yr. 5 mo. 26 da.

1. Find the interest on \$800 for 2 yr. 6 mo. 15 da. at 6%.

2. Find the interest on \$346.50 for 1 yr. 8 mo. 2 da. at 6%.

3. Find the interest on \$750 for 3 yr. 3 mo. 3 da. at 6%.

4. A boy sold a sled for \$1.40, and by doing so lost $12\frac{1}{2}\%$. What did the sled cost?

5. A man paid \$270 for a horse, which was 10% less than his carriage cost. Find the cost of both.

6. A grocer bought 535 lb. of sugar at $5\frac{1}{2}¢$ a pound, and sold it at a profit of 15%. What did he receive for it?

7. A merchant sold some cloth at \$3 a yard, and lost 25%. What did it cost him?

8. For what must a merchant sell a barrel of flour that cost him \$5.10 to gain $9\frac{1}{3}\%$?

9. A miller bought a consignment of wheat, and ground it into flour. He sold 980 bbl. for \$6.50 a barrel, making 25%. How much did he pay for the wheat?

10. Mr. Longley sold his house for \$4,248, and by so doing gained 20%. Find what the house cost Mr. Longley.

11. $3\frac{1}{8}$ cents is what per cent of $12\frac{1}{2}$ cents?

12. By selling an article for \$5.88, $14\frac{2}{7}\%$ will be lost. Find the cost.

13. \$120 is $\frac{3}{4}$ of the price I paid for my horse. Yesterday I was offered \$240 for him. Had I sold him, what per cent of profit should I have made?

14. How much will it cost to plaster and paint the walls of a house 28 ft. long, 20 ft. wide, and 12 ft. high, at $33\frac{1}{3}¢$ a square yard?

15. At \$1.50 a yard, what will it cost to carpet a room 18 ft. long, $15\frac{3}{4}$ ft. wide, the carpet being $\frac{3}{4}$ of a yard wide?

16. What is the area of a circle whose diameter is 100 ft.?

17. How many square inches of gold leaf will be required to cover the convex surface of an equilateral triangular pyramid, each side of whose base is 10 in., and whose slant height is 4 ft.?

1. Simplify:
$879 + 7 \times (275 \div 5) - (432 - 275) \times 4 + 43 \times 17.$

2. Add: $17\frac{3}{8}$, $12\frac{1}{3}$, $.5\frac{4}{5}$, $12.48\frac{2}{3}$, $.4\frac{1}{3}$, $\frac{5}{8}$, $4\frac{2}{5}$, $16\frac{1}{8}$.

3. The sum of two numbers is 528, and one of them is 11 times the other. Find the numbers. (Use x.)

4. Multiply .084 by .0036.

5. Find the cost of 18,755 ft. of lumber at $24.75 per M.

6. Find the interest on $1,763.25 for 1 yr. 3 mo. 14 days at 6%.

7. If the divisor is 675, the quotient 488, and the remainder 548, what is the dividend?

8. Divide .005,232 by .016.

9. A square field is $72\frac{1}{2}$ rd. on each side. How much will it cost to inclose it with a fence at $1.85 a rd.?

10. A grocer bought 1,152 gal. of molasses. If 12% leaked out, what is the rest worth at 65¢ a gallon?

11. A man spent $646 for board and expenses. If this was 34% of his salary, how much did he save?

12. My carriage cost $136, which is 32% less than the cost of my horse. Find the cost of both.

13. Having lost 28% of my money, I have $17,640 left.

14. Goods that cost $764 were sold at a loss of $17\frac{1}{2}$%. Find selling-price.

15. Find the entire surface of a square prism whose bases are 5 ft. square, and whose altitude is 22 ft.

16. What is the area of a circle whose radius is $4\frac{1}{4}$ ft.?

17. What is the circumference of the largest circle that can be drawn on a sheet of paper 12 in. long and 10 in. wide?

18. Find the entire surface of a cone, the radius of whose base is 3 ft. 6 in., and whose slant height is 24 ft.

19. A man had $12,000. He lost $12\frac{1}{2}$% of it the first year in business, and 15% of the remainder the second year. How much had he left?

INTEREST AFTER FINDING DIFFERENCE IN DATES.

1. Find the interest of $396.16 from July 15, 1893, to Feb. 6, 1895.

From July 15, 1893, to July 15, 1894 . . 1 yr.
From July 15, 1894, to Jan. 15, 1895 . . 6 mo.
From Jan. 15, 1895, to Feb. 6, 1895 . . 22 days.

$3.9616	int. for 2 mo.
$35.654	int. for 1 yr. 6 mo.
1.188	int. for 18 da.
.198	int. for 3 da.
.066	int. for 1 da.
$37.106	int. for 1 yr. 6 mo. 22 da.

Formulate a rule for finding the difference in dates.

Find the interest of:

2. $649.21 from June 8, 1897, to Aug. 15, 1900.
3. $1,460.78 from June 6, 1897, to April 23, 1899.
4. $284.30 from Feb. 23, 1896, to Aug. 5, 1898.
5. $366.44 from Jan. 5, 1897, to Jan. 27, 1899.
6. $491.73 from Nov. 16, 1898, to Nov. 28, 1900.
7. $91.36 from Aug. 12, 1897, to June 10, 1899.
8. $436.74 from March 25, 1897, to July, 29, 1899.
9. $589.76 from May 11, 1896, to Jan. 7, 1898.
10. $550 from May 8, 1897, to June 13, 1900.
11. $125.40 from Sept. 25, 1898, to March 16, 1899.
12. $679.08 from Feb. 10, 1897, to Dec. 7, 1898.
13. $137.65 from Oct. 14, 1897, to Dec. 29, 1899.
14. $146.35 from June 7, 1897, to Feb. 11, 1900.
15. $154.25 from Apr. 18, 1898, to Jan. 25, 1901.
16. $817.57 from Aug. 7, 1897, to Sept. 8, 1899.
17. $132.25 from Nov. 13, 1896, to May 2, 1899.
18. $446.50 from July 18, 1897, to Sept. 4, 1899.
19. $3,155.49 from Aug. 15, 1897, to May 1, 1901.

ORAL.

1. A man bought a horse for $200, and sold him so as to gain 10% of his cost. Find the gain.

2. Mr. Jones invested $2,000 in business, and gained 20% of his investment every year. How much did he gain in 1 year? 5 years?

3. An agent sold a house for $1,200. His commission was 10%. How much did he keep as commission?

4. Plush cloth bought at $5 a yard was sold at $6 a yard. What part of the cost was gained? What per cent was gained?

5. A man receiving a salary of $2,400 spends $33\frac{1}{3}\%$ of it for expenses. How many dollars does he spend?

6. Ten bushels out of 100 bushels is what per cent?

7. $1 out of every $10 is what part? Is what per cent?

8. $5 out of every $20 is what part? Is how many hundredths? Is what per cent?

9. $2\frac{1}{2}$ is $\frac{1}{4}$ of what number?

10. $2\frac{1}{2}$ is 25% of what number?

11. Yesterday I worked $\frac{1}{3}$ of the day, and the day before $\frac{1}{5}$ of a day. What part of a whole day did I work in all?

12. Change to a whole number: $\frac{5}{5}$, $\frac{12}{6}$, $\frac{14}{7}$, $\frac{24}{8}$.

13. If I pay 3 cents for a pint of milk, what must I pay for a gallon at the same rate?

14. Make a problem to illustrate, Given two numbers to find their difference.

15. 45 is $\frac{5}{9}$ of what number? $\frac{9}{10}$ of what number?

16. 81 is $\frac{9}{6}$ of what number? $\frac{9}{4}$ of what number?

17. If 8 is $\frac{2}{3}$ of a number, what is the number? What is $\frac{3}{4}$ of it?

18. How many cubic feet in a box 4 ft. long, 3 ft. wide, 2 ft. high?

19. How many yards square is a floor that is 12 ft. square? How many square yards are there in the floor?

1. Find the interest of $625.80 from Nov. 28, 1896, to Sept. 16, 1898, at 6%.

2. If 24 men can do a given piece of work in 9 days, in how many days can 18 men do it?

3. If 35 yd. of cloth cost $12.25, how much would 42 yd. cost?

4. Find the per cent of loss on goods that cost $3,072, and are sold for $2,560.

5. A merchant withdrew $2,058 from a bank, which was 28% of his deposit. How much had he remaining in the bank?

6. A farmer sold 525 bu. of wheat at $1.12 a bushel, and 20% less of oats at 45¢ a bushel. What did he receive for both?

7. A farmer owned a flock of 580 sheep, but lost 20% of the flock in a snow-storm. How many sheep had he remaining?

8. Find the number of board feet in a plank 16 ft. long, 1 ft. 3 in. wide, and 2 in. thick?

9. Find the cost of 15 joists, each 20 ft. long, 9 in. wide, and 3 in. thick, at $1.85 per C.

10. Wood cost me $4.75 a cord. I paid $28.50 for a pile. It was 24 ft. long and 4 ft. wide. How high was it?

11. At 48¢ a cubic yard, find the cost of digging a ditch 22 ft. 9 in. long, 8 ft. 6 in. wide, and 8 ft. high?

12. How many yards of carpet 32 in. wide will it take to cover a floor 18 ft. 6 in. by 15 ft. 3 in., breadths to run lengthwise?

13. How many bricks (8 in. by 4 in.) are necessary to cover a sidewalk 32 ft. 4 in. long and 14 ft. 4 in. wide?

14. At $5.75 per 100 square feet, how much will it cost to tin the roof of a house 45 ft. long if the rafters are 23 ft. long?

15. Change 5,178 pt. to bushels.

16. Change 19 rd. 4 yd. 2 ft. to feet.

17. Find the cost of insuring property worth $7,500 at 1½%.

To subtract compound numbers:

1. Subtract 8 bu. 3 pk. 7 qt. from 47 bu. 1 pk. 5 qt. 1 pt.

$$\begin{array}{r} 47-1-5-1 \\ 8-3-7-0 \\ \hline 38-1-6-1 \end{array}$$

No pints from 1 pt. leaves 1 pt. 7 qt. from 5 qt. we cannot take, so we take 1 pk. from the column of pecks, which is equal to 8 qt. 8 qt. and 5 qt. are 13 qt. 7 qt. from 13 qt. leaves 6 qt. 3 pk. from 0 pk. we cannot take. 1 bu. equals 4 pk. 3 pk. from 4 pk. leaves 1 peck. 8 bu. from 46 bu. leaves 38 bu.

NOTE. — Numbers of the same denomination should be written in the same column.

2. From 46 gal. 1 qt. 1 pt. 2 gi. take 25 gal. 2 qt. 1 pt. 3 gi.

3. From 8 bu. 1 pk. 6 qt. take 3 bu. 2 pk. 4 qt.

4. Take 160 T. 1,800 lb. 6 oz. from 175 T. 298 lb.

5. From 6 mi. take 5 mi. 319 rd. 5 yd. 1 ft. 3 in.

6. From 471 cu. yd. 16 cu. ft. 972 cu. in. take 115 cu. yd. 17 cu. ft. 1,710 cu. in.

7. From 19 yr. 5 mo. 17 da. take 12 yr. 9 mo. 14 da.

8. From 20 gal. $1\frac{1}{4}$ pt. take 3 qt. $1\frac{3}{4}$ pt.

9. From 6 mi. 220 rd. 1 ft. 8 in. take 4 mi. 261 rd. 1 yd.

10. From 275 mi. take 50 mi. 130 rd. 3 yd. 1 ft. 3 in.

11. From 1,845 yr. 9 mo. 18 da. 20 hr. take 1,774 yr. 11 mo. 20 da. $22\frac{1}{2}$ hr.

12. From 73 bu. 2 pk. 5 qt. take 59 bu. 3 pk. 7 qt.

13. From 17 mi. 311 rd. 1 yd. 1 ft. 3 in. take 3 mi. 79 rd. 1 yd. 2 ft. 7 in.

14. From 6 mi. take 4 mi. 64 rd.

15. From 116 cd. 4 cd. ft. take 105 cd. 5 cd. ft.

16. Subtract 5 mi. 215 rd. 5 yd. from 8 mi. 216 rd. 3 yd.

17. From 17 bu. 2 pk. 6 qt. take 8 bu. 3 pk. 4 qt.

18. From 14 cu. yd. 6 cu. ft. 1,011 cu. in. take 9 cu. yd. 17 cu. ft. 1,108 cu. in.

REVIEW OF DECIMALS.

1. Add five, and three hundred eighty-two ten-thousandths; one thousand two hundred thirty-five hundred thousandths; eight hundred ninety-six, and fifty-one thousand three hundred twenty-seven millionths.

2. Add nineteen, and forty-nine ten-thousandths; seventy-three, and one hundred fifty-six millionths; thirty-four, and eight hundred-thousandths; five thousand eighty-two, and one thousand nineteen hundred-thousandths.

3. Multiply .0,000,915 by .0056.

4. Multiply .58,273 by 1000.

5. Multiply 2.4675 by 100.

6. Multiply 4.3982 by 500.

7. Divide .0009 by .003.

8. Divide .0002784 by .032.

9. Divide 10 by .001.

10. Divide .31 by .0005.

11. Divide 18.45 by 10. By 100.

12. Divide 436.457 by 100. By 1,000.

13. Divide 1464.25 by 100. By 1,000.

14. Divide 1867.8 by 4,000.

15. Divide 375.82 by 500.

16. Find cost of 825 bu. @ $\$1.66\frac{2}{3}$.

17. Find cost of 72 gal. @ $\$3.87\frac{1}{2}$.

18. Add 8153 and 45 hundredths; 32 and 28 ten-thousandths; 237 and 483 thousandths; 5 and 165 hundred-thousandths; 6 hundredths.

19. Change to common fractions: .0419; .0048; .00625; 5.00125.

20. Change to decimals: $\frac{5}{16}$, $\frac{7}{64}$, $\frac{5}{32}$, $\frac{17}{64}$, $\frac{13}{32}$, $\frac{25}{64}$, $1\frac{87}{128}$.

21. Divide 16 by 10,000.

22. Divide 1846 by 100. By 1,000.

23. Change to decimals: $6\frac{3}{4}$, $32\frac{5}{8}$, $46\frac{5}{16}$, $24\frac{1}{125}$.

REVIEW IN PERCENTAGE.

1. A man owned 1,016 acres of land. He sold 12½% to one customer, and 42½% of the remainder to another customer. How many acres had he left?

2. A man's income is $1,800 a year, of which he pays 12½% for house-rent. What rent does he pay each month?

3. What number increased by 40% of itself equals $1,694?

4. A book-keeper spends $600 a year, which is 24% of his salary. Required his salary.

5. What per cent of 675 is 135?

6. A merchant bought 275 bbl. of flour. After losing 20% of it, he sold 25% of the remainder. How many barrels remained? What per cent of the whole remained?

7. I bought $820 worth of cloth, and sold it at a gain of 15%. What was the gain? The selling-price?

8. A dealer bought coal at $4.25, and sold it at 5% advance. What was his selling-price?

9. Cost $7.50, profit 18%. Find the selling-price.

10. Cost $1,500, gain 16⅔%. Required the selling-price.

11. Cost $80, gain $35. Required the gain per cent.

12. Selling price $125, loss 20%. Find the cost.

13. Gain 25%, cost $5.50. Required the selling-price.

14. An agent sold 426 bales of cotton weighing 408 pounds each, at 8½¢ a pound. How much money did he receive? He kept 2¾% of this as his commission. How much did he return to his employer?

15. A regiment went into battle with 960 men, and came out with 600 men. What per cent was lost?

16. A clerk's salary is $800 a year. He spends 10% the first quarter, 15% the second, 16% the third, and 14% the fourth. How much does he save?

17. My agent sold goods for $5,400; his commission was 2½%, and other charges $17.50. What amount should he send me?

ORAL.

1. If I can do a piece of work in 4 days, what part can I do in 2 days?

2. $\frac{4}{5}$ of 25 is $\frac{1}{2}$ of how many?

3. $\frac{6}{7}$ of 28 is $\frac{3}{5}$ of how many?

4. By selling land at \$150 an acre I gained 25%. Find cost.

5. A merchant sold goods for \$500 at a loss of 20%. What was the cost?

6. I sold my horse for \$200, and by so doing lost 20%. What was the value of the horse?

7. Grace gave one-half of her oranges to her mother, and one-third of them to her father. What per cent had she left?

8. If you sell an article for $12\frac{1}{2}$ cents that cost 10 cents, what will be your rate of gain?

9. If an article costs \$600, what will be the gain at 1%? At $\frac{1}{3}$ of 1%?

10. A man paid \$500 for wheat, and sold the whole at a loss of 6%. Find the loss. Find the selling-price.

11. One-half of a lot of goods cost \$180. Find the loss at 10% on the whole lot.

12. $\frac{1}{8}$ of 40 is what per cent of $\frac{1}{2}$ of 20?

13. $\frac{1}{5}$ of 30 is what per cent of $\frac{1}{3}$ of 40?

14. How many barrels will it take to hold 25 bu., if 1 bbl. holds $2\frac{1}{2}$ bushels?

15. Divide $5\frac{3}{5}$ by $\frac{2}{5}$. $6\frac{3}{5}$ by $\frac{3}{5}$.

16. A man paid \$24 for $\frac{2}{3}$ of an acre of land. If he sold $\frac{1}{6}$ of an acre for \$15, how much did he gain on the part sold?

17. Find the cost of 12 primers at $12\frac{1}{2}$ each.

18. At the rate of $\$7\frac{1}{2}$ a ton, what will 12 tons cost?

19. What is the difference between $\frac{1}{3}$ of two and $\frac{2}{3}$ of 1?

20. If 4 yd. of cloth cost 72 cents what will $\frac{7}{3}$ yd. cost?

21. $\frac{5}{6}$ of 30 is $\frac{3}{4}$ of what number?

INTEREST AT DIFFERENT RATES.

1. Find the interest on \$1,200 for 1 yr. 2 mo. 18 da. at 5%.

\$12.00 = 2 mo.
\$84.00 = 1 yr. 2 mo.
3.60 = 18 da.
6) \$87.60 = 6%.
14.60 = 1%.
\$73.00 = 5%.

First find the interest at 6%, as usual. If \$87.60 is the interest at 6%, \$14.60 will be the interest at 1%, and \$73.00, the difference between 6% and 1%, will be the interest at 5%.

2. How would you find the interest at 7%? What per cent would you add to 6%?

3. What per cent would you subtract from 6% to find 4%?

4. How do you find 2% when you know 6%?

5. When you know 6%, what part of it must you find to know 3%?

6. 8% is how many per cent greater than 6%? 2% is what part of 6%? What part of 6% then do you add to 6% to get 8%?

7. 9% is how many per cent more than 6%? 3% is what part of 6%? What part of 6% then do you add to 6% to get 9%?

8. How do you find interest at 3% the shortest way?

9. How do you find interest at 4% the shortest way? At 5%? At 7%? At 8%? At 9%? At 10%?

10. Find the interest on \$486.50 for 1 yr. 2 mo. 24 da. at 5%. 7%. 9%.

11. Find the interest on \$247.65 for 1 yr. 3 mo. 15 da. at 4%. 8%.

12. Find interest on \$1,264.30 for 1 yr. 5 mo. 13 da. at 5%. 7%.

Find the interest of:

13. \$798.81 for 1 yr. 1 mo. 1 d. at 8%.

14. \$346.84 for 1 yr. 11 mo. 18 d. at 5%.

15. \$816.24 for 1 yr. 7 mo. 6 da. at 7%.

16. \$745.00 for 10 mo. 10 da. at 10%.

1. If 2.25 tons of hay cost $15.75, what will 5.75 tons cost?

2. The base of a triangle is 120 ft.; its altitude is 80 ft. What is its area?

3. If a vessel sails 325.5 miles in 46.5 hours, how many miles will she sail in $43\frac{3}{7}$ hours?

4. Find the cost of building a wall 110 ft. long, $2\frac{1}{2}$ ft. thick, 10 ft. high, at 18 cents a cubic foot.

5. A barn is 60 ft. long, 40 ft. wide, with 20 ft. posts. The roof has a $\frac{1}{4}$ pitch, and the rafters are 24 ft. long. At $15 per M. find the cost of lumber to roof, board, and floor it. Inch boards are used for the walls, $1\frac{1}{2}$-inch for the roof, and for the floor 2-inch plank.

6. Find the cost of $416\frac{3}{8}$ cd. of wood at $\$4.87\frac{1}{2}$ a cord.

7. Find the interest on $4,763.25 for 1 yr. 9 mo. 13 da. at 7%.

8. Find the convex surface of a cone whose base is 60 ft. in circumference, and whose slant height is 40 ft.

9. The parallel sides of a trapezoid are 13 ft. and $6\frac{1}{2}$ ft., and its altitude 6 ft. Find the area.

10. The area of a rectangle is 285,516 square yards. Its base is 924 yd. Find its altitude.

11. 7,360 is 92% of what number?

12. What number decreased by 23% of itself equals 1,155?

Find the interest on:

13. $128.125 for 1 yr. 3 mo. 22 da. at 8%.

14. $224.375 for 2 yr. 9 mo. 21 da. at 9%.

15. $485.16 from Aug. 3, 1898, to Nov. 17, 1899, at 5%.

16. $864 from March 10, 1898, to Aug. 30, 1900, at 5%.

17. $252.64 for 3 yr. 9 mo. 19 da. at 7%.

18. $539.50 for 2 yr. 5 mo. 16 da. at 4%.

19. $1,200 for 2 yr. 4 mo. 8 da. at 7%.

20. $168.54 for 1 yr. 6 mo. 24 da. at 5%.

21. $1,260 for 3 yr. 6 mo. 15 da. at 8%.

REVIEW OF FRACTIONS.

1. A man deposited in a bank $\$475\frac{3}{5}$ Monday, $\$370\frac{7}{20}$ Tuesday, $\$400\frac{13}{20}$ Wednesday, and drew out $\$563\frac{4}{5}$ Thursday, and $\$145\frac{9}{10}$ Friday. How much had he in the bank Saturday?

2. What is the least common multiple of 20, 24, 36?

3. A man had $490\frac{6}{7}$ bu. of grain, and bought $784\frac{1}{14}$ bu. more, and then sold $900\frac{5}{7}$. How many bushels had he left?

4. The area of an oblong is 24 square feet. What part of its area is that of a square whose side is 2 ft.?

5. Reduce $380\frac{4}{5}$ to 72ds.

6. If a car runs $48\frac{1}{2}$ miles in an hour, how far will it run in 16 days, running $14\frac{1}{2}$ hours a day?

7. Find the cost of $15\frac{1}{4}$ cd. of wood at $\$6.37\frac{1}{2}$ a cord, and $7\frac{3}{4}$ cd. at $\$5\frac{3}{8}$ a cord.

8. $(\frac{1}{2} + \frac{2}{3} + \frac{1}{9}) \times (\frac{2}{3} \times \frac{7}{8} \times 16) = ?$

9. Find the cost of $19\frac{4}{5}$ cd. of wood @ $\$6\frac{1}{4}$.

10. A has \$540, which is $\frac{2}{3}$ of $3\frac{1}{3}$ times as many as B has. How much money has B?

11. How many yards of cloth does a merchant buy if he spends \$1,200, of which \$680 was spent for cloth at $\$5\frac{3}{5}$ a yard, and the remainder at $\$4\frac{1}{3}$ a yard?

12. Divide $2\frac{1}{3}$ by $2\frac{1}{4}$, and multiply the quotient by the quotient of $4\frac{1}{2}$ divided by $2\frac{1}{2}$.

13. Find the cost of a house and lot when the house costs \$6,300, which is $1\frac{3}{4}$ times the cost of the lot.

14. From $20\frac{1}{7}$ take $16\frac{1}{4}$.

15. The diameter of a circle is 15 ft. Find circumference.

16. The circumference is 33 rd. Find diameter.

17. The radius is 17 in. Find circumference.

18. The diameter of a circular pond is 15 rods; what is the area?

19. Find the convex surface of a triangular pyramid, each side of whose base measures 6 ft., and its slant height 24 ft.

1. Find $12\frac{1}{2}\%$ of 2,464 rd.

2. If a man's salary is \$2,500 a year, how much can he save if he spends 30% for board, $12\frac{1}{2}\%$ for clothes, and 20% for other expenses?

3. \$645 is $62\frac{1}{2}\%$ of how many dollars?

4. What number diminished by 20% of itself equals 936?

5. A merchant took a sum of money to market and spent 24% of it. If he brought back \$760, how much money did he take?

6. What per cent of \$14.10 is \$2.25?

7. A farmer raised 55 bu. of potatoes. He sold 20% to one man, and 25% of the remainder to another man. What per cent of the whole remained unsold?

8. A merchant bought 96 yd. of cloth at 40¢ a yard, and sold it at a gain of $33\frac{1}{3}\%$. Find the gain.

9. A gentleman sold his library for \$860, which was 16% less than it cost.

10. A gentleman sold a lot of goods at a loss of $12\frac{1}{2}\%$, and by so doing lost \$450. What did he get for them?

11. A horse and carriage were sold for \$450, and 20% was gained.

12. Find the amount of \$1,900.75 from June 9, 1897, to Jan. 15, 1901, at 5%.

13. Find the interest on \$147.37 for 4 yr. 11 mo. 13 da. at 7%.

14. Find the convex surface of a cone, the circumference of whose base is 64 in., and slant height 40 in.

15. What is the convex surface of a cylinder 40 ft. long and 15 ft. in diameter?

16. Required the convex surface of a pentangular pyramid, whose sides are each 5 ft. and slant height 60 ft.

17. A dealer sold 438 tons of coal at \$4.75 a ton, and a number of tons of another kind at \$5.20 a ton. He received for all \$4,254.10. How many tons did he sell?

ORAL.

Find the cost of one pound or one yard in the following:

1. 9 lb. figs cost. $1.08. 3 lb. steak cost $.75.

2. 15 yd. ribbon cost $1.05. 14 lb. rice cost $1.12.

3. A newsboy bought 75 papers at 2¢ each, and sold them at 3¢ each. How much less than $1.00 did he gain?

4. I have a number in my mind. If I take 15 from it, 35 will remain. What is the number?

5. When is the selling-price equal to the cost and something added?

6. When is the selling-price equal to the cost and something subtracted?

7. When is the selling-price more than the cost?

8. When is the selling-price less than the cost?

9. When is the selling-price equal to the cost?

10. The cost is always considered what per cent?

11. When the gain is 20% what is the selling per cent?

12. When the loss is 10% what is the selling per cent?

13. When there is neither gain nor loss what is the selling per cent?

14. Eggs are 38¢ a dozen at one store, and 45¢ a dozen at another. I bought 9 doz. at the second store. How much would I have saved had I bought at the first store?

15. Make change from three quarters for a 69¢ purchase.

16. Make change from a half-dollar for a 31¢ purchase.

17. Find the change due from three dimes for a 27¢ purchase.

18. A man worked for a farmer at 20¢ an hour, and received 4 bu. of potatoes at 50¢ a bushel. How many hours did the man work?

19. If a man receives $6.60 for 22 hours' work, how much does he receive an hour?

20. What part of a pound is 12 oz.? 4 oz.?

21. Find the cost of 5 T. 400 lb. of coal at $5 a ton.

1. Divide $2\frac{7}{8}$ times $\frac{4}{5}$ of $29\frac{1}{3}$ by $3\frac{5}{6}$ times $\frac{3}{10}$ of 8.

2. A house is 40 ft. long, 26 ft. wide, and has 18 ft. posts. The roof has a one-half pitch, and there is no allowance for doors and windows. What will it cost, at 22¢ a square yard, to paint the outside?

3. Multiply the difference between 4.4 and .00027 by the product of 2.1 and .005.

4. How many square feet of surface in a stove-pipe 16 ft. long and 7 in. in diameter?

5. At 30¢ a square yard what will it cost to plaster a hall 74 ft. long, 48 ft. wide, and 16 ft. high, deducting 10% for doors and windows.

6. How many board feet of lumber in 8 sticks of timber 18 ft. long, 10 in. wide, and 12 in. thick?

7. A pile of wood contains $4\frac{1}{2}$ cd. How long is it, if it is 7 ft. 6 in. high, and 4 ft. wide?

8. How many feet of boards will be needed to cover a building, including the roof, 48 ft. long, 24 ft. wide, $17\frac{1}{2}$ ft. high? The height of the ridge-pole above the attic floor is 12 ft., and the rafters are 18 ft. long.

9. The circumference of a circular pond is 150 rd. What is its diameter and its area?

10. How many yards of carpeting, $\frac{3}{4}$ yd. wide, will be necessary to carpet a room 18 ft. 4 in. long, and 15 ft. wide?

11. Find 43% of the area of a piece of land 46 rd. long and 17 rd. wide.

12. Divide fifty and five thousandths by five millionths.

13. At $37\frac{1}{2}$¢ a square yard, find the cost of plastering a room 15 ft. 6 in. long, 14 ft. wide, 10 ft. high. The room contains 4 windows, each 3 ft. 6 in. by 5 ft. 6 in.; 2 doors, each 6 ft. 4 in. by 2 ft. 6 in.; 1 fireplace, 3 ft. by 3 ft. 6 in.

14. A man bought 13 horses at $165 each, and 19 at $210 each. He sold them all at $185 each. Find the gain or loss.

1. Divide two tenths by five ten-millionths.

2. At $6.75 a cord, required the cost of a load of wood 10 ft. long, 4 ft. wide, and 4 ft. 6 in. high.

3. A park is 80 rd. long and 60 rd. wide, and is surrounded by a walk 15 ft. wide. How many cubic yards of gravel will be needed to cover the walk 4 in. deep?

4. Add $2\frac{1}{2}$, $3\frac{2}{7}$, $\frac{1}{4}$ of $\frac{5\frac{1}{2}}{7}$, $\frac{3}{14}$.

5. Two men had each $420. One of them spent 15%, and the other $18\frac{1}{2}$%. How many dollars more had one man than the other, then?

6. I bought cloth at $1.75, but finding it damaged I decided to sell it at a loss of 15%. What do I ask for it?

7. A can do a piece of work in 10 days, and B in 12 days. In what time can they do it if they work together?

8. What is the least common multiple of 8, 13, 24?

9. Sold my horse for $200, which was 20% less than his value. Find his value.

10. Multiply twelve thousandths by fifteen hundredths, and divide the product by five tenths.

11. Required the amount of $24.17 for 11 mo. 29 da. at 9%.

12. At $3.75 a cord, find the cost of 30 loads of wood, each measuring 1 cd. 1 cd. ft.

13. Bought a horse and carriage for $650, and sold them for $806. What per cent was gained?

14. Cost $90, gain $12\frac{1}{2}$%. Required the selling-price.

15. If 18 tons of coal cost $117, how many tons can be bought for $234?

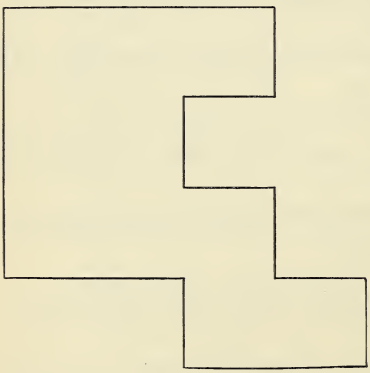
16. If $\frac{3}{8}$ of an acre of land can be bought for $35.00, what is the value of $49\frac{3}{7}$ acres?

17. If an engine runs 1,700 miles in 85 hours, how far will it run in 146 hours?

18. What number besides 149 will exactly divide 11,771?

Starting at A, the boundary line of a garden runs east 5 rd., thence south 2 rd., thence west 2 rd., thence south 2 rd., thence east 2 rd., thence south 1 rd., thence east 1 rd., thence south 1 rd., thence west 6 rd., thence north to A.

1. Make a drawing, scale 1 in. to 1 rd.
2. Find the perimeter of the garden.
3. Find the area of the garden.
4. Find the number of posts, placed $8\frac{1}{4}$ ft. apart, needed for a fence.
5. Find the feet of lumber in the two scantling (rails) running round the lot, each 4 in. by 3 in.
6. Find the feet of lumber in a tight board fence 5 ft. high all round it.
7. Find the cost of the posts at 25¢ each.
8. Find the cost of scantling and boards at $16 per M.
9. Find the cost of painting the fence at $33\frac{1}{3}$¢ a square yard.



10. This is a plan of a hall in a public building, drawn to a scale of $\frac{1}{2}$ in. to 12 ft. Find the number of square feet in the floor.
11. If the walls are 12 ft. high, find the square feet in the walls and ceiling.
12. Beginning at a point called A, the northern boundary line of a park runs west 30 rd. to B; thence south 25 rd. to C; thence east 40 rd. to D; thence to place of beginning. Draw a diagram, scale $\frac{1}{2}$ in. to 5 rd. Find the square rods in the park.
13. How many square yards of cloth will it take to cover a column that is 16 ft. high, and $18\frac{1}{4}$ ft. in circumference?

1. Find the difference between 100,100,100 and 90,090,090.

2. If a man buys 395 acres at $37 an acre, and sells his purchase for $15,176, what will be his gain?

3. Multiply 183,600 by 427,000.

4. Multiply 630,000 by 3,800.

5. If the product of two numbers is 143,186,076, and one of the numbers is 32,871, what is the other number?

6. Divide 27,180,000 by 15,100.

7. A man had $2,013.42. He bought 370 bu. wheat at $1.12 per bushel; 980 bu. corn @ 54¢; 536 bu. rye @ 62¢; and invested the remainder of his money in flour at $6.25 a barrel. How many barrels of flour did he buy?

8. A merchant sold 12 bbl. of pork, averaging 200 lb. a barrel, at 12¢ a pound, and took in payment 160 hams weighing 10 lb. each. Find the price of the ham a pound.

9. Reduce to improper fractions: $27\frac{9}{16}$, $42\frac{8}{9}$.

10. Find the difference between $438\frac{1}{6}$ and $287\frac{5}{7}$.

11. Multiply $75\frac{5}{16}$ by $64\frac{7}{15}$.

12. Divide $816\frac{5}{12}$ by $16\frac{5}{6}$.

13. How many acres does a farm contain, if $\frac{3}{8}$ of it is in grass, $\frac{5}{16}$ in corn, $\frac{1}{4}$ in wheat, and the remaining 16 acres in oats?

14. A can finish a piece of work in 4 days, B in 6 days, and C in 8 days. In what time can the work be completed if all work together?

15. Multiply $1.729\frac{5}{16}$ by $2.5\frac{4}{5}$.

16. Divide $13.702\frac{1}{3}$ by $.16\frac{5}{6}$.

17. Find the cost of 619 lb. @ $27\frac{1}{2}$¢.

18. Find the cost of $12\frac{1}{2}$ yd. @ $34\frac{1}{8}$¢.

19. What is the cost of $3\frac{1}{2}$ reams of paper at $12\frac{1}{2}$¢ a quire?

20. Reduce 587 gills to a Compound Number.

21. A owns 15% of a business; B, 25%; C, 28%; and D the remainder. What is the value of A's share if D's share is worth $17,232?

ORAL.

1. A merchant bought 5 boxes of butter for $50, and sold them so as to gain $10. What did he receive for each?

2. What number added to twice itself gives 18?

3. If one man can do a piece of work in 44 days, how many men can do the same work in 4 days?

4. At 80¢ a bushel, what is a peck and a half of corn worth?

5. Five boys bought a ball for 85 cents, and sold it for 70 cents. How much did each boy lose if they divided the loss equally?

6. A man bought a calf for $12, and sold it to the butcher so as to gain 5%. How much did he gain?

7. What is the amount of $60 for 60 days?

8. What is the interest for $60 for 1 yr. 6 mo. at 5%?

9. What is the interest of $100 for 1 yr.? For 2 yr.? 1 yr. 6 mo.? 2 yr. 3 mo.?

10. $20 is $16\frac{2}{3}\%$ of what sum?

11. A grocer sold tea at 50¢ a pound, and thereby gained 25%. What was the cost a pound?

12. What is $8\frac{1}{3}\%$ of 48 books?

13. If $3\frac{2}{5}$ bbl. of flour cost $\$20\frac{2}{5}$, what will $6\frac{4}{5}$ bbl. cost?

14. If a family consume $\frac{3}{4}$ barrels of flour in a month, how long will $3\frac{3}{4}$ barrels last them?

15. At $\frac{1}{2}\frac{4}{5}$ of a dollar a rod, what will it cost to build $\frac{6}{7}$ of a rod of fence?

16. A boy had 36 hens, and sold $\frac{5}{9}$ of them at 50¢ each.

17. How many are $\frac{1}{2}$ of $\frac{5}{9}$ of 36?

18. In one room there are 32 pupils. $\frac{5}{8}$ of these are $\frac{2}{3}$ of the number in the other. How many pupils are there in the second room?

19. In a pile of wood there are 24 cd. Three-eighths of the pile are worth $54. What is 1 cd. worth?

20. 54 are how many times $\frac{3}{8}$ of 24?

1. What will it cost to floor a room 17½ ft. long and 16 ft. wide at $1.10 a square yard?

2. A man had a capital of $2,500. He put 25% of it into business, 33⅓% of it into a bank, and invested 28% of it in real estate. How much had he left?

3. A grocer bought 800 bags of coffee, each bag containing 49¼ lb., at 18¢ a pound, and sold it at a profit of 16⅔%. How much did he receive for the whole lot?

4. I lost 10% by selling goods at 27¢ a yard. How much did I lose on 485 yd.?

5. What will be the cost of 35 3-in. planks, 24 ft. long, 16 in. wide, at $16.75 per M?

6. A man sawed a pile of wood 40 ft. long, 4 ft. wide, and 5½ ft. high, for $1.25 a cord. How much did he earn?

7. If ¾ of my share of a farm is worth $420, and I own ⅔ of the farm, what is the value of the farm?

8. Find the convex surface of a log whose circumference is 18 ft. and length 35 ft.

9. What is the area of a circle whose circumference is 160 yd.?

10. The parallel sides of a trapezoid are 25 yd. and 21 yd., and its altitude 16 yd. What is the area?

11. The length of a rhomboid is 17 ft., and the perpendicular height 16 ft. What is the area?

12. How many acres in a field 800 rd. long and 128 rd. wide?

13. Find the area of a triangle whose base is 49 yd., and altitude is ½ its base.

14. If 4½ tons of coal cost $18, what will 18 tons cost?

15. If 5 bu. 3 pk. of potatoes cost $4.60, what will 2 bu. 1 pk. cost?

16. A paid $10,500 for 125 acres of land; B paid $6 more an acre. What did B pay for 35 acres?

17. 6 A. 80 sq. rd. is 33⅓% of how much land?

1. Multiply $(14 \times 25) - (9 \times 36) + 4324$ by $(280 - 112) + (376 + 42) \times 4$.

2. What number divided by 453 will give the quotient 307, and the remainder 109?

3. If 2, 2, 5, and 7 are four factors of 1,680, what is the other factor?

4. If $5\frac{4}{7}$ yd. of cloth cost \$1.17, how much must be paid for $43\frac{1}{3}$ yd.?

5. A owns $\frac{5}{8}$ of a ship, and sells $\frac{3}{5}$ of his share for \$1,800. What is the value of the ship?

6. A pole stands $\frac{1}{5}$ in the ground, $\frac{1}{4}$ in water, and 33 ft. above water. What is the length?

7. Find the cost of 4,700 rails at $\$7\frac{3}{4}$ per C.

8. At $\$1.37\frac{1}{2}$ a yard, what will it cost to carpet a floor 18 ft. 6 in. long, and 16.4 ft. wide, with carpeting $\frac{3}{4}$ yd. wide?

9. How many square yards in the walls of a room 40 ft. long, $31\frac{1}{2}$ ft. wide, and 12 ft. high?

10. How many square yards in the walls and ceiling of a room 36 ft. long, 24 ft. wide, and 20 ft. high, allowing for a fireplace 6 ft. by $5\frac{1}{2}$ ft., and for 2 windows, each $7\frac{1}{2}$ ft. by $3\frac{3}{4}$ ft., and for a door $4\frac{1}{4}$ ft. by 8 ft.?

11. A man's salary is \$1,500 a year. If he spends 35% of it, how much will he have left?

12. A merchant pays \$10,050 for stock, and sells at an advance of $33\frac{1}{3}\%$. If the expenses are \$1,500, how much will he gain?

13. Find the interest on \$1,700 for 28 da. at 8%.

14. How many cubic feet of water will fill a rectangular tank 25 ft. long, 18 ft. wide, and 16 ft. 9 in. deep?

15. Find the cost of goods that are sold at a loss of \$129, if the rate of loss is $33\frac{1}{3}\%$.

16. Find the cost of goods sold for \$73.85 at a gain of $16\frac{2}{3}\%$.

1. A and B can do a piece of work in 8 days, A and C in 9 days, and A alone in 12 days. In how many days can B and C do it?

2. How many board feet are there in 56 joists, each 20 ft. long, and 9 in. by 3 in.?

3. Add $\frac{7}{8}$, $\frac{2}{3}$, $\frac{4}{5}$, 9.647, 8.93$\frac{1}{3}$, 59.7$\frac{3}{4}$, 4.07$\frac{3}{5}$.

4. At 75¢ a square yard it cost \$99 to pave a walk. If the walk is 6 ft. wide, how long is it?

5. How much will it cost at 36¢ a square yard, to plaster the walls and ceiling of a room 18 ft. $\times$ 14 ft. $\times$ 9 ft., allowing 180 sq. ft. for openings.

6. A room is 24 ft. long and 19 ft. 8 in. wide. How many yards of carpet 1 yd. wide will it take for this room if the breadths run lengthwise, and there is a waste of 10 in. on each breadth for matching? Would it take any less if the breadths ran the other way.

7. Find the cost of building a tight board fence 4 ft. 6 in. high, on two sides of a lot 32 rd. long, and $\frac{1}{2}$ as wide. The boards are nailed to 2 scantlings each 2 by 4 in. The posts are 8 ft. apart, and cost \$27 a hundred. The scantlings cost \$16 per M., and the boards \$18 per M.

8. Add 22 sq. yd. 132 sq. in.; 8 sq. rd. 28 sq. yd. 5 sq. ft.; 32 sq. yd. 9 sq. ft. 110 sq. in.; 46 sq. rd. 16 sq. yd. 3 sq. ft.

9. A speculator paid \$4,000 for some land, and sold it for \$12,500. Find the gain per cent.

10. Find the interest of \$2,679.13 from June 6, 1897, to July 6, 1899, at 7%.

11. Find the area of a triangle whose altitude is 16 ft. and base 18 ft.

12. Find the area of a trapezoid when the parallel sides are 84 rd. and 66 rd., and the altitude 38 rd.

13. What must be the height of a pile of wood 32 ft. long and 6 ft. wide, to contain 9 cords?

1. A farmer bought a twelve-acre field of wheat for $225. He paid $1.45 an acre for cutting and 5¢ a bushel for thrashing, and $1.75 a load (42 bu.) for teaming. The wheat yielded 28 bu. to the acre, and was sold for $1.12½ a bushel. Did he gain or lose? and how much?

2. What number must be added to 32,684 to make it exactly divisible by 126?

3. If a railroad charges ½¢ a mile for the first fifty miles for carrying a barrel of flour, and then 4¢ for every 9 miles beyond the 50, what will it cost to carry 344 bbl. 230 miles?

4. The length of an oblong is 26 ft. and the width 14 ft. Find the area and the perimeter.

5. A train leaves Springfield at 8.45 A.M., and goes 27⅓ miles an hour. Another train leaves at 9 A.M., and goes 41 miles an hour. When will the second train overtake the first?

6. Divide 216¼ acres among 3 men, giving A 9¼ acres more than B, and B 12 acres more than C.

7. If 17 men can build a wall in 11 days, how many men will it take to build a wall three times as long in ⅓ of the time?

8. What will it cost to plaster a room 18 ft. by 22 ft. and 14 ft. high, at 22¢ a square yard, deducting 10% for doors and windows?

9. The inside dimensions of a rectangular fort are 240 ft. by 190 ft. The wall surrounding this fort is 6 ft. thick and 15 ft. high. How many cubic ft. of masonry are there in the walls?

10. A rectangular field is 40 rd. long, and contains 2 acres. Trees are planted 12 ft. apart around the outside. Find the number of trees.

11. A man gave ½ of his money to his eldest son, ⅓ of what was left to the second, ⅔ of what was then left to the third, ⅞ of what was then left to the fourth, and the remainder, $280, to the fifth. How much money did the man have to divide?

ORAL.

Give the names of the following figures:

1. A figure having three sides.
2. A figure having three equal sides.
3. A figure having three sides, two of which are equal.
4. A figure having four equal sides and four right angles.
5. A four-sided figure, having opposite sides parallel, but containing no right angle.
6. A figure having four equal sides and opposite sides parallel, but containing no right angle.
7. A figure having four sides, with opposite sides parallel and equal.
8. A figure having four sides with only two parallel sides.
9. Any figure having four sides.
10. A figure having four sides with no parallel sides.
11. A rose garden is 12 ft. long and 9 ft. wide. How many bouquets can I gather, if 3 sq. ft. will furnish 1 bouquet?
12. $9 + 7 - 6 + 5 - 8 + 4 - 9 + 7 - 6 - 3 + 2 = ?$
13. How many cubic feet in a wall 30 ft. long, 4 ft. high, 2 ft. thick?
14. How many one-foot cubes can be placed in a cubical box one yard long, one yard wide, and one yard high?
15. A farmer sold his wheat for \$267, and his oats for \$234. How much did he receive for both?
16. At 45¢ a pound, how many pounds can be bought for \$1.35?
17. Divide 18 lb. 12 oz. by 3.
18. Divide 30 da. 15 hr. 45 min. by 3.
19. What part of 2 gal. is 2 qt. 1 pt.?
20. 15 is $\frac{3}{7}$ of $\frac{7}{8}$ of what number?
21. If $\frac{7}{8}$ of a stack of hay is worth \$42, what will 2 stacks be worth?
22. What is the least common multiple of 8, 12, and 24?

1. By selling goods for $16\frac{2}{3}\%$ profit, a merchant clears $1,474. What was the cost of the goods?

2. A man bought 27 head of cattle at $32 a head. One-third of them were killed, and the remainder sold at $53 a head.

3. By selling a farm for $3,240, a man lost 10% of the cost.

4. 650 bbl. of flour were bought at $5.25 a barrel. The freight was $15.40 and storage $5.85, and I paid 25% of the cost for other expenses. If I sold the flour for $5,716, what was my gain?

5. I sold my horse to Mr. Smith, and gained $7\frac{1}{2}\%$. Mr. Smith sold it to Mr. Brown for $141.90, and lost 12%. How much did I pay for the horse?

6. A farm was sold for $8,260, which was $16\frac{2}{3}\%$ more than it cost. Find the cost.

7. My agent buys for me 4,750 bu. of wheat at $1.12. He charged me $\frac{1}{2}\%$ commission. What is his commission? How much in all will the wheat cost me?

8. An agent sells for me 360 acres of land at $22.50 an acre, and keeps $2\frac{1}{2}\%$ commission. How much does he keep? How much does he return to me?

9. A man owned $\frac{3}{4}$ of a mine, and sold $\frac{3}{10}$ of his share for $40,500. If I own $\frac{3}{5}$ of the mine, how much ought I to receive for $\frac{5}{8}$ of my share at the same price?

10. How many feet of lumber are there in a 2-inch. plank 16 ft. long and 9 in. wide?

11. A man bought a house, and paid for taxes, insurance, etc., $350. He rents the house for $35 a month, and at the end of the year sells for $40 less than he paid for it. How much more did he receive than he paid out during the year?

12. Find the interest of $4,163.17 from April 11, 1898, to July 1, 1900, at 9%.

13. Change 1 yr. 271 da. 45 min. to seconds.

14. Change 348,480 sq. ft. to acres.

1. How many feet of boards will it require to roof and board a building 60 ft. 6 in. long, 40 ft. 3 in. wide, having 22 ft. posts? The rafters are 24 ft. 2 in. long, and the gable ends 10 ft. high.

2. Find $6\frac{2}{3}\%$ of \$426.25.

3. What is $15\frac{3}{4}\%$ of 840?

4. How many pickets 3 in. wide, and nailed 3 in. apart, will be used in fencing a lot 14 rd. long, 6 rd. wide?

5. A cellar 36 ft. 6 in. long, 24 ft. wide, and $6\frac{1}{2}$ ft. deep, was excavated by 4 men in 12 days. What was the average number of cubic feet each man excavated in a day? What was the cost of digging the cellar at 36¢ a cubic yard?

6. The triangular gable of a house has a base of 44 ft. and an altitude of 18 ft. How many square feet of boards will cover the two gables?

7. If I own $\frac{5}{8}$ of a farm, and sell $\frac{2}{3}$ of my share for \$3,460, what is the whole farm worth?

8. What is the perimeter of a rectangular field whose length is twice its breadth, if one end measures 28 rd. 4 yd.?

9. When \$1.95 are paid for 8 gal. 1 pt. of milk, what is the price a quart?

10. A man's salary is \$800 a year. He pays 25% of it for board, 10% of the remainder for rent, 20% of what is then left for clothes, \$32 for books, and lends 50% of the last remainder. How much of his salary had he left?

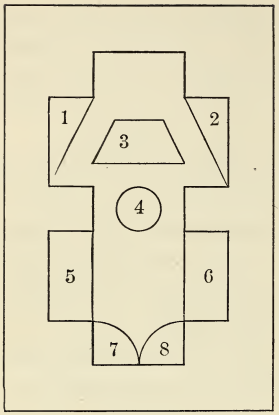
11. A and B can build a wall in 20 days. If C helps them, they can do it in 12 days. In what time can C do it alone?

12. A man bought a watch for \$60, and sold it for \$100. What per cent did he gain?

13. I bought a horse for \$110. For how much must he be sold to gain $37\frac{1}{2}\%$?

14. If I pay \$13.50 for $22\frac{1}{2}$ lb. of tea, for how much must I sell $\frac{1}{4}$ lb. to gain 20%?

15. One-fifth is what per cent of three-fourths?



This diagram is drawn to a scale of $\frac{1}{8}$ in. to 5 ft.

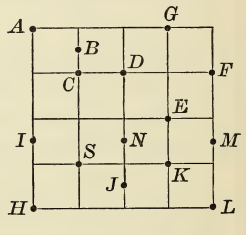
1. 1, 2, 3, 4, 5, 6, 7, 8, are flower-beds. Find their area, and deduct from the area of the whole lawn.

2. Find the area of the space between the inner and outer lines.

3. Starting at the south-west corner of a lot, the boundary line runs north 30 rd., then east 10 rd., south 12 rd., east 20 rd., then south-west to the point of starting. Draw a diagram, scale $\frac{1}{4}$ in. to 4 rd. Find cost of the field at 35¢ a square foot.

4. The boundary line of the little park back of the school-house runs as follows: Beginning at the point nearest to the school-house, it runs west 120 ft., thence south 120 ft., thence to starting-point. At 18¢ a sq. ft., find the cost of sod to cover it.

5. Using a scale of $\frac{1}{4}$ in. to 20 rd., draw the following plan of a portion of our city. Let each letter represent the house of some person.



6. How far must A travel to reach each of the other persons?

7. Walking a mile in 15 min., how long will it take C to visit G, passing by L, remaining with G 15 min., and returning home the same way?

8. At the same rate how long will it take K to visit A, going past G's house, and coming home past H's house, remaining with A 30 minutes?

9. S is the school-house; how far must each person travel every day in going to and returning from school, if he goes home to dinner?

ORAL.

1. If a boy buys oranges at 40¢ a dozen, how must he sell them apiece so as to make 20% on each orange?

2. If a yard of silk costs a merchant 80¢, for how much must he sell it to gain 12½%?

3. What is the gain per cent on an article that is bought for 40 cents and sold for 60 cents?

4. I went out into the country and bought eggs at 25¢ a dozen, and brought them to the city and sold them for 30¢ a dozen. What was my gain per cent?

5. At the same time I bought potatoes at 60¢ a bushel, and sold them at 25¢ a peck. What was my gain per cent?

6. A lawyer agreed to collect for me at 5% commission. He collected ½ of a debt of $1,200. How much commission did he keep?

7. At 8%, find the interest on $50 for one year.

8. At 7%, find the interest on $40 for a year.

9. At 10%, find the interest on $60 for 60 days.

10. At 6%, find the interest on $200 for 33 days.

11. A watch cost $70 more than a chain, and together they cost $160. How much did each cost?

12. A can do a piece of work in 3 days, B in 4 days, and C in 5 days. How much can each do in a day? How much can all do in a day? How many days will it take, all working together, to do the whole work?

13. Two men can do a piece of work in 3 days. If one man can do it in 5 days, in how many days can the second man do it?

14. A is 40 yd. ahead of B. If B runs 5 yd. while A runs 4, how many yards must B run to overtake A?

15. A is 30 ft. ahead of B, but B runs 5 ft. while A runs 2 ft. How many feet will B run to overtake A?

16. Divide 64, 76, 96, 104, 112, 216 by 4.

17. If ½ a yard of cloth costs $4, what will 1¾ yd. cost?

MISCELLANEOUS FACTS FOR REFERENCE.

A hand is 4 in., used in measuring horses.

A size is $\frac{1}{3}$ in., used by shoemakers.

A span is 9 in., a fathom, 6 ft., used by sailors.

A pace is 3 ft., used in estimating distances.

A league is 3 miles, used in measuring distances at sea.

A load is one cubic yard of earth.

A perch is $24\frac{3}{4}$ cubic feet, used in measuring stone and masonry.

A long ton is 2240 lb., used in buying coal at the mines, and by custom-house officers in collecting duties.

A barrel of flour weighs 196 lb.; a barrel of beef or pork, 200 lb.; a quintal of fish, 100 lb.; a keg of nails, 100 lb.

A bushel of oats weighs 32 lb.; barley, 48 lb.; rye or corn, 56 lb.; wheat or potatoes, 60 lb.; a firkin of butter, 56 lb.

A gallon is 231 cu. in., or $7\frac{1}{2}$ gal. fill a cubic foot.

2150.42 cu. in. or $1\frac{1}{4}$ cu. ft., in 1 bushel, even measure.

2688 cu. in. or $1\frac{1}{2}$ cu. ft., in 1 bushel, heaped.

A chain is 66 ft., used by surveyors.

2 reams of paper make a bundle, 5 bundles, a bale.

A folio is paper folded in 2 leaves for a book; a quarto or 4to, 4 leaves; an octavo or 8vo, 8 leaves; a duodecimo or 12 mo, 12 leaves.

Shingles are packed in bunches. 4 bunches make 1000. The price is always given by the thousand.

1000 shingles, laid 4 in. to the weather, will cover a square, or 100 sq. ft.; 900 shingles when laid, $4\frac{1}{2}$ in.

A lath is 4 ft. long, and $1\frac{1}{2}$ in. wide. 50 laths make a bunch. 1 bunch will cover 3 sq. yd.

A section of land is 1 mile square, or 320 rd. $\times$ 320 rd.

A brick is 8 in. long, 4 in. wide, and 2 in. thick. 22 bricks make 1 cu. ft. of wall.

Wall-paper is 18 in. wide, and 24 ft. long, a single roll.

1. Find the cost of 1,240 lb. of wheat at 90¢ a bushel.
2. Find the cost of 3,246 lb. of barley at 88¢ a bushel.
3. Find the cost of 5,684 lb. of corn at 58¢ a bushel.
4. Find the cost of 1,462 lb. of oats at 32¢ a bushel.
5. Find the cost of 3,220 lb. of rye at 92¢ a bushel.
6. How many gallons in a reservoir 40 ft. long, 16 ft. wide, 8 ft. deep?
7. How many bushels of grain will a bin contain that is 14 ft. long, $3\frac{1}{2}$ ft. wide, and 6 ft. high?
8. Find the cost of a tight board fence, 5 ft. high, around a field 40 rd. by 60 rd. The posts cost 22¢ each, and are placed 6 ft. apart. Two scantlings around the field are 3 in. by 4 in., and the boards are 6 in. wide and 10 ft. long. Both scantlings and boards cost $22.25 per M.
9. 28 bu. of coal make a long ton. How deep must be a rectangular bin 18 ft. long and 5 ft. wide, to hold 20,000 lb. coal?
10. At 83¢ a perch, what is the cost of 1,188 cu. ft. of stone?
11. How many reams of paper will be needed to print 10,000 copies of an octavo book containing 160 pages?
12. How many bricks are required for a wall 7 ft. high and 12 in. thick, under a house that is 22 ft. wide and 30 ft. long?

NOTE. — In estimating for stone or brick work, the distance round the outside is taken for the length of the wall. Corners are thus counted twice. No allowance is made for openings unless they are very large, and then $\frac{1}{2}$ of the opening is deducted. Masons estimate 7 bricks for every square foot of surface, when the walls are 1 brick in thickness, and multiply that by the number of bricks in thickness. When thickness of the wall is given in feet, find the cubic feet in wall, and multiply by 22, the number of bricks in a cubic foot.

13. How many bricks will be needed for the walls of a house 60 ft. by 24 ft. by 36 ft. high, the walls being 3 bricks thick?
14. How many bunches of laths are required for the walls and ceiling of a room 15 ft. by 18 ft. and 10 ft. high, there being 6 openings that will average $2\frac{1}{2}$ sq. yd. each?

NOTE. — Contractors usually deduct only $\frac{1}{2}$ of the surface of openings.

LESSON 62.

TO FIND THE CONTENTS OF CYLINDERS.

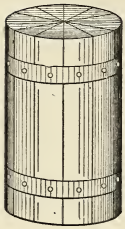


Fig. 1.

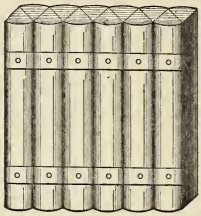


Fig. 2.

NOTE. — These drawings were made from a cut-up cylinder. One should be in the hands of the teacher when this lesson is given.

1. Of what is Fig. 1 a drawing?
2. Of what is Fig. 2 nearly a drawing?

NOTE. — The more parts into which the cylinder is cut, the more nearly will it approach a prism, when arranged as in Fig. 2.

3. How do you find the contents of the prism?
4. How does the length of the prism compare with the circumference of the cylinder?
5. How does the width of the prism compare with the diameter of the cylinder?
6. How does the height of the cylinder and prism compare?
7. Since every cylinder can be changed into a rectangular prism, with $\frac{1}{2}$ the circumference as the length, the radius as the width, and the same height; formulate a rule for finding the contents of a cylinder.
8. What shape is one end of the cylinder?
9. What does this circle become when the cylinder is changed into a prism?
10. Prove that the way to find the contents of cylinders is identical with that of finding the contents of prisms. Find the number of cubic units that can be placed in one layer on the base, and multiply by the number of layers.

SURFACE AND VOLUME OF CYLINDERS.

1. Find the volume of a cylinder whose altitude is 8 ft. 6 in. and the diameter of the base 3 ft.

2. Find the solid contents of a cylinder whose altitude is 15 ft., and the radius of the base 1 ft. 3 in.

3. What is the entire surface of a cylinder 6 ft. 6 in. long, and the radius of its base 4 ft.?

4. What are the contents of a cylinder whose length is 5 ft. and diameter of the base 15 in.?

5. How many gallons will a circular cistern hold that is 6 ft. in diameter and 10 ft. deep?

6. Find the entire surface of a cylinder 30 ft. long, and 30 in. in diameter.

7. How many gallons of water will a cylindrical vessel hold that is 9 ft. deep and 3 ft. in diameter?

8. A cylindrical vessel 8 ft. high and 5 ft. in diameter is filled with potatoes. What is the value of the potatoes at 75¢ a bushel?

9. How many gallons of water are in a well 5 ft. in diameter, if the water is 7 ft. deep?

10. Find the entire surface and volume of a cylindrical column $3\frac{1}{2}$ ft. in diameter, and 28 ft. high.

11. At 32¢ a cubic foot what is the value of a log 45 ft. long and 2 ft. in diameter?

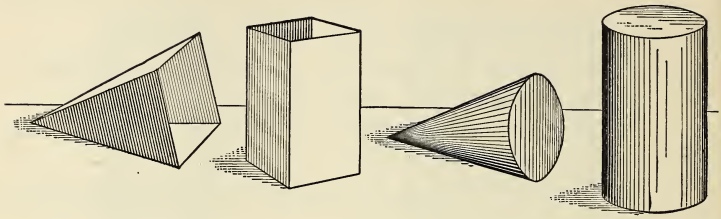
12. A cylindrical water-tank is 25 ft. high and its diameter is 30 ft. How many gallons of water will it hold?

13. A circular reservoir is 80 ft. in diameter, and 20 ft. deep. How many gallons of water will it hold when full?

14. How much more gilding will it take to cover a 9-inch cube, than to cover a cylinder whose height and diameter are each 9 inches?

15. Find the volume of a cylinder whose altitude is 7 ft. 4 in. and the diameter of the base 5 ft.

TO FIND THE CONTENTS OF CONES AND PYRAMIDS.



To illustrate this principle there should be in the room a hollow cone and cylinder, each having the same base and altitude, also a hollow pyramid and prism, each having the same base and altitude. These can easily be made from cardboard. Using sand or sawdust, let each pupil determine, by measuring, the ratio or relation of the contents of the cone to the contents of the cylinder, and the contents of the pyramid to the contents of the prism. This they will find to be one-third.

NOTE. — To find surface, the slant height must be known; but to find volume or contents, the altitude must be known.

Formulate a rule for finding contents of cones and pyramids.

1. Find the volume of a square pyramid each side of whose base is 4 ft. and altitude 18 ft.

2. Find the volume of a cone the circumference of whose base is 9 ft., and whose altitude is 14 ft.

3. What is the volume of a square pyramid, the perimeter of whose base is 8 ft., and whose altitude is 10 ft.?

4. What is the volume of a pyramid whose base is 6 ft. square, and whose altitude is 21 ft.?

5. Find the volume of a cone whose diameter is 6 ft., and altitude 18 ft.

6. Find the volume of a cone whose circumference is 31.416 feet and altitude 20 feet.

7. Find the volume of a square pyramid with a base 10 ft. square, and an altitude 25 ft.

8. Find the volume of a cone, when the circumference of its base is 48 ft., and its altitude 50 ft.

ORAL.

1. A sailor took the sounding, and found the water to be 60 ft. deep. How many fathoms was it?

2. If we add $\frac{1}{8}$ of a number to itself, the sum will be 36. What is the number?

3. If we increase a number by $\frac{3}{5}$ of itself, the sum will be 80. What is the number?

4. $\frac{2}{5}$ of a number increased by $\frac{1}{2}$ of the number equals 27. Required the number.

5. A man spent $\frac{3}{5}$ of his money for a horse, and then had $80 remaining. How much did the horse cost?

6. One-third of the length of a pole is in the air, $\frac{1}{4}$ in the water, and 10 ft. in the ground. Required the length of the pole.

7. If a boy, after spending $\frac{1}{5}$ of his money for candy and $\frac{1}{4}$ for peanuts, found that 12 cents was $\frac{3}{11}$ of what remained, how much money had he?

8. My brother's age diminished by 7 years equals 15 years. How old is my brother?

9. A fishing-pole which is 12 ft. long lacks 3 ft. of being $\frac{5}{8}$ as long as the line. How long is the line?

10. I owned a farm, and sold $\frac{1}{4}$ of it. Afterward I bought 13 acres, and then had 43 acres. How many acres in my farm at first?

11. Belle spent $\frac{1}{3}$ of her money for candy, and 15 cents for ribbons. If she then had 25 cents, how much had she at first?

12. 4 times a number, increased by 9, equals 7 times a number. What is the number?

13. Three-fourths of a tree were left standing after a storm had broken off 15 ft. less than $\frac{1}{3}$ of it. How tall was the tree?

14. Jennie has three times as many pins as Grace, and they together have 24. How many has each?

15. Divide the number 42 into two such parts that one part may be 8 less than the other.

1. A merchant by selling cloth at $2.50 a yard gained 25%.

2. An agent bought 50 carriages for $140 each, and charged me 3½% commission. He also paid $75 for freight, and $35 for cartage. What did the carriages cost me?

3. Find the interest of $475.05 for 6 yr. 10 mo. 10 da. at 6½%.

4. A man sold a cow for $37.50, and lost 25%. Find the cost.

5. A man sold a wagon for $41.25, and gained 25%.

6. I sold a horse for $240, and lost 20%.

7. A man owned 156 A. of land, and sold 75% of it for $5,265. What was the price an acre?

8. A man bought a farm 180 rd. long and 160 rd. wide, for $6,750, and sold it at a gain of 20%. How much did he receive an acre?

9. I purchased 417 bbl. of flour at $5.25 a barrel. For how much must I sell the whole to gain 35%?

10. If it costs a man who earns $90 a month $72 for expenses, what per cent of his money can he save?

11. A manufacturer made 5,280 barrels of flour. He sold 12½% to one man, 33⅓% of the remainder to another, and 50% of what was then left to another. If he received $4,666.20 for what was then left, how much was that a barrel?

12. Find the interest of $875 for 80 days at 7%.

13. $596.50 for 33 days at 4%.

14. $1,375 for 5 mo. 3 days at 6%.

15. $7,000 for 2 yr. 2 mo. 16 da. at 10%.

16. $3,456 from Oct. 12, 1896, to May 3, 1902, at 8%.

17. If I lose 10% by selling goods at 18¢ a yard, what did they cost?

18. A merchant sold tea at 60¢ a pound, gaining 20%. Find the cost.

19. Find the interest of $7,000 for 93 da. at 7%.

1. A can do a piece of work in 6 days, B in 7, and C in 8. In what time can they do it working together?

2. How many casks (40 gal.) of water will a cylindrical cistern hold, whose diameter is $9\frac{1}{2}$ ft., and depth 10 ft.?

3. If the diameter of my carriage wheel is $4\frac{1}{2}$ ft., how many revolutions will it make in going 2 miles and back again?

4. The height of a cylinder is 6 ft., and the diameter of the base is $2\frac{1}{2}$ ft. Find the entire surface and volume.

5. A field in the form of a trapezoid contains $23\frac{1}{2}$ acres. One of its parallel sides is 95 rd., and the other 65 rd. What is its altitude?

6. Write a promissory demand note. Find the interest on it for 1 yr. 3 mo. 17 da. at 7%.

7. Find the interest at $7\frac{1}{2}$% on \$256.34 from Nov. 17, 1897, to Aug. 24, 1899.

8. Find the commission on \$46,912.60 at $1\frac{3}{8}$%.

9. At \$1.85 a yard, find the cost of carpet 1 yd. wide to cover the floor of a room 22 ft. long, 19 ft. wide, strips to run lengthwise.

10. How many 4-oz. bottles ($\frac{1}{4}$ pt.) can be filled from 4 gal. 2 qt. 1 pt. 3 gi. of alcohol?

11. Find the cost of 86 pieces of maple flooring, 3 in. wide, 16 ft. long, at \$38.50 per M.; same number of pieces 4 in. wide, 15 ft. long, at \$35 per M.; 48 boards 10 in. wide, 18 ft. long, @ \$28.75 per M.

Find the interest of:

12. \$248 for 90 days at 7%.

13. \$636 for 1 yr. 5 mo. 10 da. at 5%.

14. \$1,478 for 1 yr. 2 mo. 13 da. at 6%.

15. \$414.80 for 97 days at 7%.

16. \$2,500 from Sept. 2 to Nov. 30 at $7\frac{1}{2}$%.

17. \$4,375 for 2 yr. 8 mo. 24 da. at 6%.

18. \$3,485 from July 17, 1896, to Nov. 27, 1899, at 6%.

1. How many square inches are there in the convex surface of a square pyramid whose base is 8 in. square, and whose slant height is 2 ft.?

2. What is the convex surface of a cylinder formed by the revolution of a rectangle which is 12 ft. long and 8 ft. wide?

3. At 45¢ a square yard, how much will it cost to paint a church spire, whose base is a 9 ft. hexagon and slant height 80 ft.?

4. If a bin is 10 ft. long and 7 ft. wide, how deep must it be to hold 448 bushels of apples?

5. Add 121 sq. rd. 23 sq. yd. 13 sq. in.; 72 sq. rd. 3 sq. ft. 11 sq. in.; 59 sq. rd. 13 sq. yd. 3 sq. ft. 9 sq. in.; 47 sq. rd. 19 sq. yd. 21 sq. in.

6. At 6 o'clock A.M. A started from Holyoke at the rate of 7 miles an hour; at 8 o'clock B started after him at the rate of $9\frac{1}{2}$ miles an hour. When will B overtake A?

7. At \$.75 a square yard, find the cost of cementing the sides and bottom of a cistern 14 ft. long, 10 ft. wide, and 7 ft. deep?

8. If I sell goods for \$6,720, and gain 12%, what is the cost price?

9. A can do $\frac{1}{3}$ of a piece of work in 4 days, and B can do the whole of it in 8 days. In how many days can both do it, working together?

10. From 24 mi. take 21 mi. 88 rd. 2 yd. 2 ft.

11. A roll of wall paper, 8 yd. long and 18 in. wide, costs 38 cents. How much will this paper cost for a room 32 ft. by 24 ft. by 14 ft., deducting 265 sq. ft. for openings?

12. At \$28 per hundred for the posts, and \$17 per M for the boards, how much will it cost to build a fence five boards high round a square field 40 rd. on a side? The boards are 10 in. wide, and the posts are set 8 ft. apart.

13. Change $\frac{1}{4}$, $9\frac{1}{8}$, $\frac{2}{5}$, $\frac{3}{5}\frac{3}{5}$, and $5\frac{5}{8}$ to decimals.

REVIEW OF DECIMALS.

1. How far will light travel in 12 min. 45 sec., if it travels 186,000 miles in one second?

2. Divide 567,891 by 729. 900,972 by 843.

3. Divide 120,000,000 by 12,000,000.

4. Add: Twenty-six and fifteen thousandths; eighty-one and one thousand nine hundred ten-thousandths; eleven and twenty thousand seven hundred four hundred-millionths; twelve hundred and twelve hundred-thousandths.

5. Multiply 36.03 by .06006.

6. Divide 5.958 by .0009.

7. Divide 16.27704 by 14.664.

8. If a man can build .425 of a rod of fence in an hour, how many rods can 12 men build in 6.5 days, working 8.25 hours a day?

9. Thirty-five hundredths of a cargo of 8,000 bushels of wheat were destroyed by fire. What was the value of the part left at $.875 a bushel?

10. A farmer exchanged wood for coal. If he bought 9.5 tons of coal at $4.25 a ton, how many cords of wood at $3.75 a cord did he give in exchange?

11. What is .15 of $47.65?

12. Divide 10.201 by 101.

13. Divide 1.125 by 937.5.

14. Find the cost of 8,724 roofing-slate at $5.75 per hundred.

15. The bricks in a schoolhouse cost $10,875. If the price was $7.25 a thousand, how many bricks were used?

16. Find the cost of 17,250 lb. of hay at $15.75 a ton.

17. A ton of coal costs $2.75 to mine it, $.85 for freight, and $.25 for delivery. A dealer sold 425,600 lb. at $5.50 a ton. How much did he make?

In buying coal at wholesale, a ton is 2240 pounds. This is called a *long* ton.

ORAL.

1. 4 times $\frac{5}{6}$ of 36 is one-half of what number?

2. A store is insured to the amount of \$5,000, at $1\frac{1}{2}\%$. What is the premium?

3. A pole increased by $\frac{1}{3}$ of its own length would be 18 ft. long. What is its length?

4. A horse was sold for $\frac{5}{6}$ of its cost, and thereby a loss of \$16 was incurred. At what price was it sold?

5. A horse was sold at a loss of $16\frac{2}{3}\%$, and thereby a loss of \$16 was incurred. At what price was it sold?

6. How long will it take 18 men to do a piece of work, if 6 men can do it in 9 days?

7. If 9 yd. of muslin cost \$1.50, how much will 27 yd. cost?

8. A merchant bought 8 desks for \$25 each, and sold them for \$24.75 each. How much was lost on all?

9. How many baskets, holding 2 pk. each, will 5 bu. of peaches fill?

10. What is the cost of 2 doz. arithmetics at $33\frac{1}{3}¢$ each?

11. At $33\frac{1}{3}¢$ each, how many books can be bought for \$9?

12. If $\frac{3}{4}$ of a ton of hay cost \$15, what will $\frac{7}{8}$ of a ton cost?

13. I started to go from here to the city. After going $\frac{1}{4}$ of the distance by cars, and $\frac{2}{3}$ by stage, I found I had 7 miles yet to go. How far away is the city?

14. $\frac{1}{4}$ of 80 is how many times $\frac{1}{6}$ of 30?

15. 35 is $\frac{5}{6}$ of how many?

16. $\frac{3}{4}$ of 44 is $1\frac{1}{2}$ of what number?

17. $\frac{3}{5}$ of 25 is $\frac{1}{3}$ of what number?

18. A boy wishes to buy a pony for \$100. If he saves \$8 a month for 12 months, how much will he then lack of enough to buy the pony?

19. Eight boys contributed 30 cents each, and bought some melons at 12¢ each. How many did they buy?

REVIEW IN FRACTIONS.

1. A boy sold 2 bu. 3 pk. of pears at the rate of 3 for 5 cents. Each peck averaged $3\frac{1}{2}$ doz. pears. How much did he receive for all?

2. If a number diminished by $\frac{1}{3}\frac{5}{3}$ of itself is 7,296, what is the number?

3. A horse and carriage are worth $763. The carriage is worth $\frac{2}{5}$ as much as the horse. What is the value of each?

4. A house and lot cost $13,600. The cost of the lot was $\frac{3}{14}$ of the cost of the house. Find the cost of each.

5. A man divided his estate, giving his oldest son $\frac{1}{4}$ of it and his youngest son $\frac{1}{5}$ of it. If $375 was the difference between the sons' shares, what was the value of the estate?

6. A and B can do a piece of work in 6 days. A can do it alone in 10 days. In what time can B do it?

7. I called for bids in a piece of work. A agreed to do it in $1\frac{3}{4}$ mo. at $2.75 a day; B agreed to do it in $2\frac{1}{4}$ mo., at $2.25 a day; and C in $3\frac{1}{4}$ mo., at $1.50 a day. Each counted only 24 working days to a month. Which bid should I accept?

8. If $\frac{5}{16}$ of A's money is equal to $\frac{5}{8}$ of B's money, and B has $8,000, how many dollars has A?

9. A drover bought cows at $27.40; if he had paid $28\frac{1}{4}$, they would have cost him $120.70 more. How many cows did he buy?

10. When 9 hours is a day's work, and $1.50 is a day's pay, find each man's pay in the following time sheet:

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
A	9	$8\frac{1}{2}$	$9\frac{1}{2}$	$7\frac{1}{2}$	8	$6\frac{1}{2}$
B	8	10	7	$6\frac{1}{2}$	8	$8\frac{1}{2}$
C	$6\frac{1}{2}$	$8\frac{1}{2}$	9	8	5	7
D	$6\frac{1}{4}$	$5\frac{1}{2}$	9	$7\frac{1}{4}$	6	5
E	8	9	7	8	9	8

REVIEW OF DENOMINATE NUMBERS.

1. Change 37 sq. yd. 9 sq. ft. 38 sq. in. to square inches.

2. How many acres in 609,840 sq. ft.?

3. Add 6 mi. 83 rd. 2 yd. 3.4 in.; 4 mi. 137 rd. 5 yd. 6.5 in.; 15 mi. 37 rd. 2 yd. 7.1 in.; 1 mi. 275 rd. 6 in.; 4 rd. 1 yd.

4. From 64 T. take 42 T. 1,763 lb. 8 oz.

5. An agent collected \$1,324 at $1\frac{1}{4}\%$ commission.

6. What will be the premium at $2\frac{1}{2}\%$ for insuring goods valued at \$1,500?

7. Find the cost, at 36¢ a square yard, of plastering a room 36 ft. long, 24 ft. wide, 14 ft. high, deducting for 3 doors, each 10 ft. by 7 ft., and for 8 windows, each 7 ft. by $3\frac{1}{2}$ ft.

8. A rug 5 yd. by 4 yd. is in the center of a room. It covers the floor, except a strip 18 in. wide round the room. How many square feet of the floor are uncovered?

9. At \$1.25 a yard, find the cost of carpet $\frac{3}{4}$ yd. wide to cover a floor 27 ft. long, 16 ft. wide. The breadths run lengthwise, and there is a loss of 3 in. on each breadth for matching.

10. At \$3.50 a cord, find the value of a pile of wood 64 ft. long, 4 ft. wide, and 6 ft. high.

11. The walls of a house, 36 ft. long and 14 ft. wide, are 21 ft. high, and 12 in. thick. At \$7.75 per M find the cost of the bricks for the walls.

12. The water in a cistern was lowered $3\frac{3}{4}\frac{3}{4}$ ft. How many gallons were taken out, if the cistern was 7 ft. long, 5 ft. wide?

13. How many bricks will it take to lay a walk 40 ft. long, 6 ft. wide?

14. How many feet of lumber in 40 boards 20 ft. long, 1 ft. 9 in. wide?

15. If I wish to carpet a room 20 ft. long by 18 ft. wide with carpeting 2 ft. 6 in. wide, how much shall I save by laying the carpet crosswise instead of lengthwise, if the carpet costs \$1.75 a yard?

REVIEW OF PERCENTAGE.

1. A man had $60,000. He put 37% of it in the bank, 17% in a store, and the remainder in a railroad. How many dollars did he invest in the railroad?

2. A man owes $8,496, but can pay only $6,372. What per cent can he pay?

3. I have invested $4,896 in business, which is 16% of all my money. How much money have I?

4. What number increased by $62\frac{1}{2}\%$ of itself equals $3,942\frac{1}{4}$?

5. The Mississippi River is 4,200 miles long, which is 5% longer than the Nile, and that is $6\frac{3}{3}\%$ longer than the Amazon. Find the length of the Nile and of the Amazon.

6. A drover sold 34% of his cattle, and had 990 left. How many did he sell?

7. A man bought 800 tons of coal at $3.50 a ton, and sold it so as to gain 45%. What did he receive for it?

8. A grocer sold flour at $3.50 a barrel, and lost 30%.

9. A man sold an engine for $1,650, and gained 25%. Find the gain.

10. The same man sold another engine for the same price, and lost 25%. Find the loss. How does the loss compare with the gain in example 9?

11. An agent collected $1,680 for me, but only sent me $1,600. How much did he keep as commission? What per cent of what he collected did he keep?

12. Find the interest of $2,763 from Sept. 5, 1897, to Jan. 13, 1899, at $4\frac{1}{2}\%$.

13. Find the interest of $106.45 from Nov. 28, 1896, to June 6, 1899, at $5\frac{1}{2}\%$.

14. Find the amount of $1,047.50 for 1 yr. 9 mo. 10 da. at $7\frac{1}{2}\%$.

15. Find the interest of $750 from Sept. 8, 1896, to Aug. 8, 1899, at $6\frac{1}{2}\%$.

1. I sold 18 yd. of cloth at \$2.20 a yard, for which I paid \$1.88 a yard. How many yards must I sell at the same rate to make \$19.20?

2. A man left his estate, worth \$10,428, to be divided as follows: $\frac{1}{3}$ of it to his wife, $\frac{1}{4}$ of the remainder to his son, and the rest to be divided equally between his two daughters.

3. A man invested \$48,000 in wheat, at 80¢ a bushel; 50% as much money in corn, at 60¢ a bushel; and 20% as much in oats, at 50¢ a bushel. How many bushels of grain did he buy?

4. A had \$42,000; 8 times $\frac{1}{6}$ of his money was $\frac{1}{8}$ of B's money. How much money had B?

5. A man willed his property, worth \$250,000, among 4 institutions as follows: To the first, \$6,000 more than 20% of the whole; to the second, \$14,000 less than 25% of the whole; and the remainder equally between the other two. Find the share of each.

6. A man bought 85 yd. of cloth at 15¢ a yard. 25% of it he sold at 14¢ a yard; 50% of it at 16¢ a yard, and the rest at 15¢ a yard. Find his gain.

7. If 14 men can do a piece of work in 36 days, how long will it take them if they are re-enforced by 4 men?

8. A grocer buys potatoes at 65¢ a bushel, and sells them at 80¢ a bushel. With the gain on 340 bushels he bought corn at 15¢ a peck. How many bushels did he buy?

9. The minuend is 487,520, the subtrahend 79,026. What is the remainder?

10. If you add 10 to a number, then divide by 5, multiply by 12, divide by 2, and add 16, you will have 76. What is the number?

11. A man bought a span of horses for \$750, a carriage for $\frac{1}{2}$ as much, and 2 harnesses, each at $\frac{1}{10}$ as much as the horses, and two houses, each costing as much as horses, carriage, and harnesses. Find the cost of all.

ORAL.

1. If I sell \$400 worth of goods on 3% commission, how much shall I receive?

2. If my agent sells \$300 worth of goods on 5% commission, how much money will he keep? and how much will he send me?

3. Bought hats at \$3 each, and sold them at \$2.50. What per cent was lost?

4. I sold a barrel of apples for \$1.80, and lost 10%. What did the apples cost me?

5. If you buy an article for \$4, and sell it at \$5, what per cent will you make?

6. A man saves \$400 annually, which is $16\frac{2}{3}\%$ of his income. What is his income?

7. A man has an income of \$2,400, and spends \$2,000. What per cent of his income does he save?

8. A man's income is \$2,400, and he saves $16\frac{2}{3}$ of it. How much does he spend?

9. What per cent of 25 cents is $6\frac{1}{4}$ cents?

10. There were 36 pupils in a class. If $33\frac{1}{3}\%$ of them failed in a recitation, how many recited correctly?

11. How many seconds in 2 min. 15 sec.?

12. If school begins at 8.45 A.M., and closes at 11.45, how many minutes are there in the morning session?

13. How many square rods are there in a rectangular garden, which is 8 rd. long, and 5 rd. wide? What will it cost to fence this garden at \$1.25 a rod?

14. At \$2 a square rod, what is the above garden worth?

15. How many degrees in a circumference?

16. A man had \$180, and gave $\frac{2}{3}$ of it away, and lost $\frac{3}{7}$ of the remainder. How much had he then?

17. A boy bought 15 marbles, and lost 6 of them, and then lacked 6 of having 22 marbles. How many had he at first?

1. How many yards of carpet 27 in. wide will it require to cover the floor of a room 26 ft. long, and 11 ft. 3 in. wide. Find the cost at $2.25 a yard.

2. How many square feet of tin will cover a roof 16 ft. wide and 30 ft. long, allowing 5% for joints and waste?

3. How much will it cost, at 20¢ a square yard, to paint the convex surface of a conical spire whose slant height is 50 ft., the circumference of the base being 100 ft.?

4. At $27.50 per M., find the cost of 25 pieces of plank, each 24 ft. long, 9 in. wide, and 4 in. thick.

5. At 50¢ a load, find the cost of digging a cellar 31 ft. long, 12 ft. wide, and 6 ft. deep.

6. A stack of hay in the form of a cone is 12 ft. in diameter at the base, and the slant height is 19 ft. What is the convex surface?

7. A church spire is in the form of an octagonal pyramid, whose base measures 12 ft. on a side. The slant height is 75 ft. Find the cost of painting the outside at 20¢ a square yard.

8. A water-pipe measures 3 ft. in diameter and 18 ft. in length. How many gallons will it hold?

9. What is the volume of a prism whose base is a square, and altitude 24 ft. 6 in., each side of the base measuring 4 ft. 4 in.?

10. A house and lot were sold for $3,600, which was 20% more than they cost.

11. The sum of two numbers is 127⅞, and the less number is 49.125. Find the greater number.

12. If I charge 3½% for collecting $850, what amount must I pay over to my employer?

13. Find the interest of $5,000 for 5 yr. 5 mo. 5 da. at 5%.

14. Find the interest of $3,000 for 3 yr. 3 mo. 3 da. at 3%.

15. Find the cost of 96,000 sheets of paper @ $2.75 a ream, and 65 reams at 65¢ a quire.

1. What is the area of a circular garden whose circumference is 180 rd.?

2. Find the area of a trapezoid when the parallel sides are 120 in. and 96 in., and the altitude 86 in.

3. A and B together have 2,538 acres of land, and B has 5 times as much as A. How many acres has each?

4. A drover has 427 sheep and cows. If he has 125 more sheep than cows, how many has he of each?

5. If $13\frac{1}{2}$ bu. of corn cost $\$6\frac{1}{4}$, what will $16\frac{1}{2}$ bu. cost?

6. If 25 oxen eat the grass from 36 acres in a month, for how many oxen would 468 acres furnish feed for the same time?

7. Find the interest of \$23.75 for 6 yr. 7 mo. 21 da. at 5%.

8. How long must 3 piles of wood be to contain 27 cd., if each is $5\frac{1}{3}$ ft. high, and 4 ft. wide?

9. A can do a piece of work in 6 days, B in 8 days, and C in 12 days. In how many days can all do it together?

10. Divide .00017 by .034.

11. Add $9\frac{5}{8}$, .845, $7\frac{2}{3}$, $56\frac{4}{5}$, .$65\frac{1}{3}$, 59.34, $37\frac{3}{8}$.

12. Simplify $879+7\times(275\div5)-(432-275)\times4+43\times17$.

13. If $\frac{4}{5}$ of a certain number is greater than $\frac{1}{2}$ of it by 180, what is the number?

14. Reduce 1,345,165 seconds to higher denominations.

15. Find the cost of 2,400 qt. of onions at 18¢ a pk.; 3,200 qt. of milk @ 24¢ a gallon, and 4,200 qt. sirup @ 12¢ a pint.

16. Find the gain in buying 2,480 gal. of vinegar at 30¢ a gallon, and selling it at 9¢ a quart.

17. A man divided a field containing 16 acres into lots containing 40 square rods each. He sold the lots at \$175 each.

18. Find the cost of 17 bu. 5 qt. of oats at 2¢ a quart, and 7 lb. 2 oz. of spice at 15¢ an ounce.

19. A mill is worth \$9,900, a house \$3,000, and a farm $\frac{7}{12}$ of the difference between the value of the house and mill. Find the value of all.

1. A room that is 9 ft. high is 18 ft. 6 in. long, and 15 ft. 8 in. wide, except in one corner there is a jog outward 6 ft. 2 in. by 2 ft. 4 in. There are two doors, each $6\frac{1}{2}$ ft. by 4 ft., and four windows, each 5 ft. 6 in. by 4 ft. 3 in. Find the cost of plastering walls and ceiling at 8¢ a square yard. At $1.25 a yard find the cost of 32-inch carpeting laid lengthwise.

2. How many cords of wood can be piled in a building 8 ft. 6 in. long, 7 ft. wide, and 10 ft. high?

3. A rectangular field is 36 rd. long, 162 ft. wide. How much is it worth at $110 an acre? How many posts 9 ft. apart will be needed for a fence to inclose it? Three boards, 6 in. wide, are nailed to the posts. Find the cost of the lumber for the fence at $15 per M. A gravel walk runs round the field. Find its area if it is 6 ft. wide. Find the number of loads of loam needed to cover the rest of the field 6 in. deep?

4. How many bushels of potatoes at 75¢ a bushel will pay for 3 T. 1,500 lb. of coal at $6 a ton?

5. A man had 150 yd. of wire. He used at one time 10 yd. 1 ft. 9 in.; at another, 16 yd. 8 in.; at another, 18 yd. 2 ft. 7 in. How much wire had he left?

6. At $6 a barrel find the cost of 98 lb. of flour. Of 249 lb. Of 784 lb.

7. I had $60,000, and lost 16% in business. I took what I then had, and gained 18%. Did I then have more or less than $60,000?

8. Find the volume of a cylinder whose circumference is 15 ft., and altitude 27 ft.

9. What is the entire surface of a cone, the base of which is 4 ft. in diameter and the slant height 5 ft.?

10. The boundary line of Mr. B's farm is as follows: At A it runs east 80 rd.; thence, forming a right angle, south $\frac{1}{2}$ mile; thence west 60 rd.; thence in a straight line to A. How many acres are there in the farm?

1. A farmer delivered to a grocer: 15 bu. potatoes @ 75¢; ½ ton hay @ $16; 1 cd. wood, $4.75; 175 lb. butter @ 23¢; 115 doz. eggs @ 28¢. He carried away from the store 15 lb. coffee @ 31½¢; 18 lb. starch @ $.04; 1 box soap, $3.75; 48 lb. sugar @ 6¼¢; 9 lb. tea @ 65¢; 1 bbl. flour, $6.50. What is the balance? and in whose favor?

2. Add: 243 thousandths, 203 ten-thousandths, 546 millionths, 12 and 1,234 hundred-thousandths, 116 ten-millionths.

3. Divide 15.625 by 31¼.

4. Divide .08 by .0016. 670.08 by .016.

5. If ¾ of a yard of cloth cost $2.40, how many yards can be bought for $38.40?

6. What will 37 bbl. of flour cost at 3¾¢ a pound?

7. A man spent $6⅝ for a barrel of flour, $7¼ for sugar, $13⅘ for other groceries, and had $5⅜ left. How much had he at first?

8. My meat bill for the past two weeks was as follows: 4 lb. 8 oz. of steak @ 22¢; 2 lb. 9 oz. lamb chops @ 16¢; 1 lb. 4 oz. of sausages @ 20¢; 4 lb. 9 oz. beef @ 18¢; 8¼ lb. turkey @ 20¢. Find the amount of my bill.

9. At $9½ a barrel, how many pounds of flour can be bought for $3⅙?

10. If 2⅙ bu. of wheat cost $3½, how many bushels can you buy for $28.00?

11. If I pay $4⅗ for 5½ lb. of tea, what must I pay for 9⅞ lb. at the same rate?

12. A man's board costs him $10 a week. If he spends 12½% of his salary for other expenses, how much can he save from $1,200 in a year?

13. By selling beef at $21 a barrel, 16⅔% is gained. What is the cost of a pound of the beef?

14. Find the interest of $1,432.60 from March 10, 1896, to Aug. 5, 1899, at 7%.

ORAL.

1. Bought 40 sheep for \$160, and sold them at \$4.50 each. Find the gain on all.

2. A drover sold sheep at \$4 each, and received \$80 for them. How many more must he sell in order to sell 30 sheep?

3. A lady went to market with \$5, and bought 4 lb. of butter at 40¢, and 5 doz. eggs at 30¢. How much money did she take home with her?

4. If a boy had 48¢, and spent $\frac{4}{6}$ of it, how many cents had he left?

5. A man paid \$105 for a carriage, and $\frac{5}{7}$ as much for a sleigh. How much did both cost?

6. $\frac{6}{7}$ of 84 are how many times $\frac{3}{4}$ of 24?

7. $\frac{5}{8}$ of 63 are how many times $\frac{1}{7}$ of 49?

8. If $5\frac{1}{2}$ lb. of sugar cost 44 cents, how much do $2\frac{1}{2}$ lb. cost?

9. If $2\frac{1}{4}$ bu. cost \$8.10, what will 1 bu. cost?

10. I paid 30 cents for $2\frac{1}{7}$ yd. of gingham. What was the price of a yard?

11. What is the cost of 9 pairs of shoes at $\$3\frac{1}{3}$ a pair?

12. Reduce $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{5}$ to a common denominator.

13. Reduce $\frac{28}{40}$ and $\frac{35}{60}$ to lowest terms.

14. Dick gave $\frac{2}{5}$ of his money for peanuts, and $\frac{1}{3}$ for candy. What part of his money did he spend?

15. $\frac{1}{3}$ of a number increased by $\frac{1}{5}$ of it is 32. What is the number?

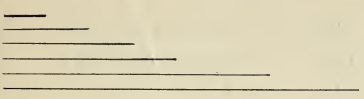
16. I spent $\$5\frac{3}{5}$ for dry goods, and $\$3\frac{1}{4}$ for groceries. How much money did I spend?

17. A man had 6 times $\$6\frac{1}{6}$, and needed \$8 more to buy a cow. Find the cost of the cow.

18. 4 times $2\frac{1}{3}$ miles is $\frac{1}{5}$ of the distance between two cities. How far apart are the cities?

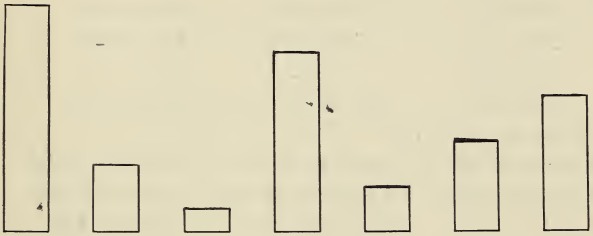
19. If a horse travels 7 miles an hour, how far will he travel in $4\frac{2}{3}$ hours?

RATIO.



1. How does a compare in length with b? What is the relation of b to a?

2. In the same way compare a with each of the other lines and each of the other lines with a.



3. Compare the area of each figure with each of the other figures.

4. Compare the volume of a 2-inch cube with that of an inch cube. With that of a 4-inch cube.

5. The comparison of one object or quantity with another object or quantity of the same kind is called ratio.

6. Ratio may be expressed in three ways:

1. By the sign of division, as $12 \div 4$.
2. By the colon, as $12 : 4$.
3. As a fraction, $\frac{12}{4}$.

7. Draw a line 2 inches long. How long will another line be if its ratio to the first line is 4? 6? $\frac{1}{4}$? $\frac{1}{2}$?

8. Three is the ratio of 6 to what? One-half is the ratio of 6 to what?

9. Draw an inch square. Draw an oblong 4 times as long and $\frac{1}{2}$ as wide. What is the ratio of the lengths? Of the widths? Of the areas?

RATIO.

1. What is the ratio of:

36 to 12?	12 to 4?	2 ft. to 4 in.?
49 to 7?	4 to 40?	$1\frac{1}{2}$ yd. to 6 in.?
72 to 8?	16 to 7?	1 lb. to 8 oz.?
42 to 6?	8 to 56?	\$4 to 50 cents?

2. What is the ratio of:

3 to 6?	4 to 20?	8 to 24?
2 to 4?	6 to 8?	12 to 60?
2 to 10?	3 to 12?	18 to 54?
6 to 30?	16 to 48?	36 to 48?

3. Find the ratio of:

1 da. to 2 hr.	4 mo. to 1 yr.	2 wk. to 2 da.
1 ft. to 1 yd.	2 min. to 30 sec.	1 pt. to 1 qt.
1 gal. to 2 qt.	4 oz. to 1 lb.	2 pk. to 1 bu.
$\frac{3}{8}$ to $\frac{3}{4}$.	$\frac{5}{6}$ to $\frac{2}{3}$.	$\frac{1}{6}$ to $\frac{1}{3}$.

4. Find the ratio of:

8.7 to 2.9.	.64 to .08.	$3\frac{1}{2}$ to $4\frac{2}{3}$.
6 mi. 15 rd. to 2 mi. 5 rd.		3 ft. 9 in. to 8 ft. 4 in.
5 lb. 4 oz. to 6 lb. 10 oz.		$2\frac{1}{5}$ to $3\frac{1}{2}$.

5. Find the ratio of:

1.25 : 37.5	$2\frac{1}{5} : 3\frac{1}{3}$	2 mi. : 640 ft.
6.25 : 2.5	$5\frac{3}{4} : 6\frac{1}{2}$	5 wk. : $4\frac{1}{2}$ da.
16.8 : 8.4	$8\frac{1}{3} : 1\frac{1}{2}$	5 tons : 500 lb.

6. Find the ratio of:

65 : 15	225 : 75	93 : 31.
25 : 625	275 : 550	48 : 72.
256 : 228	75 : 125	144 : 48.

7. Find the ratio of:

900 : 300	96 . 72	144 : 60
200 : 600	63 : 108	33 : 88
150 : 450	56 : 84	36 : 72
600 : 200	54 : 18	24 : 16

PROPORTION.

1. In every ratio the first term is called the antecedent, and the second term the consequent.

2. What is the ratio of 8 : 4? What is the ratio of 6 : 3?

These two ratios being equal may be written $8 : 4 = 6 : 3$. This is a proportion. Proportion is an equality of ratios. A proportion may be read in two ways: The ratio of 8 to 4 equals the ratio of 6 to 3, or 8 is to 4 as 6 is to 3.

3. In the proportion above, how many ratios are there? Name the antecedent of each ratio. Name the consequent of each ratio.

4. In every proportion the first and fourth terms are called extremes, the second and third means.

5. Name the extremes and means in the above proportion.

6. Multiply the extremes together; multiply the means together. What is true of your products?

7. Since this is true, if any three terms of a proportion are given, the other can be found.

8. In the proportion $x : 4 = 6 : 3$, we know that $3 \times x = 6 \times 4$. Hence, $3x = 24$. $x = 8$.

9. In the proportion $8 : x = 6 : 3$, we know that $8 \times 3 = x \times 6$. Hence $6x = 24$. $x = 4$.

10. In the proportion $8 : 4 = x : 3$, we know that $8 \times 3 = 4 \times x$. Hence $4x = 24$. $x = 6$.

11. In the proportion $8 : 4 = 6 : x$, we know that $8 \times x = 6 \times 4$. Hence $8x = 24$. $x = 3$.

Find the missing terms in the following proportions:

12.	$4 : 6 = 8 : x$.	$x : 8 = 10 : 40$.	$9 : x = 7 : 21$.
13.	$6 : 3 = x : 11$.	$8 : 4 = 12 : x$.	$x : 5 = 8 : 20$.
14.	$9 : 5 = x : 15$.	$8 : x = 6 : 12$.	$10 : 6 = 6 : x$.
15.	$140 : 8 = 70 : x$.	$8 : x = 5 : 120$.	$12 : x = 42 : 63$.
16.	$x : 8 = 7 : 3$.	$54 : 9 = x : 10$.	$63 : 7 = x : 5$.
17.	$35 : x = 21 : 3$.	$48 : x = 12 : 2$.	$36 : 6 = 24 : x$.
18.	$\frac{5}{6} : x = \frac{1}{3} : \frac{1}{5}$.	$x : \frac{3}{8} = \frac{1}{9} : \frac{1}{3}$.	$\frac{7}{8} : \frac{2}{7} = x : \frac{1}{4}$.

PROPORTION.

1. If 6 tons cost \$28, how many tons can be bought for \$84? In examples like the above we have two ratios. \$28 is to be compared with \$84. 6 tons is to be compared with x tons. These two ratios will be equal, for they bear the same relation to each other as cause to effect.

$$\$28 : \$84 = 6 \text{ tons} : x \text{ tons.}$$

$$\frac{\cancel{\$84}^{3} \times 6}{\cancel{\$28}} = 18 \text{ tons.}$$

Since we are seeking for tons, we place 6 tons in the third place, because the third and fourth terms form a ratio, and must be of the same kind.

We know that \$28 will buy 6 tons, then \$84 will buy *more* tons. This shows us that the consequent of our second ratio is more than its antecedent; therefore to have an equality of ratios, the consequent of our first ratio must be larger than its antecedent. Hence our ratio must be \$28 : \$84.

Cancelling, we have 18 tons.

2. If 6 men can build a wall in 24 days, how long will it take 18 men to build the same wall?

$$18 \text{ men} : 6 \text{ men} = 24 \text{ days} : x \text{ days.}$$

$$\frac{\cancel{6}^{1} \times \cancel{24}^{4}}{\cancel{18}_{3}} = 8. \quad \textit{Ans.}$$

Since we are seeking for days we place 24 days as our third term. Why? We know that 6 men can build a wall in 24 days; then 18 men can build it in less days. This shows us that our second consequent is less than its antecedent; hence to have an equality of ratios we must make our first consequent less than its antecedent, and our ratio must be 18 men to 6 men. Cancelling, we have 8 days.

NOTE. — The first example is an illustration of direct proportion, where *more* dollars will buy *more* tons. The second example is an illustration of an inverse ratio, where *more* men need *less* days.

3. If a man earns \$48 in 4 mo., how much will he earn in 9 mo.?

4. What will 6 tons of coal cost, if 9 tons cost \$54.

5. If 12 men can do a piece of work in 6 days, in how many days can 8 men do it?

6. If 60 bu. of wheat make 12 bbl. of flour, how many barrels of flour will 90 bu. of wheat make?

ORAL.

1. At 10¢ a half-pound, what must you pay for $2\frac{1}{4}$ lb. of honey?

2. What is 9% of $1,200?

3. A man sold a horse for $88, and gained 10%. What was the cost of the horse?

4. A carriage that cost $150 was sold for $120. What was the per cent of loss?

5. A merchant sold velvet at $4 a yard, and lost 20%. What was the cost?

6. How many quarter-inch squares can you place on a piece of paper 6 in. by 5 in.?

7. How many half-inch cubes will it take to make a pile 2 in. on every side?

8. What per cent of a yard is 2 ft.?

9. 32 is $\frac{8}{11}$ of how many times 6?

10. 49 is $\frac{7}{8}$ of how many times 10?

11. A boy had 12 chickens in one coop, and $\frac{3}{4}$ of the number in this coop is $\frac{1}{7}$ of the number in another coop. How many chickens are in the two coops?

12. If 4 men can do a piece of work in 3 days, in how many days can they do a piece of work 6 times as large?

13. $\frac{5}{8}$ of 32 are $\frac{2}{3}$ of what number?

14. Make an example to illustrate the combinations in Example 13.

15. Divide 15 apples between Richard and Henry so that Richard may have 3 apples more than Henry.

16. What number added to 3 times itself gives 32?

17. A and B have together 45 marbles, and A has $\frac{2}{3}$ as many as B. How many has each?

18. Mary and Nellie have 16 apples. Mary has $\frac{3}{5}$ as many as Nellie. How many have each?

19. Find the interest of $500 for 120 da.

Perform the examples in this lesson by Proportion and by Analysis.

1. If 45 sheep cost $265, what will 165 sheep cost?

2. If 35 acres of land cost $937.50, what will 175 acres cost?

3. If 240 acres of land cost $1,500, how many acres can be bought for $4,500?

4. If 15 yd. of cloth cost $24, what will 65 yd. cost?

5. If 24 bbl. of flour will last 160 men for 5 weeks, how many barrels will last 180 men the same time?

6. If 8 men can dig a ditch in 4 days, how long will it take 7 men to do it?

7. If 9 men can build a wall in 15 days, how long will it take 5 men to build it?

8. If 14 men can mow 25 acres of grass in a day, how many acres can 35 men mow?

9. If a staff 3 ft. high casts a shadow 5 ft. long, how long a shadow will be cast by a pole 120 ft. high at the same time?

10. If 12 lb. of sugar cost $2, what will 30 lb. cost at the same rate?

11. A family of 6 persons pays $21 a week for board; at this same rate what must a family of 8 persons pay?

12. A tree 18 ft. high casts a shadow 45 ft. long; how high must a steeple be to cast a shadow 135 ft.?

13. If 16 men can build a house in 24 days, how long will it take 12 men to build it?

14. If 24 men can build a house in 15 days, how many men can build it in 24 days?

15. If 12 tons of hay cost $264, what will 19 tons cost?

16. If a train travels 220 mi. in 8 hr., how long will it be in traveling 330 miles?

17. If 16 horses eat a ton of hay in 12 days, how many horses will eat a ton in 32 days?

PROPORTION, OR ANALYSIS.

1. If $\frac{5}{9}$ of a store is worth \$5,200, how much is $\frac{7}{8}$ of it worth?

$\frac{5}{9} : \frac{7}{8} = \$5{,}200 : \$x$

$$\frac{\$5{,}200 \times \frac{7}{8}}{\frac{5}{9}} = \frac{5{,}200 \times 7 \times 9}{8 \quad 5} = \$8{,}190$$

Arrange the ratios as in whole numbers. Arrange for cancellation as usual. \$5,200 multiplied by $\frac{7}{8}$ and divided by $\frac{5}{9}$ equals \$5,200 multiplied by $\frac{7}{8}$ and multiplied by $\frac{9}{5}$. This clears the work of fractions.

NOTE. — To arrange for cancellation, place fractions in the second or third term as for multiplication. Since we are to divide by the fraction in the first term, it will be the same to multiply by the same fraction inverted.

2. If it requires 42 yd. of carpeting $\frac{3}{4}$ yd. wide to cover a floor, how many yards $\frac{7}{8}$ yd. wide will cover the same floor?

3. If $6\frac{1}{2}$ cd. of wood cost \$$19\frac{1}{2}$, how many cords can be bought for \$78?

4. If $3\frac{1}{2}$ yd. of velvet cost \$$5\frac{1}{4}$, how much will $7\frac{1}{2}$ yd. cost?

5. If $4\frac{1}{2}$ lb. of butter cost \$1.35, what will $17\frac{1}{4}$ lb. cost?

6. If $\frac{7}{8}$ of a yard of silk cost \$2.10, what will $33\frac{1}{3}$ yd. cost?

7. If 9 weeks' board cost \$$94\frac{1}{2}$, what will 12 weeks' board cost?

8. If 7 men can lay 2 miles of water-pipe in 15 days, how many days will 48 men require?

9. If $\frac{7}{5}$ of a yard cost \$$1\frac{2}{5}$, what will $\frac{3}{4}$ of a yard cost?

10. If a loaf of bread weighs 8 oz. when flour is worth \$5 a barrel, what should it weigh when flour is worth \$6 a barrel?

11. If $2\frac{3}{4}$ yd. of cloth can be bought for \$3.10, what will $15\frac{7}{8}$ yd. cost?

12. If 25 men can do a piece of work in 12 days, in how many days can 10 men do the same work?

13. If a steeple 126 ft. high casts a shadow 93 ft. long, how long a shadow will a steeple 168 ft. high cast at the same time?

14. If a steeple 216 ft. high casts a shadow 162 ft. long, how long a shadow will be cast by a steeple 124 ft. high at the same time?

1. If a cubic foot of coal weighs 90 pounds, how high must a bin be made to hold 15 tons, if it is 10 ft. long and 4 ft. wide?

2. If a tank is 4 ft. long and 3 ft. wide, how deep is the water in it if it contains 200 gallons?

3. Find the cost of 1,860 ft. of lumber at $24.50 a thousand.

4. A house is 32 ft. 8 in. long. The rafters are 22 ft. long. How many shingles laid 4 inches to the weather will cover the roof?

5. A cylinder is 3 ft. 8 in. long, and has a diameter of $1\frac{1}{2}$ ft. How many gallons will it hold?

6. Find the feet of lumber in the following boards: 2 boards 18 ft. long, 8 in. wide, and 1 in. thick; 3 boards 16 ft. long, 9 in. wide, $\frac{3}{4}$ in. thick; 1 board 12 ft. 8 in. long, $8\frac{1}{4}$ in. wide, 1 in. thick; 2 planks 16 ft. long, 10 in. wide at one end, 8 in. wide at the other, and $1\frac{1}{8}$ in. thick.

NOTE. — Boards less than 1 in. in thickness are called 1 inch. Fractions of an inch in width are omitted, and the nearest integer taken. When the fraction is one-half the next integer is taken. When boards are not of uniform width, the average width is taken.

7. How many square feet in the surface of a spire which is in the form of an hexagonal pyramid, whose slant height is 80 ft., and each side of its base 12 ft.?

8. How many bushels of corn will a box contain which is 8 ft. long, 3 ft. wide, and 20 in. deep?

9. What will it cost, at 13¢ a square yard, to plaster the walls and ceiling of a room 16 ft. long, $15\frac{1}{2}$ ft. wide, and 9 ft. high, deducting 95 sq. ft. for openings?

10. A rectangular monument of granite is 3 ft. square at the base and 8 ft. high. How many cubic feet does it contain?

11. Find the interest on $1,643.74 for 1 yr. 7 mo. 24 da. at 8%.

12. At 19¢ a square yard, what will it cost to paint the outside and the inside of a cylindrical tank 9 ft. long and 6 ft. in diameter, no attention being paid to thickness of the material?

1. 10 hours counted as a day's work. Find weekly wages of each man.

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Wages per Day.
A	10	8	10	10	$8\frac{3}{4}$	$6\frac{1}{4}$	$2.25
B	8	$7\frac{1}{4}$	10	$6\frac{3}{4}$	10	10	2.50
C	8	10	7	10	$8\frac{1}{2}$	$3\frac{3}{4}$	2.25
D	$3\frac{1}{4}$	10	10	$6\frac{1}{4}$	10	10	2.00
E	10	10	10	$7\frac{1}{4}$	$5\frac{1}{2}$	10	1.75

2. One of the buildings at the World's Fair was 1,687 ft. long, and 787 feet wide. How many acres of ground did it cover?

3. A rectangular lawn measures 15 yd. 2 ft. in length, and 33 ft. 8 in. in width. At 18¢ a square yard, find the cost of sodding the lawn. Outside the lawn is a walk 3 ft. 8 in. wide. Find the square feet in it. At 16¢ a running foot, find the cost of a fence just outside of the walk.

4. A rectangular lot is 160 ft. long and one-half as wide. The posts are set 8 ft. apart. The scantling is 4 in. by 3 in. The pickets are 2 in. wide and placed 2 in. apart. Find the cost of the fence, if pickets are $27.50 a hundred, posts 25¢ each, and scantlings $18 per M.

5. A rectangular piece of land contains 180 square rods. What different lengths and breadths might it have, not including fractions of a foot?

6. Find the area of a rectangle 24 ft. 6 in. by 15 ft. 8 in.

7. Find the area of a triangle $6\frac{2}{3}$ yd. long, with an altitude of 8 ft. 4 inches.

8. A rectangular field contains 16 square rods and is 90 ft. long. How wide is it?

9. An agent collected $498.75 at $4\frac{1}{2}\%$ commission. What was his commission?

ORAL.

1. Buy oranges at 15¢ a dozen, and sell them at 2 for 5 cents, and tell me your gain per cent.

2. Buy a horse for $300, and sell it for $360, and tell me your gain per cent.

3. A boy bought some marbles for 12 cents, and sold them for 15 cents. Find the gain per cent.

4. A merchant bought muslin at 10¢ a yard, and sold it at a gain of 20%. Find his gain on 25 yards.

5. Eggs cost me 20 cents a dozen, but in selling them I gained 25%. How many dozen eggs must I sell in order to receive $1.00?

6. $7 is $16\frac{2}{3}\%$ more than what?

7. A farmer had 50 sheep, and bought 20% more. How many had he then?

8. If $\frac{5}{7}$ of an acre of land is worth $60, how much is $\frac{3}{4}$ of an acre worth?

9. If a boy lost $\frac{3}{5}$ of his money, and had 8 cents left, how much had he at first?

10. A boy lost $\frac{1}{5}$ of his marbles and sold $\frac{1}{3}$ of them, and then had 21 left. How many had he at first?

11. If $\frac{6}{7}$ of a yard of cloth cost 30 cents, how much will $\frac{3}{5}$ of a yard cost?

12. If 5 yd. of cloth are worth 80 cents, how much is $\frac{5}{8}$ of a yard worth?

13. $30 is $\frac{6}{7}$ of the cost of a cow. Find the cost of two cows at the same rate.

14. If 3 bu. of corn cost $3\frac{3}{4}$, how many bushels can I buy for $2.50?

15. If a yard of cloth cost $\$\frac{5}{8}$, how many yards can be bought for $10?

16. A man exchanged 5 sheep at $9 each, and 2 cows at $30 each, for pigs at $5 each. How many pigs did he get?

1. Find the volume of a cone whose base is 32 in. in diameter, and altitude 3 ft.

2. Find the entire surface of a rectangular prism whose altitude is 12 ft., and base 18 in. by 14 in.

3. The area of a rhombus is 720 sq. in.; its altitude is 24 in. Find its length.

4. The area of a triangle is 7 sq. yd., the altitude is 21 ft. What is the base?

5. If a man travels 768 miles in 4 days, how far will he travel in 65 days at the same rate?

6. If 12 men build a wall in 8 days, how long will it take 16 men?

7. Cost, \$75; selling-price, \$95; find the rate per cent of gain.

8. Find the amount of \$953 from Aug. 9, 1898, to April 1, 1899, at 5%.

9. A merchant insured his store for \$7,200, at $2\frac{1}{2}\%$ a year for 3 yr. How much did he pay for his insurance?

10. A collector received \$121.40 for collecting a debt at 5%. What was the amount of the debt?

11. By selling flour at \$6.16 a barrel, a merchant lost 22%. What was his loss on 465 barrels?

12. Selling-price, \$162.50; profit, 30%. Find the gain.

13. A boy earned \$8.40, which is 15% of what he had before. How much has he now?

14. A man lost \$1,770 out of a business of \$2,950. What per cent did he lose?

15. If $83\frac{1}{4}\%$ of a debt of \$8,400 has been paid, how much remains unpaid?

16. Find $\frac{3}{4}\%$ of 1,050.

17. At \$1.40 a yard, find the cost of carpeting a room 21 ft. by 16 ft. with carpet $\frac{3}{4}$ yd. wide. The breadths run crosswise, and there is a loss on each breadth of 1 ft. for matching.

1. Find:

$\frac{7}{8}$ of 214	$\frac{11}{16}$ of 409	$\frac{8}{21}$ of 718	$14\frac{1}{3} \times 9\frac{1}{8}$
$\frac{6}{7}\frac{4}{5}$ of 100	$\frac{2}{3}\frac{6}{7}$ of 460	$\frac{1}{4}\frac{9}{2}$ of 5,208	$62\frac{5}{7} \times 21\frac{3}{4}$
$\frac{4}{2}\frac{}{5}$ of 605	$\frac{7}{1}\frac{}{2}$ of 416	$\frac{8}{9}$ of 1,000	$69\frac{1}{11} \times 6\frac{3}{7}$

2. Divide:

$16\frac{7}{8}$ by $2\frac{1}{2}$	$6\frac{7}{24}$ by $17\frac{1}{2}$	$21\frac{3}{4}$ by $9\frac{1}{2}$
$4\frac{3}{8}$ by $15\frac{1}{4}$	$42\frac{7}{16}$ by $4\frac{1}{2}$	$436\frac{1}{4}$ by $7\frac{3}{4}$
$17\frac{1}{3}$ by $3\frac{1}{4}$	$62\frac{5}{8}$ by $4\frac{1}{3}$	$80\frac{2}{5}$ by $14\frac{3}{5}$

3. What part of an acre in a piece of land in the form of a trapezoid 10 rd. long, 7 rd. wide at one end, and 5 rd. wide at the other?

4. How many square feet of canvas will cover a conical tent, the diameter of the base being 28 ft. and the slant height 15 ft.?

5. It is 75 ft. in a straight line across a circular pond. How far must I walk to reach the point opposite me?

6. The area of a parallelogram is 300 sq. yd. The distance between its parallel sides is 50 ft., what is the base?

7. If 112 men can do a piece of work in $10\frac{1}{2}$ days, how many men can do it in 12 days?

8. If my goods are worth \$3,500, and I insure them at $\frac{3}{4}$ their value, at $1\frac{1}{4}\%$, what premium must I pay?

9. I built a house, costing \$3,500, on a lot which cost \$600. The house being burned, the insurance company paid me 80% of the cost of the house. I then sold the land at an advance of 80%. Did I gain or lose? and how much?

10. A cow is sold at 10% below cost, and brings \$54. Find the cost.

11. Some 4-foot wood is piled 6 ft. high. How long must the pile be to make 24 cords?

12. If a schoolroom is 32 ft. long, 28 ft. wide, and 14 ft. high, and is occupied by 25 pupils, in what time will they spoil the air in the room, each pupil spoiling 4 cu. ft. in a minute?

REVIEW OF PERCENTAGE.

1. A merchant sold goods which cost him $4,768.75 at a profit of 18%.

2. A man raised 1,640 bu. of grain, and sold 246 bu. What per cent did he sell?

3. A teacher's salary, having been decreased 33⅓%, is now $1,200. What was it at first?

4. A grocer bought $400 worth of oranges. 25% spoiled before he sold them. The remainder he sold at 16⅔% above cost. Did he gain or lose? and how much?

5. A farm which cost $3,400 was sold at a gain of 22%.

6. By selling hay at $15 a ton a dealer loses 10%. Find the cost.

7. What is the commission, at 3½%, on the sale of $4,769 worth of goods?

8. An agent sells 276 bbl. of flour at $6.50 a barrel. His commission was 2½%. How much money should he return to me?

9. A ship was valued at $72,000, and insured for ¾ of its value at 2½%. Find the premium.

10. A man bought 6,200 bu. of grain at $1.50 a bushel. He sold 20% of it at a 5% loss, 40% of it at a 10% gain, and the remainder at cost. What was gained on the whole?

11. Find the cost when $17.25 is the loss from selling an article at 15% below cost.

12. Find the interest on $1,500 for 1 yr. 3 mo. 27 da. at 9%.

13. Find the amount of $960 for 3 yr. 7 mo. 9 da. at 5%.

14. A farmer raised 2,480 bu. of grain. 36% of it was rye, 24% of it oats, and the rest corn. How many bushels of each kind of grain did he raise?

15. A man bought 120 acres of land at $60 an acre, and paid 25% of the cost of the land for repairs and building. For how much must he sell to gain $2,000?

REVIEW OF FRACTIONS.

1. What are the prime factors of 5,075?

2. Reduce $\frac{2}{1}\frac{0}{3}\frac{8}{9}\frac{8}{2}$ to lowest terms.

3. When $17\frac{5}{6}$ lb. cost \$11½, how many pounds can be bought for \$5¾?

4. What will 94⅓ yd. of cloth cost, if 165⅓ yd. cost \$94?

5. If a boat sails 254 miles in $19\frac{3}{5}$ hours, what is the rate an hour?

6. What will 117½ yd. of cloth cost, if $378\frac{3}{4}$ yd. cost \$1,515?

7. What will 143½ bu. of apples cost, if $584\frac{4}{9}$ bu. cost \$1,022⅞?

8. A owns $\frac{4}{7}$ of a store, and B the remainder. If A owns \$465 more than B, what is the value of the store and of each one's share?

9. How many marbles have two boys, when one owns $\frac{5}{8}$ of all, and has 60 marbles more than the other?

10. Eight-elevenths of 2,728 is $\frac{3}{3}\frac{1}{3}$ of what number?

11. A man gave 180 acres to his son, and had $\frac{2}{5}$ of his farm left. What is the value of the remainder at \$39½ an acre?

12. An estate was divided between two persons, so that A received $\frac{2}{4}\frac{9}{1}$ of the whole, and B the remainder, or \$6,400. Find the value of the whole estate.

13. An estate was divided among 3 children, so that one received $\frac{2}{7}$ of it, the second $\frac{2}{5}$ of it, and the third \$4,840. Find the value of the estate.

14. How much more is $4\frac{1}{2}$ times $9\frac{3}{7}$ than $2\frac{1}{7}$ times $5\frac{5}{8}$?

15. A owns $\frac{2}{7}$ of a store, B $\frac{2}{9}$ of it, and C the remainder, or \$31,000. What is the value of the store?

16. A room is 15 ft. by 20 ft., with walls 12 ft. high. Find how many square feet there are in the walls and ceiling. If there are 3 windows $2\frac{1}{2}$ ft. by 6 ft., and 2 doors $3\frac{1}{2}$ ft. by 8 ft., find how many square feet there are in the doors and windows. Find how many square feet there are in the walls and ceiling, after taking out the doors and windows.

ORAL.

1. If 4 men can do a piece of work in 6 days, how long will it take 12 men to do the same work?

2. If 8 men can do some work in 5 days, how long will it take 4 men to do it?

3. If $\frac{2}{3}$ of a man's age is 18 years, how old is he?

4. If $\frac{3}{4}$ of a ton of coal is worth $\$3\frac{3}{4}$, how much are $3\frac{1}{3}$ tons worth?

5. A boy spent $\frac{1}{2}$ of his money, then earned $\frac{1}{3}$ as much as he spent, and had \$20. How much had he at first?

6. Five-sixths of 60 is $\frac{2}{3}$ of how many times 5?

7. A farmer sold a cow worth \$45 at a loss of 10%. What did he receive for her?

8. Three-fifths of 80 is what per cent of $\frac{1}{2}$ of 120?

9. A butcher buys pork at 6¢ a pound, and sells it at 10¢ a pound. What is his gain per cent?

10. One-fourth of 80 is how many times 5?

11. Seventy is $\frac{7}{5}$ of how many times 5?

12. A farm was sold for \$1,800, which was $\frac{6}{7}$ of its cost. What was the loss?

13. Goods bought for \$120 must be sold for what price to gain $33\frac{1}{3}\%$?

14. From what number must $\frac{2}{5}$ of 20 be taken 3 times to leave 3?

15. Twenty-four is 60% of what number?

16. A can do a piece of work in 4 days; B can do it in 5 days. In what time can A and B do it if they work together?

17. A rectangular field contains 1 acre, and is 40 rd. long. What is its perimeter?

18. A man spent $16\frac{2}{3}\%$ of his month's salary. If he spent \$15, what was his month's salary?

19. The selling-price of a cow is \$60, the gain is 25%. What two things can be found? Find them.

1. What is the area of a circle whose radius is 50 yd.?

2. In how many days can 20 men do 4 times as much work as 15 men can do in 16 days?

3. If .8 of a piece of land is worth $6,800, how much is $\frac{11}{17}$ of it worth?

4. Find the interest of $285 from Nov. 29, 1896, to April 1, 1898, at 8%.

5. Find the cost of a man's house, who lost $631.80, by selling it at 86½% of the cost.

6. Find the gain per cent when $900 is the gain and $6,300 is the cost.

7. A man bought a watch for $80, which was 66⅔% less than 6 times the sum paid for a chain. Find the cost of the chain.

8. If an agent's commission is 5%, and he receives as his commission $143.80, what is the amount of the sale?

9. An agent sold some flour for $8,420, and sent his employers $7,999. How much did he keep as his commission? What per cent did he keep?

10. Find the cost of plastering a room 25 ft. long, 18 ft. wide, and 13 ft. high, at $.35 a square yard, deducting $\frac{1}{10}$ of walls for openings.

11. Add: 125 rd. 4 yd. 9 in.; 46 rd. 5 ft. 4 yd. 10 in.; 160 rd. 2 ft.

12. If 5 is subtracted from both terms of the fraction $\frac{12}{13}$, how much is the fraction increased or diminished?

13. At $26.50 per M., find the cost of 190 boards, 12 ft. long, 8 in. wide, and ⅜ in. thick.

14. If ⅞ of a pound of tea cost 63 cents, what will 132½ lb. cost?

15. If 7⅔ doz. eggs are worth as much as 5¾ lb. of butter, how many pounds of butter can be bought with 17¼ doz. eggs?

16. Reduce 126,784 sq. in. to higher denominations.

1. If $\frac{2}{7}$ of a yard of cloth cost \$1.20, what will $4\frac{3}{7}$ yd. cost?

2. If \$2.80 will buy $\frac{1}{8}$ of a ton of coal, how much coal can you buy for \$1.60?

3. If $\frac{1}{2}$ yd. of cloth cost $\$3\frac{1}{2}$, what will $1\frac{3}{7}$ yd. cost?

4. A grocer bought flour at \$5.04 a barrel, and sold it at a gain of $14\frac{2}{7}\%$. How much did he gain on 125 barrels?

5. How much will a grocer receive for 88 lb. of butter, if by selling it at a profit of 20% he makes 6¢ on a pound?

6. Mr. Smith borrowed \$425.80 for 2 yr. 4 mo. 18 da. at 7% per annum.

7. May 1, 1897, I borrowed \$364, and Feb. 7, 1899, I paid it back with interest at 6%. How much did I pay?

8. Find the number of square feet of blackboard in your room.

9. The carpet \$1.25 a yard, and 27 in. wide; the room 15 ft. 9 in. by 12 ft. 6 in. The breadths run crosswise. Find the cost.

10. At 5¢ a square foot, find the cost of covering the rolling (convex) surface of a roller $7\frac{1}{2}$ ft. long and $4\frac{1}{2}$ ft. in diameter.

11. A house is 42 ft. long, 28 ft. wide, with 18 ft. posts. Each gable is 15 ft. high. Find cost of painting the house at \$7.25 a square (100 square feet).

12. Find the total cost of 42 boards 12 ft. long, 9 in. wide, at \$22.50 per M., 24 planks, 14 ft. long, 6 in. wide, 3 in. thick, at \$14.25 per M.

13. How many bushels of shelled corn will a box hold which is 6 ft. by 5 ft. by 4 ft.?

14. How many bricks will a contractor estimate for a house 40 ft. long, 32 ft. wide, and 25 ft. high, the walls to be 1 ft. thick?

15. Find the cost of digging a cellar 48 ft. long, 24 ft. wide, and $6\frac{1}{2}$ ft. deep at $37\frac{1}{2}$¢ a cubic yard.

16. Reduce 5 gal. 2 qt. 1 pt. to pints.

1. Reduce 948,741 min. to higher denominations.

2. Reduce 12 sq. rd. 2 sq. yd. 15 sq. ft. 19 sq. in. to square inches.

3. After buying $3\frac{1}{4}$ lb. of butter at 28¢, $13\frac{1}{2}$ lb. of sugar at 7¢, and $1\frac{1}{2}$ lb. of coffee at 35¢, how much money do you have left, if you had $\$5\frac{3}{4}$ at first?

4. Find the least common multiple of 14, 35, 343.

5. An agent's commission is \$315 for selling property valued at \$9,000. What is the rate per cent of the commission?

6. A man takes 3 glasses of beer, at 5¢ a glass, every day for 15 years. How much money could he have saved toward a house if he had not drunk?

7. How many cubic feet in a bin that will hold 372 bu. of wheat?

8. Find the number of bushels in a bin 8 ft. long, $6\frac{3}{4}$ ft. wide, and $4\frac{1}{2}$ ft. high.

9. How many thousand shingles, laid 4 in. to the weather, will be required to cover the roof of a house 44 ft. long, if the rafters on each side are 24 ft. long?

10. How many boards 12 ft. long will be required to inclose a square field, 48 rd. on a side, with a fence 5 boards high?

11. Find the interest on \$575.87 for 1 yr. 11 mo. 15 da. at 5%.

12. How much does 5% of \$1,500 exceed $\frac{1}{2}$% of \$7,000?

13. Property worth \$15,000 is insured for $\frac{2}{3}$ of its value at $1\frac{1}{2}$%. Find the premium paid.

14. Find the commission that an agent will receive for selling 125 bbl. of flour, worth \$6 a barrel, at 5% commission.

15. If velvet is sold for \$3.75 at a gain of 25%, what is its cost?

16. A merchant sold \$9,800 worth more of goods this year than last. His sales have increased 14%. What were his sales last year?

1. The difference between two numbers is 2,001,005; the larger number is 89,009,089. Find the smaller.

2. At $5.75 a barrel, how many barrels of flour can be bought for $1,161.50?

3. The quotient is 4,769. What will the quotient be if the dividend is multiplied by 9?

4. The quotient is 4,664. What will the quotient be if the divisor is multiplied by 8?

5. The quotient is 805. What will the quotient be if the divisor is $\frac{1}{6}$ of what it is now?

6. The quotient is 909. What will the quotient be if both dividend and divisor are multiplied by 15?

7. The quotient is 478. What will the quotient be if both divisor and dividend are divided by 12?

8. If the divisor were 8 times as large as it is, the quotient would be 489. What is the quotient?

9. What number must be taken from 7,684 that it may be exactly divisible by 33?

10. A book agent bought 112 books at $3.20 each. He sold them at $4.90 each. If his expenses were $75, and he could not collect the money for 4 books, how much did he gain or lose?

11. If 37 is added 99 times to itself, the result will be how much less than 3,750?

12. If 37 be added to a certain number, 85 can be subtracted from it 113 times. Find the number.

13. Of what number is 463 both divisor and quotient?

14. If 593 is subtracted 347 times from a certain number, the remainder is 287. Find the number.

15. A house and lot cost $9,600. The house cost 5 times as much as the lot. Find the cost of each.

16. How much will a dealer gain by buying 2,464 bu. of potatoes at $87\frac{1}{2}$¢ a bushel, and selling them at $\$1.12\frac{1}{2}$ a bushel?

ORAL.

1. For how much must silk that cost $1.20 a yard be sold to gain 20%?

2. A dealer bought cloth at $4 a yard, and sold it at $6 a yard. What per cent of profit did he make?

3. A grocer bought flour at a profit of $1.20 a barrel, which was a gain of 25%. What was the cost a barrel?

4. What per cent was lost on a horse which cost $90 and was sold for $75?

5. When a hat was sold for $2 there was a gain of $33\frac{1}{3}\%$. What was the cost?

6. A mowing-machine was sold for $36 at a loss of 25%.

7. A house was sold for $1,500 at a gain of 25%.

8. A house was sold for $1,800 at a loss of 25%.

9. A cow that cost $45 was sold for $40.

10. When goods are sold for $\frac{3}{5}$ of their cost what per cent is lost?

11. When $\frac{4}{5}$ of an article is sold for what the whole article cost, what per cent is gained?

12. A grocer sold a pound of butter for 24 cents, by which he gained 20% on its cost. What would have been his gain had he sold it at 30 cents a pound?

13. Mr. Smith sold a city lot for $700, losing $100. What per cent did he lose?

14. A gain of $5 on goods that sold for $25 is a gain of what per cent?

15. How shall I mark cloth that cost 12¢ a yard to make 25%?

16. What per cent of an acre is a rectangular lot 4 rd. by 5 rd.?

17. If one-fourth yard of cotton cloth cost one and one-half cents, what will 12 yards cost?

18. At 20¢ a yard what will 42 ft. of ribbon cost?

1. What is the convex surface of a cone whose base is 10 in. in diameter, and whose slant height is 12 in.?

2. The base of a pyramid is 15 in. square, and its altitude 18 in., and the base of a cone is 15 in. in diameter, and its altitude 18 in. What is the difference in their volume?

3. From $17\frac{1}{2}$ take $\frac{3}{5}$ of $6\frac{1}{4}$, and multiply the remainder by $\frac{1}{5}$ of $3\frac{1}{3}$.

4. By what number must $8\frac{1}{16}$ be multiplied that the product may be 3?

5. A tract of land is 4 m. long, and $2\frac{1}{4}$ m. wide. How many sections does it contain? How many acres?

6. An octavo book contains 320 pages. How many reams of paper will it take to print an edition of 1,500 copies?

7. A man sold a piece of cloth for $24, and thereby lost 25%.

8. If $\frac{5}{8}$ of a farm is worth $4,500, what is $\frac{3}{4}$ of it worth?

9. If $6\frac{1}{4}$ tons of hay cost $117.50, how many tons can be bought for $169.20?

10. A and B together own 824 sheep, and A has $1\frac{2}{3}$ times as many as B. How many has each?

11. Find the cost of 7,486 lb. of coal at $5.65 a ton.

12. If $\frac{5}{7}$ of a pound of tea costs 50 cents, what will $16\frac{2}{3}$ lb. cost?

13. Divide .012261 by 2.01.

14. Thomas sold his knife to George for $\frac{1}{3}$ more than it cost him. George sold it to Harry for 36 cents, which was $\frac{1}{4}$ less than it cost him. What did it cost Thomas?

15. Rewrite the fourteenth example as it would appear in percentage.

16. Rewrite it again as it would be written as an example in decimal fractions.

17. Find the cost of 8,798 ft. of lumber at $1.47 per C.

18. A commission merchant sold 540 bbl. of flour at $6.37\frac{1}{2}$ a barrel. Find his commission at 3%.

1. A rectangular piece of paper containing 6 sq. ft. is 9 in. wide. How long is it?

2. If a cubical pile of wood measures 20 ft. each way, how many cords of wood are there?

3. If you buy oranges at the rate of 4 for 2 cents, and sell them at the rate of 3 for 5 cents, how many oranges will you need to sell to earn $2.17?

4. Reduce 946 A. to lower denominations.

5. A house and lot cost $9,800. If the house cost $3\frac{2}{3}$ times as much as the lot, find the cost of each.

6. Reduce 468,349 in. to higher denominations.

7. A farmer received $198 for some apples and potatoes. He sold 36 bbl. of apples at $2.50 a barrel, and received 75¢ a bushel for his potatoes.

8. Change .048 to a common fraction in its lowest term.

9. Find the difference between .23 and .00728.

10. How many 3-inch cubes can be made from a stick of timber 18 ft. long, 9 in. wide, and 6 in. thick?

11. A man spent $\frac{2}{3}$ and $\frac{1}{4}$ of his money, and had $12.45 left. How much did he spend?

12. A cellar wall measures 28 ft. by 22 ft. on the outside. It is 6 ft. high and 15 in. thick. How many bricks will a contractor estimate for this wall?

13. A park is 52 rd. long and 28 rd. wide. How many times must a man walk round it to travel 50 miles?

14. If a farmer had 320 sheep, and sold 32 of them, what per cent of his sheep did he sell?

15. What sum of money less 7% of itself is $483.60?

16. $5,280 are $66\frac{2}{3}$% of how many dollars?

17. There are 5,220 pupils in school. This is 36% of the entire population. What is the population?

18. A store was sold for $6,390, which was $12\frac{1}{2}$% more than it cost.

1. Multiply .0076 by 2.04. .0064 by 2.004.

2. Divide 670.08 by .016.

3. What will 1,200 lb. of hay cost at $18.50 per ton?

4. At 64¢ a bushel, what will 300 lb. of oats cost?

5. If you should buy a barrel of flour for $6.50, and retail it at 5½ cents a pound, how much would you gain?

6. A man bought 4 bu. of chestnuts, paying at the rate of 5¢ a quart, and retailed them so as to gain $3.84 on the whole. What was his selling-price a quart?

7. Find the area and perimeter of a hall 7½ ft. wide and 18⅓ ft. long.

8. If you take 67¾ lb. of pork from a barrel that is ¾ full, how many pounds will be left in the barrel?

9. A farmer exchanged 19⅓ tons of straw at $15½ a ton, for cloth at ¾ of a dollar a yard. How many yards did he receive?

10. Find the cost of 13⅔ bbl. of flour, when ⅔ of a barrel cost $1⅗.

11. At $15¾ a ton, find the cost of ⅔ of 3⅗ tons.

12. When ¾ of a ton of hay costs $9¾, what will 7⅔ tons cost?

13. I borrowed $350, at 6% interest, Oct. 10, 1897. How much shall I owe Jan. 1, 1899?

14. I borrowed $500 from a friend, promising to pay 6 cents a year for every dollar I borrowed. If I kept his money 3 yr. 3 mo., how much must I pay for the use of it?

15. What is the interest of $900 for 2 yr. 3 mo. at 8%?

16. What will it cost to pave a street one mile long and 100 ft. wide, at 65¢ a square foot?

17. A owns 45% of a factory worth $48,000, B owns 36½% of it, and C owns the remainder. What is the value of each of their shares?

18. If a horse is tied to a stake in an open field by a rope 39 ft. long, over how much surface can the horse graze if he can reach 1 ft. beyond the end of the rope?

1. If $\frac{9}{16}$ of a store are worth \$631.80, what are $\frac{5}{16}$ of it worth?

2. Find the cost of 1 ton of coal when I sell 2 tons for \$14.40, and gain 20%.

3. How many more half-inch cubes than inch cubes will it take to fill a box 9 in. long, 6 in. wide, and 4 in. high?

4. If 5 men can do a piece of work in 14 hours, how many hours will it take if 2 more men are employed?

5. Find the amount of \$489.36 from Jan. 1 to Nov. 18, 1899, at 7%.

6. If a bird can fly $9\frac{1}{4}$ miles in $\frac{1}{3}$ of an hour, how far can it fly in $1\frac{1}{2}$ hours?

7. If a reservoir is 30 ft. 6 in. long, and 20 ft. 6 in. wide, how many cubic feet of water must be removed to lower the water $1\frac{1}{2}$ ft.?

8. Acting as agent, I receive \$6.80 for collecting a bill. If I retain 8%, how much do I collect?

9. A man sold 9,000 bbl. of flour at \$6 a barrel, and lost 10%?

10. What will 12,784 lb. of hay cost at \$13.50 a ton?

11. What will be the cost of laying a pavement 45 ft. long and $8\frac{1}{2}$ ft. wide, at 55¢ a square yard?

12. If A can do a piece of work in 7 days which A and B can do in 5 days, in how many days can B do the work?

13. One merchant sold some cloth for \$3,120, and gained 20%. Another merchant paid the same price, but sold it at a loss of 15%. What was his selling-price?

14. Find the cost of 3 doz. eggs @ 15¢, 7 lb. butter @ 23¢, 47 yd. cotton @ 12¢, 8 lb. coffee @ 32¢. Make out a correct bill, supplying names.

15. Find the amount of \$161.60 for 2 yr. 9 mo. 3 da. at $4\frac{1}{2}$%.

16. A boy paid \$1.60 for 40 qt. of chestnuts, and sold them at a profit of 75%. How much did he receive a quart?

ORAL.

1. What is the loss per cent on goods costing 15¢ a yard, if sold at 12¢?

2. What per cent of a score is a dozen?

3. What per cent of an acre is a lot that is 5 rd. by 16 rd.?

4. If 3.5 acres of land cost $35, what will a farm of 40 acres cost?

5. A farmer sold a calf for $4, and lost 30%. What did it cost?

6. A boy earned $20, which was 20% of what he had before. How much has he now?

7. A man sold a wagon for $15 less than it cost him, and lost 20%. What did the wagon cost?

8. An article that cost $4.50 was sold for $6. What was the gain per cent?

9. An article sold for $32 at a loss of 20%. What was the first cost?

10. A man gained 12½% by selling a wagon for $8 more than it cost him. What did it cost?

11. Find the cost of a hat that was sold for $1.60 at a loss of 20%.

12. By selling a watch for $60 I gained 20%. Find its cost.

13. Flour sold at $6 a barrel yields a profit of 20%. Find the cost of 10 barrels.

14. Sold a cow for $5 less than cost, and lost 12½%. Find the cost and selling-price.

15. I sold a harness for $48, which was 20% below cost. What did it cost?

16. An article that cost $40 was sold for $50. What was the gain per cent?

17. If a merchant buys shoes at $5 a pair, at what price must he sell them to gain 25%?

18. How much will a 40 qt. can of milk cost at 24¢ a gallon?

1. A man owned a farm of 115 A., valued at $82.50 an acre. He exchanged it for another farm, valued at $75 an acre. How many acres did he get?

2. Multiply 60.325 by 7.0034, and divide the product by 3.01625.

3. A man bought 100⅜ acres in one farm and 87 A. 80 sq. rd. in another. He sold 62⅛ acres. How much had he remaining?

4. At $1.20 a bushel, find the cost of 12 bu. 3 pk. 1 qt. of beans.

5. I sold two horses at $125 each. On the first I lost 16⅔%, and on the second I gained 25%. Find gain or loss.

6. I bought two horses at $125 each. In selling I lost 16⅔% on the first, and gained 25% on the second. How much did I gain or lose?

7. How many rolls of paper 8 yd. long and ½ yd. wide will it take to paper a room 24 ft. long, 18 ft. wide, and 10 ft. high?

8. How many cubic feet of air in the room mentioned in Example 7?

9. At $1.25 a cord, find the cost of sawing a pile of wood 60 ft. long, 4 ft. wide, and 6 ft. high.

10. A rectangular garden is 120 ft. long and 40 ft. wide. A path 3 ft. from the fence and 2 ft. wide runs round the whole garden. How many square feet does the path contain?

11. What is the interest of $650.30 for 6 yr. 3 mo. at 8%?

12. I paid $78.75 to insure my store for $4,500. What was the rate?

13. A man paid me $65 for collecting a bill. If he paid me 2½% of all I collected, what did I collect?

14. Divide 234.61875 by 16⅛.

15. What is the cost of 6,340 lb. of coal at $6.25 a ton?

16. What is the volume of a triangular prism, having a height of 9 ft. and a base area of 18 square feet?

1. A miller ground $98\frac{1}{4}$ bu. of corn one day, $87\frac{9}{24}$ the next, $75\frac{3}{8}$ the next, and $87\frac{5}{16}$ the next. How many bushels did he grind in these 4 days?

2. At $\$17\frac{1}{2}$ a barrel, how much sugar can I buy for \$420?

3. If $\frac{4}{7}$ of a barrel of sugar cost \$12, what will $15\frac{1}{2}$ bbl. cost?

4. A man owned $\frac{2}{3}$ of a mill, and sold $\frac{4}{5}$ of his share for \$26,320. Find the value of the whole mill.

5. If $\frac{5}{8}$ of $3\frac{3}{7}$ qt. of berries cost $\frac{1}{13}$ of $\$9\frac{3}{4}$, how much is that a quart?

6. Find the circumference of a circle whose diameter is 75 feet.

7. How much land is inclosed by a circular race-track $\frac{7}{8}$ mi. in circumference?

8. An octagonal spire whose slant height is 28 ft. is 3 ft. 6 in. on each side at the base. Find the convex surface.

9. How many acres in a rectangular field 65 rd. long and 48 rd. wide?

10. At \$75 an acre, what is the value of a field, one of whose parallel sides is 40 rd., the other 120 rd., and the perpendicular distance between them 72 rd.?

11. If 640 qt. of milk produce 96 lb. of butter, how much milk will be required to produce 50 lb.?

12. If a train travels 260 mi. in 8 hr., how far will it travel in 6 hr. 30 min.?

13. My mill is valued at \$90,000. If I pay $2\frac{1}{4}\%$ on $\frac{3}{4}$ of its value for insurance, what premium must I pay?

14. How many board feet in 12 planks 21 ft. long, 18 in. wide, and $2\frac{1}{2}$ inches thick?

15. Three piles of wood, each 8 ft. high and 4 ft. wide, contain $16\frac{1}{2}$ cords. How long are they?

16. How long will it take 5 men to do a piece of work that can be done by 15 men in 9 days?

1. What is 9 months' interest of \$300 at 8%?

2. Three-fourths bu. is what part of $\frac{7}{8}$ bu.?

3. What is the ratio of $\frac{1}{2}$ to $\frac{1}{3}$?

4. $33\frac{1}{3}$ is the product of the extremes. One mean is 5, what is the other?

5. I spent $\frac{4}{5}$ of my money, and lost a quarter of a dollar. If I then had 75 cents, what did I have at first?

6. A boy began to work at 9 A.M. In 20 minutes he had done $\frac{2}{5}$ of all his work. When did he finish?

7. How many yards of 4-inch bandages can be made from 12 yd. of linen $1\frac{1}{4}$ yd. wide?

8. What per cent of a day has gone at 6 P.M.?

9. Find the cost of $\frac{7}{8}$ yd. silk at \$2 a yard, and $1\frac{3}{8}$ yd. of cotton at $37\frac{1}{2}$¢ a yard.

10. If an article was sold for \$32 at a gain of $33\frac{1}{3}$%, what was the cost?

11. A man engaged 72 men for 12 days at $\$1.66\frac{2}{3}$ a day. Find the amount of their wages.

12. An estate was sold for \$45,000, which was $37\frac{1}{2}$% below its value. What was its value?

13. If $\frac{2}{3}$ of a ton of coal cost \$2.56, how much will $2\frac{1}{2}$ tons cost, the latter being 25% a ton cheaper?

14. If 1 piece of cloth of 11 yd. costs \$1.75, what will 8 pieces, each $13\frac{1}{3}$ yards, cost?

15. How many tons of coal can be put into a bin 12 ft. square, and 6 ft. high, allowing 55 lb. to a cubic foot?

16. Compare a 5-inch square with one half as long.

17. A lot of land is 200 ft. long, and contains 24,000 square feet. How wide is it?

18. How many acres of land in a field in the form of a triangle, the base of which is 120 rd. and the altitude 40 rd.?

19. Find the entire surface of a cylinder 14 ft. long, the diameter of the ends being 3 ft. 6 in.

1. If 16 cd. of wood cost \$96, what will 25 cd. cost?

In solving problems like the above, it is a good plan to make statements like the following:

1. I am asked to find the cost of 25 cd. of wood.
2. I know the cost of 16 cords.
3. I need to know the cost of 1 cord.
4. Process $\frac{96 \times 25}{16} = \$150$.
5. Is the result reasonable? 25 cords are a little more than $1\frac{1}{2}$ times 16 cords. My result should be a little more than $1\frac{1}{2}$ times \$96.

NOTE. — If pupils were always obliged to take the 5th step we should have fewer nonsensical answers.

Solve the following problems by this method:

2. If a young man earns \$36 a month, in how many years will he earn \$5,616?

3. If 7 tons of coal cost \$35, what will 4 tons cost?

4. My sister Alice hires a bicycle for 30¢ an hour. What does she pay for its use if she uses it from 10 A.M. till 3.30 P.M.?

5. A has $\frac{1}{3}$ of a sum of money, B $\frac{1}{2}$ of it. B has \$30 more than A. How much has each?

6. If a bushel of beans weighs 60 lb., and a barrel holds 3 bu., how many barrels will it take to hold 5 tons?

7. If an ocean steamer uses 300 tons of coal in a day, how many pounds will it use in a month of 30 days?

8. Four men cut a pile of wood. If the first man cut $\frac{1}{4}$ of it, the second $\frac{1}{3}$, and the third $\frac{3}{8}$, how much did the fourth cut?

9. I hired 4 men to work at \$3 a day each. The first worked $\frac{1}{2}$ a day, the second $\frac{5}{8}$, the third $2\frac{1}{4}$ days, and the fourth $1\frac{1}{3}$ days. How much must I pay them?

10. If 3 bbl. of oil cost \$15.75, what will $18\frac{1}{3}$ bbl. cost?

11. If I buy a 42-gal. barrel of oil for \$3.50, and retail it at $12\frac{1}{2}$¢ a gallon, how much do I make?

12. My house cost me \$5,000, and my tax is \$16 on a thousand. If I rent my house for \$30 a month, what is my annual income?

ORAL.

1. What will it cost to get a house insured for $4,000 for 10 years, at $\frac{1}{4}\%$ a year?

2. A house valued at $3,500 was insured at 1%. What was the premium?

3. If a book-agent received $50 for selling $150 worth of books, what was his rate of commission?

4. An auctioneer sold $500 worth of goods at a commission of 4%. What was his commission?

5. Can you lose more than 100% in selling an article?

6. Give a case where you lose 100%.

7. Can a gain be greater than 100%? If so, make an example to illustrate.

8. If not greater than 100%, tell why not. Make an example where the gain is just 100%.

9. A man sold a horse for $90, and gained 20%. Find the cost of the horse.

10. Read the 9th example, using a common fraction instead of per cent.

11. When cloth that cost $6 a yard is sold for $4 a yard, what is the loss per cent?

12. If you buy an article for $80, and sell it at 25% profit, what will be your selling-price?

13. A man paid $160 for a horse, which was 20% less than the cost of a carriage. Find the cost of both.

14. What per cent of a number is $\frac{3}{5}$ of it?

15. What per cent of a number is $\frac{5}{8}$ of it?

16. What per cent of a number is $\frac{3}{4}$ of it?

17. Find the cost of .75 bu. of chestnuts at 5¢ a pint.

18. What will 2 doz. knives cost at $33\frac{1}{3}$¢ each?

19. How far must a man go in a day to travel 133 miles in a full week?

20. A river is 60 ft. deep. How many fathoms deep is it?

REVIEW OF FRACTIONS.

1. Reduce to whole or mixed numbers: $\frac{211}{8}$, $\frac{337}{15}$, $\frac{521}{23}$, $\frac{1002}{39}$, $\frac{312}{11}$, $\frac{389}{16}$, $\frac{929}{22}$, $\frac{1807}{40}$, $\frac{305}{12}$, $\frac{348}{17}$.

2. Reduce to improper fractions: $516\frac{4}{5}$, $84\frac{4}{7}$, $134\frac{3}{5}$, $125\frac{2}{3}$, $160\frac{6}{7}$, $105\frac{5}{16}$, $113\frac{7}{8}$, $63\frac{7}{8}$.

3. Reduce $\frac{2}{3}$ and $\frac{3}{4}$ to 12ths. $\frac{3}{4}$ and $\frac{7}{8}$ to 8ths. $\frac{5}{6}$ and $\frac{3}{4}$ to 24ths. $\frac{2}{5}$ and $\frac{5}{6}$ to 30ths.

4. Reduce to equivalent fractions having a common denominator: $\frac{7}{8}$, $\frac{8}{9}$, $\frac{5}{8}$, $\frac{5}{9}$, $\frac{8}{12}$, $\frac{13}{24}$, $\frac{7}{9}$, $\frac{5}{24}$.

5. Add: $16\frac{1}{2}$, $22\frac{2}{3}$, $45\frac{7}{8}$, $50\frac{5}{16}$, $8\frac{1}{2}$, $10\frac{5}{6}$, $14\frac{3}{4}$.

6. Add: $\frac{8}{15}$, $\frac{11}{12}$, $\frac{7}{8}$; $\frac{7}{9}$, $\frac{23}{24}$, $\frac{29}{36}$.

7. From $20\frac{1}{7}$ take $8\frac{3}{14}$. From $47\frac{2}{5}$ take $19\frac{9}{15}$.

8. What is $\frac{5}{11}$ of 3,218? $\frac{6}{23}$ of 3,002?

9. $\frac{4}{5}$ of $\frac{3}{8}$ of $\frac{5}{5}$? $\frac{4}{9}$ of $\frac{7}{11}$ of $\frac{9}{14}$? $\frac{9}{10}$ of $\frac{5}{18}$ of $\frac{6}{27}$?

10. Multiply $40\frac{2}{3}$ by 20. 122 by $6\frac{5}{7}$.

11. Divide 231 by $\frac{77}{10}$. $65\frac{1}{3}$ by $18\frac{2}{3}$.

12. A man lost $\frac{2}{5}$ of his money and had $411 remaining. How much had he at first?

13. If $\frac{3}{4}$ of a farm is valued at $2,253\frac{1}{2}$, what is the value of $\frac{2}{3}$ of it?

14. $96\frac{3}{4} - \dfrac{770\frac{5}{6}}{16\frac{2}{3}}$?

15. If $8\frac{3}{4}$ tons of coal cost $30\frac{5}{8}$, how many tons can be bought for $127\frac{3}{4}$?

16. A farmer raised 2,146 bbl. of apples. He sold $\frac{5}{8}$ of them at $1\frac{3}{4}$ a barrel, and the remainder at $2\frac{1}{2}$ a barrel. How much did he receive?

17. A boy bought 120 oranges at the rate of 5 for 2 cents. He sold $\frac{1}{2}$ of them at the rate of 3 for 1 cent and the remainder at 3 for 2 cents. How much did he gain or lose?

18. If $1\frac{1}{4}$ lb. of beef and $1\frac{3}{8}$ lb. of flour are allowed to each man as a ration, how much will rations for 618 men cost if beef is $11\frac{3}{8}¢$ a pound and flour $3\frac{1}{4}¢$ a pound?

REVIEW OF PERCENTAGE.

1. A man bought a house for $4,200, and sold it at a gain of 25%.

2. A man spent 30% of his income for family expenses, and 25% of it for books and clothing, and saved the rest. If he saved $900, what was his income?

3. Change ¼% to a decimal. Change .005 to a per cent.

4. Of a lot of goods a man sold $528 worth, which was 5% of the cost. What was the cost?

5. 75 is 15 per cent of what number? 24 is 40 per cent of what number?

6. 26 is 13 per cent of what number? 105 is 35 per cent of what number?

7. If an agent's salary was increased 30%, making it $2,600, what was it before it was increased?

8. A man bought a farm for $1,250, and sold it at a gain of $250.

9. What per cent of 800 is 48? Of 700 is 35? Of 450 is 45? Of 75 is 37.5?

10. If the ore is 35% pure, how much iron will 6,893 lb. of ore produce?

11. A man owned a part of a mill for which he paid $12,250. He was obliged to sell at a loss of 15%.

12. Given the amount gained and the rate of gain. What can you find? Illustrate by an example.

13. Given the cost of an article and the rate of gain. What can you find? Illustrate by an example.

14. Given the cost of an article and the gain. What can you find? Illustrate by an example.

15. Given the cost and the selling-price. What can you find? Illustrate.

16. A dealer lost 20% by selling a carriage for $120. What was the cost?

MEASUREMENTS.

1. Draw a right angle, and name its vertex x.

2. How many degrees in a right angle?

3. If an angle measures 45°, what part of a right angle is it?

4. Over how many degrees does the long hand of a watch move in 20 min.? In $\frac{1}{4}$ hr.?

5. What name is given to a quadrilateral with four right angles?

6. Find the area of rectangles measuring: 15 ft. by $6\frac{1}{2}$ ft.; $13\frac{1}{2}$ ft. by 20 ft.; $16\frac{1}{2}$ ft. by $14\frac{1}{2}$ ft.; $5\frac{1}{2}$ yd. by $4\frac{1}{4}$ yd.

7. At \$1.25 a yard find the cost of tapestry carpet ($\frac{3}{4}$ yd. wide) for a room 15 ft. wide and 21 ft. long.

8. Find the area of a rhomboid with a base $2\frac{1}{2}$ yd. and an altitude of 18 in.

9. Cut a rhomboid from paper. Cut this rhomboid, and arrange its parts so as to develop the rule for finding the area of a rhomboid.

10. Cut out of paper a trapezoid. Cut it, and arrange its parts so as to formulate a rule for finding its area.

11. Find the area of a trapezoid whose parallel sides are 25 in. and 24 in. and altitude $4\frac{1}{2}$ in.

12. Cut out of paper a trapezium. Fold and cut it on its longer diagonal. How many triangles have you? Of these triangles what dimensions do you need to know to find their areas?

13. The diagonal of a trapezium is 24 in. The altitudes perpendicular to it are 18 in. and 15 in. What is its area?

14. Cut a circle, and formulate a rule for finding its area.

15. Find the area of a circle when the diameter is 40 in. When the circumference is 200 in.

16. A button is 4.7124 in. round it. How long a buttonhole is needed?

17. A hogshead is $12\frac{1}{2}$ ft. in circumference. Can it pass through a door 3 ft. 9 in. wide?

MEASURING.

1. Find the contents of a rectangular prism $12\frac{1}{2}$ yd. by 10 ft. by 16 in.

2. A rectangular prism is $20\frac{1}{2}$ ft. long, $17\frac{1}{3}$ ft. wide, and 6 in. deep. Find its contents.

3. At \$3.00 a cord, find the cost of a pile of wood 24 ft. long, 4 ft. wide, and $7\frac{1}{2}$ ft. high.

4. I bought 6 boards, each 16 ft. long and $1\frac{1}{2}$ in. thick. Their width was as follows: 8 in., 10 in., 12 in., 13 in., 14 in., 9 in. How many feet of lumber did I buy?

5. The entire surface of a cube is 294 sq. in. How long is the cube?

6. Find the entire surface of a 9-in. cube.

7. Find the entire surface and the contents of a prism 20 ft. long, 14 ft. wide, and 10 ft. high.

8. What is the difference in volume between a square prism 4 in. wide and 25 in. long and the largest cylinder that can be cut from the prism?

9. A well is 32 ft. deep and 5 ft. in diameter. How many cubic feet of water in it if it is $\frac{3}{4}$ full?

10. The area of a rectangular field is 12 acres. If its length is 20 rd., what is its altitude?

11. In digging a trench 3 ft. wide and $4\frac{1}{2}$ ft. deep, 330 cu. yd. of earth were removed. How long was the trench?

12. From a lot of land 40 rd. square I sold 40 sq. rd. What is the remainder worth at \$120 an acre?

13. A railroad company fenced 8 miles of its road at $67\frac{1}{2}$¢ a rod.

14. On a pond covering 1 acre the ice when removed was 15 in. thick. If a cubic foot weighs $57\frac{1}{2}$ lb., how many tons were cut?

15. What will it cost to polish the sides and top of a granite shaft 6 ft. by 2 ft. by 22 in. at $1\frac{1}{8}$¢ a square inch?

ORAL.

1. If a certain number diminished by $\frac{1}{4}$ of itself is 15, what is the number?

2. Nellie has 18 buttons, and $\frac{2}{3}$ of her buttons equals $\frac{3}{4}$ of Mary's buttons. How many buttons has Mary?

3. What is $\frac{5}{7}$ of $\frac{2}{3}$? $\frac{6}{8}$ of $\frac{3}{4}$? $\frac{7}{6}$ of $\frac{3}{7}$?

4. Having lost $\frac{1}{4}$ of his money, Harry found $\frac{1}{2}$ of what he lost, and then had 70 cents. How much had he at first?

5. If a man can walk $3\frac{1}{4}$ miles in 2 hours, how far can he walk in 8 hours?

6. How far apart are two places, when 7 times $3\frac{1}{7}$ miles is $5\frac{1}{2}$ times the distance between them?

7. If cloth costs \$5 a yard, how much can you buy for $\$2\frac{1}{2}$?

8. If your brother can earn \$6 a week, how long will it take him to earn $\$4\frac{1}{2}$?

9. If 5 pints of milk cost 12 cents, what will 25 pints cost?

10. If 4 men can do a piece of work in $4\frac{3}{4}$ days, how long will it take 12 men to do the same work?

11. A girl gave $3\frac{1}{2}$ apples to each of her girl friends. If she gave away 14 apples, to how many friends did she give her apples?

12. A watch cost \$40, and a chain cost \$12. What per cent of the cost of the watch is the cost of the chain?

13. A cow cost \$24, and $\frac{4}{5}$ of the cost of the cow is $\frac{2}{3}$ of the cost of the horse. Find the cost of the horse.

14. Five-sixths of 72 is how many times $\frac{5}{4}$ of 16?

15. A horse cost \$150, and $\frac{1}{5}$ of this is three times the cost of a sleigh, and the sleigh cost twice as much as a harness. Find the cost of the sleigh and the harness.

16. A vessel was sunk in 9 fathoms of water. How many feet deep was the water?

17. The distance round the school-yard is 160 paces. How many feet is it? How many yards is it?

1. Find the cost of 60 planks, each 14 ft. long, 10 in. wide, and $1\frac{1}{2}$ in. thick, at \$40 per M.

2. A starts from Holyoke, and travels 8 miles an hour, and 6 hours afterwards B starts from the same place, and follows at the rate of 10 miles an hour. At what distance from Holyoke will B overtake A?

3. By selling flour at a gain of 40¢ a barrel, a man gained $6\frac{2}{3}\%$. What was the cost of a barrel?

4. A dealer bought 400 boxes of oranges at \$1.25 a box. He sold 20% of them at a loss of 40%, 25% of them at a gain of 10%, and the remainder at a gain of 30%. How much did he gain?

5. What will it cost to fence a field 800 ft. long, 600 ft. wide, at \$1.20 a rod?

6. What is the cost of a pile of wood 27 ft. 6 in. long, 4 ft. wide, 11 ft. 3 in. high, at \$$5\frac{1}{3}$ a cord?

7. A boy gave his brother Charles $\frac{2}{7}$ of his marbles, and Henry $\frac{3}{5}$ of the remainder. Henry received 7 more than Charles.

8. My horse and carriage cost \$660. The horse cost $1\frac{1}{5}$ times the cost of the carriage.

9. The area of a parallelogram is 60 sq. yd., its base is 120 ft. Find its altitude.

10. What will it cost to pave a sidewalk 300 ft. long, 12 ft. wide, with bricks 8 in. long, 4 in. wide, worth \$6 per M.?

11. My house, worth \$7,200, is insured for $\frac{3}{4}$ of its value. If the rate is 60 cents on \$100, what premium do I pay?

12. Write the following as per cents, using the sign: .08, .025, 1.05, .00$\frac{1}{2}$, .06$\frac{1}{4}$, $\frac{3}{10}$, $\frac{7}{12}$, 3.75, .0045, 4.50.

13. What is $3\frac{1}{3}\%$ of $3\frac{3}{5}$?

14. What per cent of 4 bu. is 2 bu. 3 pk.?

15. Three-fourths per cent of 400 is what per cent of 12?

16. For what must I sell coffee that cost 24¢ a pound so as to gain 25%?

1. Find the area of an isosceles triangle whose base is 18 ft. and altitude 9 ft.

2. Find the area of a trapezoid whose parallel sides are 16 ft. and 22 ft. respectively, and whose altitude is 12 ft.

3. A horse is tethered by a rope 45 ft. 6 in. long. How much land can he graze over, if he can reach $\frac{1}{2}$ ft. beyond the end of the rope?

4. How many square yards of plastering are required for a room 22 ft. long, 16 ft. wide, and 10 ft. 6 in. high, allowing 49 sq. ft. for openings?

5. How many planks will it take to floor a barn 60 ft. long by 35 ft. wide, if planks are 15 ft. long and 15 in. wide?

6. How many yards of Brussels carpet will it take for a room 22 ft. by 15 ft.; a room 18 ft. by 15 ft.; a room $10\frac{1}{2}$ ft. by 9 ft., the carpet to run lengthwise? At \$1.35 a yard, find the entire cost.

7. How many pickets, 3 in. wide and 3 in. apart, will it take to fence a lot 4 rd. wide and 10 rd. long?

8. A bin 12 ft. long, 4 ft. wide, and 3 ft. deep, is full of potatoes. What are they worth at 49¢ a bushel?

9. A pile of wood 9 ft. high and 4 ft. wide contains 20 cords. How long is it?

10. How many cords of wood will a log make that is 3 ft. in diameter and 40 ft. long?

11. A man had a lot 40 rd. long, 18 rd. wide. What is 35% of it worth at \$360 an acre?

12. Find the cost of plastering a room 20 ft. long, 16 ft. wide, and 10 ft. high, at 18¢ a square yard. There are 4 windows, each 7 ft. by 3 ft. 6 in.; 2 doors, each 8 ft. by 3 ft. 4 in.; and a base-board 8 in. high.

13. A mill was sold for \$16,650 and 40% lost.

14. A man paid for merchandise \$875, and sold it for \$1,015. What per cent did he gain?

1. Land which cost $5,600 was sold at a profit of 25%.

2. A line of wire 1,560 ft. long is supported by 13 posts, placed the same distance apart. How far apart are the posts?

3. 17 gal. 3 qt. 1 pt. 2 gi. were sold from a cask containing 25 gal. 2 qt. 1 gi.

4. I lost 12% by selling some goods for $215.60. Find the cost of the goods.

5. How many $\frac{1}{8}$-in. cubes can be put into a cubical box 1 ft. on a side?

6. I bought 320 lb. of sugar at $5\frac{3}{4}¢$ a pound. I lost $3\frac{1}{8}\%$ by drying, and sold the rest at 6¢ a pound. Find my gain.

7. A man lost $\frac{1}{5}$ of his money, and then $\frac{1}{2}$ of what was left. If he then had $12.60, what had he at first?

8. In a school the girls are 52% of the whole number, and there are 240 boys.

9. A dealer buys tea at 56¢ a pound, and sells it at $2\frac{1}{2}\%$ profit. How many pounds must he sell to gain $70?

10. How many yards of cloth a yard wide will it take to cover the top and sides of a box $4\frac{1}{2}$ ft. long, 3 ft. wide, and 3 ft. deep?

11. If an acre of ground costs $240, what is the value of a rectangular lot 12 rd. long and 165 ft. wide?

12. If a sheet of brass containing 5 square feet weighs 13 lb., what will a sheet 5 ft. square weigh?

13. James spent $\frac{1}{2}$ of his money, then $\frac{2}{3}$ of what remained, then $\frac{3}{4}$ of what still remained. If he then had $15, what had he at first?

14. A lawyer collected a note of $2,375. How much did he pay to the owner of the note, his commission being 5%?

15. What is the value of 12 pairs of shoes @ $3.25 a pair, less 5%?

16. At what price must ribbon be sold a yard so as to gain 20%, if $22\frac{1}{2}$ yd. cost $6.75?

1. If I buy a book for $6, and sell it for $7.50, what is my gain per cent?

2. If I buy $800 worth of goods at 25% and 10% off, what do they cost?

3. My agent sells my farm for $7,600. What shall I receive if the commission is 2½%?

4. My agent bought for me 8,000 lb. of butter at 30¢ a pound. If his commission is 3%, how much money must I send him?

5. Find the interest of $162.50 from Aug. 16, 1898, to Nov. 29, 1899, at 8%.

6. If I insure my life for $3,000 at the rate of $23.40 a thousand dollars, what is the premium?

7. If I buy 160 bbl. of potatoes at $1.60 a barrel, and after losing 10% of them I sell the remainder at $1.90 a barrel, what is my gain?

8. I sold $800 worth of goods, ½ at a gain of 20%, and the remainder at a loss of 20%. What did the goods cost me?

9. What shall I receive for 7,400 yd. of cloth at 7½¢ a yard if I deduct 15% from the bill?

10. Write in words the denominator of a decimal of 4 figures. Of 7 figures.

11. What decimal is as much smaller than .5275 as .5275 is smaller than .74?

12. Add the product of 7.1 and 7 ten-thousandths to 9 hundredths.

13. The subtrahend is 6.9×3.04, the minuend is 26.08×1.002.

14. What will 3.5 lb. of meat cost if $.15 will buy .75 of a pound?

15. Change to common fractions in their lowest terms: .00032, .16016, .71875.

16. What will 16.375 casks of wine cost if 8.1875 cost $982.50?

ORAL.

1. Find the cost of 1,000 cords of wood at $7.37½ a cord.

2. A man earned $100 a month. If he spent $4 out of every $10, how many dollars did he save every month?

3. How much did a grocer pay for a quart of milk, if he sold a gallon for $.32, at a gain of 33⅓%?

4. A rectangular field contains 1 acre. If it is 80 rd. long, how wide is it? What is its perimeter?

5. I sold a dozen oranges costing 24 cents for 18 cents. What per cent did I lose?

6. I sold a dozen oranges costing 18 cents for 24 cents. What per cent did I gain?

7. What will 27 lb. of coffee cost at 33⅓¢ a pound?

8. What will 40 pt. of milk cost at 2½¢ a pint?

9. What is the interest of $2,468 for 30 days at 6%?

10. If 2½ qt. of beans cost 25 cents, what will 10 qt. cost?

11. Add all the prime numbers between 1 and 10.

12. 5 qt. is what decimal of a peck? What per cent of it?

13. A can do a piece of work in 4 days, B can do it in 5 days. In what time can A and B do it working together?

14. I bought a table for $4. At what price must I sell it to gain 12½%?

15. How many 2-in. cubes in a 10-in. cube?

16. If a dealer sells goods for double what they cost him, what per cent does he make?

17. I sold my watch for $18, which was 12½% more than it cost. Find the cost.

18. What part of a dollar did I pay for 6¼ lb. of candy at 12¢ a pound?

19. How many hours is it from 2.45 P.M. to 5.15 P.M.?

20. A man bought a gallon of milk for 28 cents, and sold it at 4¢ a pint. How much did he gain on a quart?

21. How many cows at $25 a head can be bought for $250?

1. At $50 an acre, find the cost of a quadrangular piece of land whose parallel sides are 25 rd. and 35 rd., and 50 rd. apart.

2. What will it cost to sod a yard $28\frac{2}{3}$ ft. long, and $24\frac{3}{4}$ ft. wide, at 75¢ a square yard?

3. A and B can build a wall in 10 days; A can build it in 18 days. How long will it take B to build it alone?

4. What will 5 cd. ft. of wood cost at $3.76 per cord?

5. What will it cost, at 30¢ a square yard, to plaster a room 27 ft. long, 18 ft. wide, and 9 ft. high, allowing for 2 windows and 1 door, each 6 ft. by $2\frac{1}{3}$ ft.?

6. 25% of 560 is $33\frac{1}{3}$% of what number?

7. A man spent $\frac{2}{5}$ of his money, and then $\frac{2}{3}$ as much as he had already spent, and had remaining $4,800 less than he had at first.

8. Eight-seventeenths of 1,768 is $\frac{13}{20}$ of what number?

9. If 6 acres of land cost $72, what will $\frac{3}{16}$ of 80 acres cost?

10. One-eighth of a certain number is 16 more than one-ninth of it.

11. I sold an article to a man for $\frac{1}{3}$ more than it cost me. He sold it for $12, which was $\frac{2}{5}$ less than it cost him. What did it cost me?

12. A pile of wood contains 200 cords. It is 8 ft. wide and 8 ft. high.

13. What will it cost to dig a ditch 2 ft. deep and $1\frac{1}{2}$ ft. wide around a lot 4 rd. long and $3\frac{1}{3}$ rd. wide, at 54¢ a cubic yard?

14. How many rods of fence will inclose a rectangular field of 20 acres, whose width is 40 rd.?

15. If 27 bu. of apples cost 60\frac{3}{4}$, how many bushels can be bought for 461\frac{1}{4}$?

16. If a stick of timber 20 ft. long, 12 in. wide, 10 in. thick, is sawed into boards 1 in. thick, how many board feet will there be?

1. Multiply: .8 by .96; 2.052 by .0037; .7 by .5; 2.16 by 40.7; 2.406 by .008.

2. Divide: .00512 by 2.048; .03 by .001; 15.4546 by .0019; .01124 by 11.24.

3. Find the cost of 98,762 laths, at \$.35 per C.

4. A merchant sold 3 pieces of matting, each containing 45.5 yd., at \$.375 a yard.

5. At \$4.75 a ton, what is the cost of 563,800 lb. of coal?

6. Find the least common multiple of 28, 32, 56, 72, and 96.

7. How many square feet of tin plate will be required for making 800 rectangular cans, 8 in. by 6 in. by 12 in., adding 6 square inches for waste in making each can?

8. Find the shortest distance that three lines, 8 ft., 9 ft., and 12 ft., will exactly measure.

9. A gardener exchanged 15 boxes of celery, 120 bunches in each, at 18¢ a bunch, for barrels of sugar, 240 lb. in a barrel, at 5¢ a pound. How many barrels did he get?

10. Change to improper fractions:

$29\frac{1}{2}\frac{3}{1}$, $42\frac{1}{1}\frac{7}{9}$, $146\frac{3}{3}\frac{7}{6}$, $13\frac{2}{8}\frac{9}{1}$, $154\frac{2}{3}\frac{9}{5}$.

11. Find products of:

$\frac{2}{5} \times 2\frac{1}{7} \times 7\frac{1}{2} \times 4\frac{1}{5} \times \frac{8}{9}$. $6\frac{3}{4} \times 9$.

$11\frac{3}{7} \times 16\frac{4}{1}\frac{4}{1} \times \frac{7}{8}\frac{7}{0} \times \frac{1}{3}\frac{1}{0}$. $9 \times 3\frac{3}{5}$.

12. Find results:

$16 \div \frac{7}{1}\frac{7}{5}$ of $2\frac{8}{1}\frac{8}{1}$ of $\frac{1}{3}\frac{1}{5}$. $8\frac{3}{5} \div 6\frac{1}{7}$.

$3\frac{3}{8}$ of $4\frac{4}{5} \div \frac{2}{5}$ of $6\frac{1}{2}$ of $\frac{3}{8}$. $9\frac{1}{6} \div 3\frac{1}{2}$.

13. If $\frac{3}{1}\frac{3}{0}$ of a yard of cloth cost 80¢, what should be paid for $\frac{1}{4}$ of a yard?

14. Find the sum of:

$23\frac{5}{8}$, $32\frac{8}{9}$, $18\frac{3}{4}$, $27\frac{5}{6}$, $28\frac{2}{3}$. $64\frac{3}{4}$, $28\frac{1}{1}\frac{3}{6}$.

$36\frac{4}{7}$, $37\frac{2}{5}$, $59\frac{1}{7}$, $54\frac{2}{7}$, $16\frac{4}{5}$. $55\frac{3}{8}$, $54\frac{1}{1}\frac{5}{6}$.

15. Change to common fractions: .005, .0425, .00375, .00256, .0625.

1. Find the cost of carpet at $1.25 a yard, for 30 in. wide carpet, for a room 18 ft. by 14 ft., if the strips run lengthwise.

2. Find the cost of papering a room 32 ft. long, 22 ft. wide, 13 ft. high, with paper 18 in. wide, 8 yd. in a roll, at 65¢ a roll, if 50 sq. yd. are allowed for openings.

3. How many board feet in twelve 4-in. planks 16 ft. long and 10 in. wide?

4. What will it cost to shingle a roof, each side of which is 30 ft. long, and 25 ft. wide, at $4.50 a square?

5. What will it cost to build a wall 90 ft. long, 7½ ft. high, 2 ft. thick, at $6 a cubic yard?

6. Find the number of bushels of grain in a bin that is 6 ft. long, 5 ft. wide, 4 ft. deep.

7. What is the breadth of a rectangular field containing 7½ acres, if the length is 242 yards?

8. Make out a bill that shall contain five debit and one credit items.

9. A merchant sold cloth for $4.20 at a gain of 20%.

10. A man sold 40 horses at $200 each. On one-half of them he gained 25%, and on the rest he lost 20%. Find the entire gain or loss.

11. Find the interest on $1250 from Nov. 15, 1897, to Mar. 1, 1899, at 5%.

12. If 2.45 tons of straw cost $29.40, how many tons can be bought for $9?

13. Find the surface and volume of a prism measuring 4′ 8″ × 3′ 10″ × 3′ 6″.

14. Find the number of barrels of water in a circular cistern 21 ft. in diameter and 10 ft. deep.

15. Find the difference in the surface and volume between a square pyramid, 12 ft. on a side, slant height 25 ft., and a cone, whose circumference is 42 ft. and slant height 25 ft. Altitude of both, 24 ft.

[The remaining pages of this book contain a few topics which have not been thought of sufficient value for more than the brief treatment already given to some of them. They may without loss be entirely omitted unless required by the course of study.]

GREATEST COMMON DIVISOR.

1. Name a divisor of 8.

2. A divisor is a number that will exactly divide another number.

3. Name a common divisor of 8 and 12.

4. A common divisor is a number that will exactly divide two or more numbers.

5. Name the greatest common divisor or factor of 8 and 12.

6. The greatest common divisor or factor of two or more numbers is the greatest number that will exactly divide them.

7. What is the greatest common divisor of 18, 30, and 48?

$$\begin{array}{r|l} 2 & 18\ \ 30\ \ 48 \\ \hline 3 & 9\ \ 15\ \ 24 \\ \hline & 3\ \ 5\ \ 8 \end{array}$$

By the definition we see that any factor or divisor must be a divisor of all the numbers. We arrange the numbers in a horizontal line, and by division remove all factors that are common to all. The product of these factors must be the greatest common factor. Removing 2, we find our quotients to be 9, 15, and 24. Any number, to be a part of our greatest common divisor, must be a part or factor of these quotients. We remove three as common to them all. Our quotients are 3, 5 and 8. Since these numbers are prime to each other, there can be no more factors common to all.

2×3 or 6 then must be the greatest common divisor.

8. What is the greatest common divisor of 60, 72, 48, 84?

9. What is the greatest common divisor of 45, 75, 90, 135, 150, 180?

10. What is the greatest common divisor of 75, 300, 450?

11. Find the greatest common divisor of 108, 270, 432.

12. Find the greatest common divisor of 16, 20, 24.

13. Find the greatest common divisor of 44, 110, 154.

NOTE. — In the 8th example 45 is contained in 90, 135, and 180. 75 is contained in 150. This example means, find the G. C. D. of 45 and 75, because a divisor of these numbers will be a divisor of any multiple of themselves.

1. Find the greatest common divisor of 91 and 325.

$$
\begin{array}{r|l}
3)\,91 & 325\,(3 \\
\quad 52 & 273 \\
\hline
3)\,39 & \overline{52}\,(1 \\
\quad 39 & 39 \\
\hline
 & \overline{13} \\
 & \textit{Ans.}
\end{array}
\qquad
\begin{array}{r}
91\,)\,325\,(3 \\
\underline{273} \\
\overline{52}\,)\,91\,(1 \\
\underline{52} \\
\overline{39}\,)\,52\,(1 \\
\underline{39} \\
\overline{13}\,)\,39\,(3 \\
\underline{39}
\end{array}
$$

This method is based on the principle that a common divisor of two or more numbers is also a divisor of the less and the remainder after dividing the greater by the less. According to this principle the divisor of 91 and 325 must also be a divisor of 52. Any divisor of 52 and 91 is also a divisor of their difference, 39. Any divisor of 39 and 52 is also a divisor of their difference, 13, etc.

RULE. — Divide the larger number by the smaller and the last divisor by the last remainder, etc.; the last divisor will be the greatest common divisor.

NOTE. — This method should be used only with large numbers. When more than two numbers are given, take any two and find their divisor, then the divisor of those two and another number, etc.

Find the greatest common divisor of:

2. 308, 630.

3. 200, 125, 350.

4. 165, 231, 385.

5. 120, 210, 345.

6. 414, 690, 966.

7. 533, 697, 779.

8. 1265, 1870, 8613.

9. 7944, 12247, 13902.

NOTE. — In the following examples find the greatest common measure of the numerator and denominator of each fraction, and divide each term by it to reduce the fraction to its lowest terms.

10. Reduce to lowest terms:

$\frac{16}{24}$ $\frac{14}{21}$ $\frac{16}{34}$ $\frac{24}{80}$ $\frac{32}{36}$ $\frac{18}{99}$ $\frac{39}{48}$ $\frac{45}{60}$

$\frac{35}{91}$ $\frac{48}{64}$ $\frac{14}{63}$ $\frac{48}{156}$ $\frac{54}{78}$ $\frac{84}{96}$ $\frac{14}{18}$ $\frac{63}{81}$

11. Reduce to lowest terms:

$\frac{212}{371}$ $\frac{435}{522}$ $\frac{155}{279}$ $\frac{164}{205}$ $\frac{333}{407}$ $\frac{183}{273}$ $\frac{427}{488}$ $\frac{672}{784}$

$\frac{306}{561}$ $\frac{300}{825}$ $\frac{819}{936}$ $\frac{144}{156}$ $\frac{104}{156}$ $\frac{850}{935}$ $\frac{202}{303}$ $\frac{275}{625}$

12. Reduce to lowest terms:

$\frac{96}{108}$ $\frac{325}{730}$ $\frac{132}{168}$ $\frac{475}{625}$ $\frac{288}{512}$ $\frac{1056}{1584}$ $\frac{1001}{1144}$ $\frac{1278}{3474}$

$\frac{85}{105}$ $\frac{144}{180}$ $\frac{105}{120}$ $\frac{512}{728}$ $\frac{375}{1000}$ $\frac{1440}{1728}$ $\frac{1136}{3088}$ $\frac{2688}{3072}$

MULTIPLICATION OF COMPOUND NUMBERS.

1. Multiply 7 bu. 3 pk. 5 qt. by 6.

7 bu.	3 pk.	5 qt.
		6
42 bu.	18 pk.	30 qt.
47 bu.	1 pk.	6 qt.

Multiply as in whole numbers. 6 times 5 qt. are 30 qt. 6 times 3 pk. are 18 pk. 6 times 7 bu. are 42 bu. Draw a line under this answer, and change to the next higher denomination if possible. 30 qt. equal 3 pk. and 6 qt. Write the 6 qt. 18 pk. and 3 pk. are 21 pk., which equal 5 bu. and 1 pk. Write the 1 pk. 42 bu. and 5 bu. are 47 bu.

2. What is the weight of 9 loads of hay, each weighing 1 T. 545 lb. 12 oz.?

3. Multiply 217 rd. 4 yd. 2 ft. 7 in. by 32.

4. Multiply 13 gal. 2 qt. 1 pt. 7 gi. by 17.

5. If it takes 4 d. 5 hr. 15 min. to build a machine, how long will it take to build 24 machines?

6. Multiply 46 T. 439 lb. 8 oz. by 7.

7. Multiply 14 m. 85 rd. 9 ft. 11 in. by 11.

8. Multiply 3 m. 180 rd. 3 yd. 2 ft. 9 in. by 9.

9. Multiply 7 wk. 3 d. 14 hr. by 7.

10. How many bushels of grain in 49 bags, each containing 2 bu. 1 pk. 3 qt.

11. Multiply 10 cd. 13 cu. ft. by 12.

12. Multiply 7 A. 73 sq. rd. 21 sq. yd. 7 sq. ft. by 9.

13. Multiply 64 bu. 2 pk. 6 qt. 1 pt. by 7.

14. Multiply 14 T. 1527 lb. 9 oz. by 8.

15. Multiply 4 yd. 1 ft. 4.7 in. by 124.

16. Multiply 93 A. 132 sq. rd. 18 sq. yd. by $15\frac{2}{3}$.

17. Multiply 4 gal. 1 qt. 4.25 gi. by 96.

18. If a man can build 7 rd. 11 ft. 6 in. of fence in a day how much can 8 men build in 2 days?

19. Multiply 124 bu. 3 pk. 5 qt. by 18.

20. If a car runs 18 m. 149 rd. in $\frac{1}{2}$ hr., how far will it run in 12 hours?

21. Multiply 3 d. 16 hr. 50 min. by 15.

DIVISION OF COMPOUND NUMBERS.

1. Divide 50 bu. 3 pk. 2 qt. by 6.

8 1 7
6) 50 bu. 3 pk. 2 qt.
48 bu.
2 bu.
4
8 pk.
3 pk.
11 pk.
6 pk.
5 pk.
8
40 qt.
2 qt.
42 qt.
42 qt.

One-sixth of 50 bu. is 8 bu. (write it above bushels) and 2 bu. remaining. 2 bu. equals 8 pk., and 3 pk. make 11 pk. One-sixth of 11 pk. equals 1 pk. and 5 pk. remaining. 5 pk. equal 40 qt., and 2 qt. make 42 qt., one-sixth of 42 qt. equals 7 qt.

Divide:

2. 17 hr. 32 min. 24 sec. by 4. 23 sq. yd. 9 sq. ft. 117 sq. in. by 9.

3. 35 wk. 5 d. 15 hr. 12 min. 18 sec. by 6.

4. 21 cu. yd. 20 cu. ft. 17 cu. in. by 7. 89 bu. 1 pk. 7 qt. by 7.

5. 23 cu. yd. 12 cu. in. by 4. 53 T. 176 lb. by 28.

6. 112 A. 8 sq. rd. by 9. 332 lb. 8 oz. by 19.

7. 125 cd. 7 cd. ft. 7 cu. ft. by 9.

8. 115 T. 476 lb. 12 oz. by 28.

9. 67 yr. 10 mo. 14 d. 19 hr. 41 min. 53 sec. by 47.

10. 25 sq. rd. 158 sq. ft. 128 sq. in. by 24.

11. 42 bu. 3 pk. 7 qt. 1 pt. by 7.

12. 28 sq. mi. 19 A. 10 sq. rd. by 15.

13. 415 cu. yd. 7 cu. ft. 984 cu. in. by 24.

14. 5 hhd. 40 gal. 3 qt. by 3. 39° 12′ 42″ by 21.

15. 420 bu. 2 pk. by 12. 27 m. 145 rd. 12 ft. 6 in. by 12.

16. 14 m. 180 rd. 2 yd. 9 in. by 7.

17. Add 183 rd. 3 yd. 2 ft. and 296 rd. 1 ft., and divide the sum by 22.

18. 36 gal. 3 qt. 1 pt. 3 gi. by 9.

19. 30 gal. 3 qt. 1 pt. 3 gi. by 7.

20. 98 bu. 3 pk. 2 qt. 1 pt. by 11.

TO CHANGE A FRACTION OF A HIGHER DENOMINATION TO INTEGERS OF LOWER DENOMINATIONS.

1. Change $\frac{11}{16}$ gal. to integers of lower denominations.

$\frac{11}{16} \times 4$ qt. $= \frac{11}{4}$ qt. $= 2\frac{3}{4}$ qt.
$\frac{3}{4} \times 2$ pt. $= \frac{3}{2}$ pt. $= 1\frac{1}{2}$ pt.
$\frac{1}{2} \times 4$ gills $= 2$ gills.
Ans. 2 qt. 1 pt. 2 gi.

Since there are 4 qt. in one gal., in $\frac{11}{16}$ gal. there are $\frac{11}{16}$ times 4 qt., or $2\frac{3}{4}$ qt. Since there are 2 pt. in 1 qt., in $\frac{3}{4}$ qt. there are $\frac{3}{4}$ times 2 pt. or $1\frac{1}{2}$ pt. Since there are 4 gi. in 1 pt., in $\frac{1}{2}$ pt. there are $\frac{1}{2}$ times 4 gi., or 2 gi.

2. Change $\frac{11}{12}$ gal. to lower denominations.
3. Change $\frac{7}{24}$ of a ton to lower denominations.
4. Change $\frac{1}{12}$ bu. to quarts and pints.
5. Change $\frac{53}{71}$ gal. to quarts, etc.
6. Change to lower denominations: $\frac{3}{4}$ bu.; $\frac{7}{8}$ gal.; $\frac{5}{6}$ bu.; $\frac{5}{9}$ gal.; $\frac{11}{12}$ qt.; $\frac{11}{15}$ pk.
7. Change $\frac{3}{7}$ mi. to lower denominations.
8. Change $\frac{8}{9}$ rd. to integers of lower denominations.
9. Change $\frac{2}{11}$ sq. mi. to integers of lower denominations.
10. Change $\frac{5}{7}$ cu. yd. to cubic feet and cubic inches.
11. Change $\frac{23}{64}$ bu. to integers of lower denominations.
12. Add 4,621 in. to $\frac{4}{7}$ of a mile.
13. What will $\frac{1}{2}$ mile of fence cost a $1.50 a rod?
14. Change $\frac{3}{5}$ A. to square rods.
15. Change $\frac{1}{6}$ T. to integers of lower denominations.
16. Change $\frac{5}{6}$ bu. to pecks, quarts, and pints.
17. Change $\frac{9}{25}$ of an acre to lower denominations.
18. Change $\frac{10}{11}$ rd. to lower denominations.
19. Change $\frac{4}{15}$ of a mile to rods.
20. Change $\frac{5}{6}$ A. to lower denominations.
21. Change $\frac{2}{3}$ bu. to pecks, etc.
22. Change $\frac{4}{7}$ gal. to quarts, etc.
23. Change $\frac{11}{15}$ rd. to lower denominations.
24. Change $\frac{5}{14}$ bu. to pecks, quarts, and pints.

TO CHANGE A DECIMAL OF A HIGHER DENOMINATION TO INTEGERS OF LOWER DENOMINATE NUMBERS.

1. Change .6875 of a gallon to integers of lower denominations.

.6875 gal.
4
2.7500 qt.
2
1.50 pt.
4
2.0 gi.

Ans.
2 qt. 1 pt. 2 gi.

The explanation is the same as for common fractions. See Lesson 128.

2. Change .85 lb. to integers of lower denominations.
3. Change .325 T. to integers of lower denominations.
4. Change .0135 cd. to cubic feet.
5. Change .08⅓ yd. to feet, etc.
6. Express .09375 A. in square rods.
7. Change .015625 bu. to pecks, etc.
8. Express .5625 da. as a compound number.
9. Change .8534 bu. to pecks, etc.
10. Change .375 gal. to a compound number.
11. Change .475 yr. to integers of lower denominations.
12. Change .14,225 yr. to months, etc.
13. Change .1375 bu. to integers of lower denominations.
14. Change .378,125 A. to square rods., etc.
15. Express 7.88,125 acres as a compound number.
16. Change .625 rods to feet.
17. Change .6625 sq. m. to square rods.
18. Change .645 rd. to integers of lower denominations.
19. Change .965,625 m. to integers of lower denominations.
20. Express .976 A. as a compound quantity.
21. Change .875 rd. to yards, etc.
22. Change .9375 gal. to integers of lower denominations.
23. Change .984,375 bu. to lower denominations.
24. Change .40,625 gal. to quarts, etc.
25. Change .1875 bu. to quarts.
26. Change .4285 months to days, hours, etc.

TO CHANGE INTEGERS OF LOWER DENOMINATIONS TO DECIMALS OF A HIGHER DENOMINATION.

1. Change 2 pk. 6 qt. to the decimal of a bushel.

8) 6 qt.
4) 2.75 pk.
.6875 bu.

Since 8 qt. make a peck, 6 qt. are equal to .75 pk. which added to the 2 pk., make 2.75 pk. Since 4 pk. make a bushel, 2.75 pk. are equal to .6875 bu.

2. Change 4 yd. 2 ft. 5.25 in. to the decimal of a rod.

12) 5.25 in.
3) 2.4375 ft.
5.5) 4.8125 yd.
.875 rds.

The explanation is the same as in Example 1. Can you formulate a rule?

3. Change 18 hr. 15 min. 54 sec. to the decimal of a day.

4. Reduce 564 lb. to a decimal of a ton.

5. Change to the decimal of an acre 135 square rods 54.45 square feet.

6. What decimal of a ton is 306 lb. 3 oz.?

7. Reduce 1 qt. 1 pt. to the decimal of a gallon.

8. Change 6 qt. 1 pt. to the decimal of a peck.

9. Find the cost of 1 T. 280 lb. at $24 a ton.

10. At $1.75 a bushel, find the cost of 48 bu. 1 pk.

11. Change 2 pk. 6 qt. to the fraction of a bushel.

6 qt. $\div$ 8 = $\frac{6}{8}$ pk. = $\frac{3}{4}$ pk.
$2\frac{3}{4}$ pk. = $\frac{11}{4}$ pk.
$\frac{11}{4}$ pk. $\div$ 4 = $\frac{11}{16}$ bu.

The explanation is the same as for changing to a decimal.

12. Change 4 yd. 2 ft. 5.25 in. to the fraction of a rod.

$5\frac{1}{4}$ in. $\div$ 12 = ($\frac{21}{4}$ in. $\div$ 12) = $\frac{21}{48}$ = $\frac{7}{16}$ ft.
$2\frac{7}{16}$ ft. $\div$ 3 = ($\frac{39}{16}$ $\div$ 3) = $\frac{13}{16}$ yd.
$4\frac{13}{16}$ yd. $\div$ $5\frac{1}{2}$ = ($\frac{77}{16}$ yd. $\div$ $\frac{11}{2}$) = $\frac{7}{8}$ rd. Ans.

NOTE. — Change the first 8 examples in this lesson to common instead of decimal fractions.

13. In .75 rd. how many yards, etc.?

14. Add $\frac{3}{8}$ of a gallon and .375 gal.

15. Add 103.75 ft. and .845 miles.