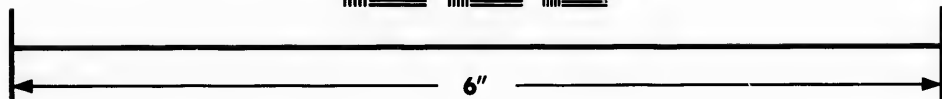
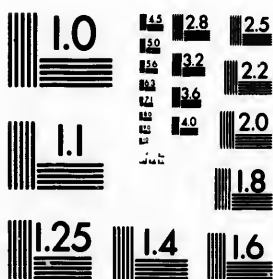


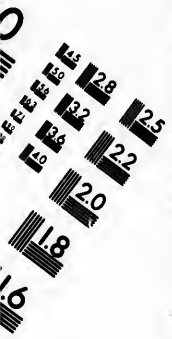
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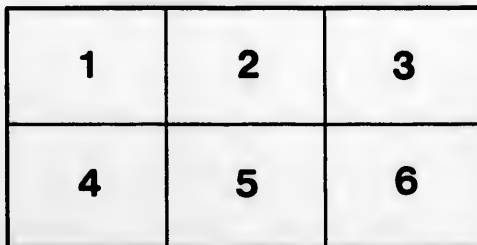
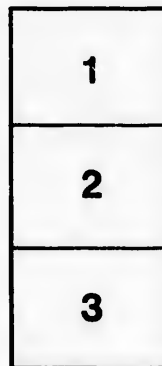
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PART II.

BY

CHAS. G. FRASER,
Assistant Master, Gladstone Ave. School, Toronto.

PRICE 15 CENTS.

THE EDUCATIONAL PUBLISHING CO.

TORONTO, 1899.

Entered according to Act of Parliament of Canada, in the year one thousand eight hundred and ninety-nine, by the Educational Publishing Company, at the Department of Agriculture.

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PREFACE.

The complaints that business men are making of the lack of accuracy and thoroughness in the rising generation, would indicate a lack of system in presenting the subject of arithmetic, or insufficient drill to firmly ground the principles presented. We have perhaps been taking up too many subjects, taking them up at the same time, and in the same lesson, and the result is unsatisfactory. We have been taking up subjects that require faculties which are not developed and do not naturally mature at an early period of the child's life. The old rule, *One thing at a time, and that done well*, is being discarded, and we are of the opinion that this is being done at the sacrifice of the true development of the child.

In the two little "School Helps" which we now place before the public, we have endeavored to supply a set of questions so graded that, under the supervision of the teacher, the pupil himself will take step after step with little "telling,"—so logical as to be natural—so difficult as to call for effort—so full as to be thorough. The pupil will thus be led to have a confidence in himself, and be so thorough that he will not need to stop and think to tell how much 6 times 9 is. The province of the teacher has not been invaded by inserting pages to explain how to add or subtract; but the questions suggest the successive steps in the presenting of the subject, and the books can be used in the teaching of it.

In the few pages at our disposal we have included over 20,000 questions, covering the whole field of public

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school arithmetic. To secure this great number of questions we have resorted to an expedient which we believe to be original, and which enables us to include three questions in the space usually occupied by one, by inserting, in brackets, the numbers for the additional questions. These may, or may not, be used at the discretion of the teacher; but even in these we have endeavored to have the questions progressive. The example: "*I bought a sheep for 8 (4, 7) dollars, and sold it to gain 2 (5, 3) dollars. How much did I get for it?*" is really three questions involving the addition of 8 and 2, 4 and 5, and 7 and 3.

The work has been divided into two parts. The first includes Numeration and Notation, Addition, Subtraction, Multiplication, Division, and Weights and Measures, which includes Reduction and the Compound Rules. The second part includes Measures and Multiples, Vulgar Fractions, Decimal Fractions, Percentage, Mechanical Measurements and Type Questions. Each chapter takes up its work sufficiently thoroughly for our most advanced classes, and concludes with an exercise on theory which, we trust, will lead to the mastering of the whys and wherefores of the rules of Arithmetic.

C. G. F.

TORONTO, AUGUST 10TH, 1899.

MEASURES AND MULTIPLES.

A Number is a unit, or a collection of units.

An Even Number is one that is exactly divisible by 2.

An Odd Number is one that is not exactly divisible by 2.

A Composite Number is one that is exactly divisible by some other number. It is a number that can be factored.

A Prime Number is one that is not exactly divisible by some other number. It is a number that cannot be factored.

A Factor, or Measure of a number, is a number that will exactly divide it.

A Prime Factor, or Prime Measure, of a number, is a prime number that will exactly divide it.

A Common Factor, or Common Measure, of two or more numbers, is a number which will divide each of them exactly.

The Greatest Common Factor, or Measure (H.C.F., or G.C.M.) of two or more numbers, is the greatest number which will divide each of them exactly.

A Multiple of a number is a number which will contain it exactly.

A Common Multiple of two or more numbers, is a number which will contain each of them exactly.

The Least Common Multiple (L. C. M.) of two or more numbers, is the least number which will contain each of them exactly.

Exercise 1.

1. Which of the following numbers are even :—
2, 3, 5, 8, 11, 24, 27, 35, 39, 42, 48, 56, 80.
2. Which of the following numbers are odd :—
4, 6, 7, 9, 12, 20, 25, 27, 32, 38, 45, 75.
3. Which of the following numbers are composite :—
3, 5, 6, 7, 9, 10, 12, 15, 18, 30, 45, 60.

4. Which of the following numbers are prime :—
2, 4, 7, 8, 11, 15, 17, 20, 25, 27, 29, 39, 49.
5. Name all the measures of 24, 36, 72.

Exercise 2.

What two numbers multiplied together produce :—

1.	8.	22.	42.	56.	80.	94.	52.
2.	10.	27.	44.	60.	87.	95.	57.
3.	14.	28.	45.	63.	88.	96.	62.
4.	15.	33.	49.	66.	90.	98.	68.
5.	21.	35.	55.	77.	93.	99.	91.

Exercise 3.

What are the factors of :—

1.	21.	16.	33.	66.	24.	81.
2.	35.	18.	55.	44.	32.	76.
3.	49.	25.	54.	42.	29.	95.
4.	63.	45.	56.	22.	39.	91.
5.	28.	64.	48.	30.	46.	60.

Exercise 4.

Resolve into factors :—

Give the co-factors of :—

1.	4.	18.	32.	50.	81.	26.	58.
2.	6.	20.	34.	64.	82.	38.	69.
3.	9.	24.	36.	65.	84.	39.	75.
4.	12.	25.	40.	70.	85.	46.	76.
5.	16.	30.	48.	72.	86.	51.	78.

Exercise 5.

Give all the numbers that are measures of :—

1.	8.	24.	42.	64.	81.	100.	128.
2.	12.	30.	48.	70.	84.	108.	132.
3.	16.	32.	56.	72.	88.	112.	144.
4.	18.	36.	60.	75.	90.	120.	160.
5.	20.	40.	63.	80.	96.	125.	196.

Exercise 6

Give the prime factors of :—

1.	4.	21.	32.	44.	64.	78.
2.	6.	15.	36.	55.	66.	79.
3.	8.	27.	40.	51.	70.	80.
4.	9.	28.	42.	56.	72.	81.
5.	10.	30.	45.	54.	75.	84.
6.	12.	33.	48.	60.	76.	90.
7.	18.	35.	50.	63.	77.	96.

Exercise 7.

What prime factors are common to :—

1.	24 and 30.	35 and 45.	\$28 and \$32.
2.	18 and 30.	36 and 42.	\$33 and \$66.
3.	35 and 42.	28 and 42.	\$48 and \$64.
4.	20 and 28.	35 and 49.	£63 and £84.
5.	28 and 36.	42 and 63.	£99 and £36.
6.	36 and 48.	55 and 77.	£55 and £75.
7.	45 and 63.	63 and 72.	£75 and £125.

Exercise 8.

Find the largest number which will exactly divide :—

1.	36 and 42.	30, 42, and 48.
2.	15 and 25.	25, 30, and 40.
3.	28 and 49.	28, 35, and 49.
4.	32 and 44.	32, 36, and 48.
5.	35 and 65.	36, 54, and 63.
6.	44 and 77.	45, 63, and 81.
7.	36 and 96.	56, 42, and 70.

Exercise 9.

Find the G. C. M. of :—

1.	15 and 18.	\$21 and \$28.	36 tons, and 40 tons.
2.	18 and 27.	\$14 and \$35.	25 cwt., and 35 cwt.
3.	24 and 36.	\$35 and \$49.	44 gal., and 66 gal.
4.	25 and 45.	\$63 and \$81.	36 cents, and 54 cents.
5.	27 and 45.	\$54 and \$45.	28 boys, and 49 boys.
6.	30 and 48.	\$45 and \$81.	39 pens, and 65 pens.
7.	45 and 72.	\$54 and \$81.	46 pks., and 69 pks.

52.
57.
62.
68.
91.

81.
76.
95.
91.
60.

of :—

58.
69.
75.
76.
78.

128.
132.
144.
160.
196.

Exercise 10.

Find the H. C. F. of:—

- | | | |
|----|------------------|------------------------|
| 1. | 15, 25, and 30. | \$18, \$24, and \$36. |
| 2. | 21, 28, and 42. | \$25, \$35, and \$45. |
| 3. | 18, 30, and 42. | \$50, \$75, and \$125. |
| 4. | 28, 42, and 49. | \$63, \$84, and \$105. |
| 5. | 42, 48, and 60. | \$55, \$77, and \$220. |
| 6. | 24, 36, and 42. | \$36, \$72, and \$144. |
| 7. | 72, 90, and 108. | \$45, \$75, and \$150. |

Exercise 11.

Find the G. C. M. of:—

- | | | |
|----|---------------------------|----------------------------------|
| 1. | 16 feet, and 28 feet. | 1', 6", and 1' 9". |
| 2. | 18 yds., and 12 yds. | 3 yds., 1 ft., and 8 yds., 1 ft. |
| 3. | 36 inches, and 48 inches. | 6 ft., 3 in., and 8 ft., 9 in. |
| 4. | 40 mi., and 25 mi. | 6 bu., 1 pk., and 8 bu., 3 pk. |
| 5. | 36 tons, and 28 tons. | 3s. 9d., and 4s. 2d. |
| 6. | £30, and £42. | £2 10s., and £3 15s. |
| 7. | \$42, and \$62. | 7 mi., 4 fur., and 10 mi. |

Exercise 12.

Find the largest bills with which I can pay:—

- | | | |
|----|-------------------------|-----------------------------|
| 1. | \$45, \$60, and \$85. | \$50, \$60, and \$72. |
| 2. | £35, £45, and £75. | £60, £80, and £90. |
| 3. | \$30, \$45, and \$80. | \$45, \$90, and \$100. |
| 4. | £42, £63, and £70. | £60, £75, and £120. |
| 5. | \$50, \$75, and \$90. | \$75, \$225, and \$150. |
| 6. | £75, £100, and £120. | £80, £120, and £200. |
| 7. | \$90, \$135, and \$180. | \$1.25, \$2.00, and \$2.75. |

Exercise 13.

Find the largest number which will exactly divide:—

- | | | |
|----|----------------------|---------------------------|
| 1. | 12, 18, 24, and 27. | 18, 24, 27, 36, and 48. |
| 2. | 18, 27, 45, and 48. | 35, 45, 70, 90, and 105. |
| 3. | 32, 64, 80, and 88. | 36, 54, 60, 72, and 90. |
| 4. | 54, 81, 108, and 99. | 28, 42, 70, 84, and 98. |
| 5. | 21, 35, 84, and 91. | 33, 66, 99, 88, and 77. |
| 6. | 42, 63, 84, and 77. | 75, 90, 45, 60, and 120. |
| 7. | 28, 56, 84, and 63. | 45, 60, 75, 120, and 150. |

Exercise 14.

What is the largest unit which will measure :—

1. \$15, \$30, \$20, \$45, and \$55 ?
2. 15 bush., 30 bush., 60 bush., 90 bush., and 100 bush. ?
3. 20 min., 40 min., 60 min., 75 min., and 80 min. ?
4. 45 sheep, 60 sheep, 75 sheep, 120 sheep, and 150 sheep ?
5. 42 tons, 56 tons, 70 tons, 84 tons, and 91 tons ?
6. 63 cords, 84 cords, 126 cords, 105 cords, and 147 cords ?
7. 45 yds., 75 yds., 90 yds., 180 yds., and 270 yds. ?

Exercise 15.

Find the number of which the factors are :—

- | | | |
|-------------|-----------------|--|
| 1. 2 and 3. | 2, 2, and 3. | 2 ² , 3 ² , and 5. |
| 2. 5 and 3. | 3, 3, and 5. | 2 ² , 5 ² , and 7 ² . |
| 3. 6 and 7. | 3, 5, and 7. | 2 ³ , 3, 5 ² , and 7. |
| 4. 8 and 5. | 2, 3, 5, and 7. | 2 ⁴ , 3 ² , and 5 ⁴ . |
| 5. 3 and 7. | 5, 7, and 11. | 3 ² , 5 ² , and 7 ² . |

Exercise 16.

Find the square of :—

- | | | | | | |
|-------|-----|-----|-----|-----|------|
| 1. 1. | 8. | 12. | 40. | 25. | 75. |
| 2. 2. | 7. | 11. | 80. | 35. | 95. |
| 3. 3. | 9. | 15. | 60. | 45. | 55. |
| 4. 4. | 6. | 20. | 50. | 65. | 105. |
| 5. 5. | 10. | 30. | 90. | 85. | 115. |

Exercise 17.

Find the cube of :—

- | | | | | | |
|-------|-----|-----|-----|------|------|
| 1. 1. | 6. | 11. | 30. | 80. | 200. |
| 2. 2. | 7. | 12. | 60. | 100. | 300. |
| 3. 3. | 8. | 15. | 90. | 110. | 500. |
| 4. 4. | 9. | 20. | 50. | 120. | 700. |
| 5. 5. | 10. | 40. | 70. | 150. | 900. |

Exercise 18.

Find the equal co-factors of:—

1.	4.	49.	169.	400.	1600.	1225.
2.	9.	81.	144.	900.	3600.	2025.
3.	16.	64.	196.	625.	2500.	3025.
4.	36.	100.	225.	484.	8100.	4225.
5.	25.	121.	256.	576.	4900.	5625.

Exercise 19.

1. Divide $10 \times 12 \times 14$ by 21×20 .
2. Divide $12 \times 14 \times 18$ by 21×24 .
3. Divide $15 \times 18 \times 21$ by 27×35 .
4. Divide $21 \times 24 \times 25$ by $30 \times 35 \times 12$.
5. Divide $22 \times 24 \times 28$ by $33 \times 14 \times 32$.
6. Divide $28 \times 30 \times 32$ by $24 \times 40 \times 14$.
7. Divide $32 \times 33 \times 35$ by $24 \times 28 \times 35$.

Exercise 20.

1.	$\frac{10 \times 15 \times 16}{25 \times 24} =$	$\frac{27 \times 28 \times 30}{35 \times 36 \times 18} =$	$\frac{54 \times 55 \times 56}{35 \times 66 \times 72} =$
2.	$\frac{18 \times 20 \times 21}{28 \times 30} =$	$\frac{27 \times 32 \times 35}{21 \times 36 \times 40} =$	$\frac{55 \times 56 \times 60}{25 \times 32 \times 77} =$
3.	$\frac{22 \times 24 \times 25}{33 \times 40} =$	$\frac{33 \times 35 \times 36}{27 \times 28 \times 55} =$	$\frac{56 \times 64 \times 65}{40 \times 32 \times 26} =$
4.	$\frac{27 \times 35 \times 40}{45 \times 56} =$	$\frac{35 \times 40 \times 42}{25 \times 48 \times 49} =$	$\frac{64 \times 65 \times 70}{50 \times 52 \times 56} =$
5.	$\frac{24 \times 28 \times 30}{36 \times 42} =$	$\frac{44 \times 45 \times 49}{28 \times 33 \times 35} =$	$\frac{70 \times 72 \times 80}{56 \times 60 \times 60} =$
6.	$\frac{30 \times 32 \times 33}{44 \times 48} =$	$\frac{45 \times 48 \times 50}{25 \times 36 \times 60} =$	$\frac{75 \times 80 \times 81}{45 \times 45 \times 60} =$
7.	$\frac{28 \times 30 \times 36}{42 \times 45} =$	$\frac{54 \times 56 \times 60}{42 \times 45 \times 48} =$	$\frac{80 \times 91 \times 90}{45 \times 56 \times 130} =$

Exercise 21.

1. What is the longest measure which can be used to find the size of a field [96' x 132']? [84' x 120']? [72' x 120']?

2. Find the length of the longest boards which can be used to fence a garden [48' x 84'], [72' x 132'], [68 yds. x 84 yds.].

3. Find the greatest distance at which the posts may be placed to fence a garden [84' x 108'], [80' x 112'], [168' x 200'].

4. How many posts, placed at the greatest distance possible, will be required to fence a lot [24' x 64']? [36' x 84']? [45' x 81']?

5. How many boards, the longest possible, will reach around a lot [24' x 56']? [36' x 81']? [72' x 132']?

6. How many boards, of the greatest length possible, will be required for a 5-board fence, for a lot [36' x 60']? [48' x 88']? [56' x 88']?

7. What is the least cost, at 25 cents each, of the boards required to make a 5-board fence, for a lot [45' x 63']? [40' x 88']? [60' x 96']?

Exercise 22.

1. A grocer has 49 (56, 45) pounds black tea and 63 (72, 85) pounds green tea. He puts it up in caddies, the largest possible, without mixing it. Find the weight of the caddies.

2. A grocer has 45 (39, 60) pounds of green tea and 65 (45, 84) pounds black, and puts it up in the largest caddies possible, without mixing the teas. Find the number of caddies of each.

3. A grocer has 48 (65, 63) pounds green tea and 88 (85, 77) pounds black. He puts it up in the largest caddies possible, without mixing the teas. Find the value of each caddie of tea at 75c. a pound.

4. A grocer has 51 (63, 88) pounds green tea, and 57 (75, 100) pounds black tea. He puts it into caddies the largest possible, without mixing the teas. How many caddies will he require?

1225.
2025.
3025.
4225.
5625.

5 x 56 =
5 x 72 =
6 x 60 =
2 x 77 =
4 x 65 =
2 x 26 =
5 x 70 =
2 x 56 =
2 x 80 =
0 x 60 =
0 x 81 =
5 x 60 =
1 x 90 =
x 130 =

Exercise 23.

1. Give a multiple of 2, 3, 5, 6, 9, 11.
2. Give two multiples of 4, 6, 7, 8, 12, 15.
3. What number is a multiple of 3 and 4? 5 and 6?
7 and 9? 8 and 12? 9 and 15?
4. What multiple is common to 2 and 5? 3 and 7?
8 and 9? 6 and 8? 10 and 15? 16 and 24?
5. What multiples, less than 50, are common to 2 and 3?
3 and 4? 3 and 5? 4 and 6?

Exercise 24.

Find a Common Multiple of:—

- | | | |
|-------------|-----------|-----------|
| 1. 2 and 3. | 3 and 6. | 4 and 6. |
| 2. 3 and 4. | 4 and 8. | 8 and 10. |
| 3. 2 and 5. | 3 and 9. | 8 and 12. |
| 4. 3 and 5. | 5 and 15. | 9 and 12. |
| 5. 5 and 6. | 7 and 11. | 9 and 15. |

Exercise 25.

Find the Least Common Multiple of:—

- | | | |
|---------------|------------|-------------|
| 1. 4 and 6. | 15 and 25. | 28 and 49. |
| 2. 6 and 8. | 28 and 35. | 63 and 81. |
| 3. 9 and 12. | 32 and 42. | 45 and 63. |
| 4. 8 and 12. | 32 and 48. | 72 and 84. |
| 5. 12 and 16. | 56 and 70. | 96 and 108. |

Exercise 26.

Find the L. C. M. of:—

- | | | |
|-------------------|---------------------|-----------------|
| 1. 2, 3, and 4. | 2, 4, 6, and 8. | 18, 24, and 36. |
| 2. 3, 4, and 6. | 6, 9, 12, and 15. | 15, 25, and 35. |
| 3. 6, 8, and 9. | 9, 10, 12, and 15. | 18, 27, and 45. |
| 4. 8, 9, and 12. | 10, 12, 15, and 20. | 36, 48, and 60. |
| 5. 8, 10, and 15. | 9, 15, 20, and 45. | 54, 72, and 81. |

Exercise 27.

Find the least sum of money which can be paid with :—

1. 5-cent pieces, or 10-cent pieces.
2. 10-cent pieces, or 25-cent pieces.
3. 20-cent pieces, or 25-cent pieces.
4. 20-cent pieces, or 50-cent pieces.
5. \$2 bills, or \$5 bills.
6. \$4 bills, or \$5 bills.
7. \$2 bills, \$4 bills, or \$10 bills.

Exercise 28.

Find the least sum of money which can be paid with :—

1. 4-penny pieces, or 6-penny pieces.
2. 3-penny pieces, or 4-penny pieces.
3. 6-penny pieces, or shillings.
4. 9-penny pieces, or shillings.
5. Shillings, or half-crowns.
6. Shillings, or crowns.
7. Crowns, guineas, or sovereigns.

Exercise 29.

1. Find the least number which is exactly divisible by 6 or 9, 8 or 12, 12 or 15,

2. Find the least number which is exactly divisible by 6, 8, or 10; 9, 12, or 15; 16, 20, or 24.

3. Find the least number which when divided by 5, 7, or 10 leaves a remainder of 2 (3, 4).

4. What are the least two numbers exactly divisible by 6 or 10? 12 or 15? 15 or 20?

5. Find two numbers each of which leaves a remainder of 3 (5, 4) when divided by 6, 9, or 12.

6. What is the least sum of money with which I can buy sheep at \$9, cows at \$15, or horses at \$25?

7. I have enough money to buy lambs at \$3 (\$4, \$5), or sheep at \$5 (\$6, \$8), or pigs at \$8 (\$10, \$12), and have \$2 left. How much money have I at least?

Exercise 30.

1. What is the least number of bushels of wheat that would make an exact number of full loads of 30, 32, or 36 bushels?
2. What is the least sum of money with which I can buy an exact number of 3-cent, 5-cent, 6-cent, 8-cent, or 10-cent, stamps?
3. A farm can be divided into fields containing 8, 9, 10, or 12 acres. Find the size of the farm.
4. A farm can be divided into fields of 9, 12, or 15 acres. Find value of farm at \$25 (\$75, \$125) an acre.
5. When the boys of a school are divided into sixes, sevens, eights, or elevens, there are five over. How many boys are there?
6. When a farm is divided into fields of 8, 10, or 15 acres each, there are 5 acres over. How many 5-acre lots could be made of it?
7. How many logs, of the longest uniform length, can be made of two tree trunks 63 feet and 105 feet long?

Exercise 31.

1. What measures could be used to empty, or fill, a 24-quart basket? a 36-quart basket? a 48-quart basket?
2. What weights could be used to weigh out 20, (30, 45) pounds of sugar?
3. Find all the measures which could be used to exactly fill a bushel basket.
4. Find all the measures, longer than a foot, which could be used to find the length of a pole 25 (30, 60) yards long.
5. A man has a tree 36 (40, 48) feet long. What lengths of boards may he make of it and lose none of the log?
6. Into what various sizes of fields can I divide a farm of 50 (60, 96) acres, and have an exact number of acres in each?
7. A chest contains 72 (80, 100) pounds of tea. What choice of sizes has the grocer in putting this into parcels, each having an even number of pounds of tea?

Exercise 32.

1. Find the largest number which can be subtracted an exact number of times from 56 (63, 85).
2. What is the greatest number of which 84 (96, 85) and 108 (120, 119) are multiples?
3. Find the least number of which 17, 15 and 18 are divisors.
4. Find the number which divides 78 (68, 156) and 90 (99, 181), leaving a remainder of 6 in each case.
5. Find the number which divides 82 (85, 151) and 133 (138, 136) leaving remainders of 7 and 8 respectively.
6. What is the least number of marbles which can be divided equally among 6, 8, 12, or 15 boys?
7. Two men dig 16 and 20 post-holes in a day. Find the least number of post-holes which would supply exact days' labor, either for each working alone, or for both working together.

Exercise 33.

1. The wheels of a carriage are 7 feet, and 9 feet in circumference. How often will the wheels be in the same relative position?
2. A earns \$3 a day, and B earns \$4 a day. Find the least sum of money which would pay an exact number of days' wages for A and B, working alone, or together.
3. A battalion of soldiers can be divided into companies of 64, 72, or 80 men. Find the number of men in the battalion.
4. A fence is to be built across the front of a lot. The posts may be put 8, 9, or 12 feet apart. How long is the fence at least?
5. A boy bought a number of dozens of oranges, and finds he can divide them into fives, sevens, or nines. How many did he buy?
6. Three pieces of carpet 32, 64, and 80 yds. long are used to carpet a hall, cutting the pieces into equal lengths. Find the length and width of the hall.

Exercise 34.

1. Find the longest boards possible with which I can enclose a triangular lot whose sides are 36, 54 and 81 feet.

2. A, B, and C, have 45 acres, 60 acres, and 75 acres respectively. They divide their farms into fields of the same size. Find the least number possible for each.

3. Three pieces of dress goods, 48, 64, and 72 yds., are cut into equal dress lengths. Find the least number possible.

4. I have a ditch which can be dug in an exact number of days by any one of three men who dig 4 rods, 5 rods, and 6 rods a day, respectively. Find length of the ditch.

5. Cattle are selling so that I can buy an exact number with \$45, \$75 or \$90. Find the price of cattle.

6. Find the smallest sum of money with which I can buy sheep at \$8 (\$9, \$9) each, pigs at \$12 (\$15, \$12) each or cattle at \$15 (\$20, \$20) each.

7. Find the least sum of money with which I can buy sheep at \$6 (\$6, \$8), or pigs at \$8 (\$9, \$12), or an equal number of each.

Exercise 35.

1. The product of three numbers, less than 10, is 240 (432, 252). Find the numbers.

2. The product of two consecutive numbers is 42 (56, 132). Find the numbers.

3. The product of two consecutive numbers is 210 (600, 870). Find the numbers.

4. The product of three consecutive numbers is 24 (60, 120). Find the numbers.

5. The product of three consecutive numbers is 210 (720, 3360). Find the numbers.

6. The product of three consecutive even numbers is 48 (192, 960). Find the numbers.

7. The product of three consecutive odd numbers is 105, 315 (693). Find the numbers.

Exercise 36.

1. The wheels of a carriage are 12 and 15 feet in circumference. How far will they travel before each wheel has made an exact number of revolutions?

2. The wheels of a carriage are 12 and 15 feet in circumference. In going a mile, how often will the wheels be in the same position as at starting?

How many revolutions will each have made?

How many will one have made more than the other?

3. Two wheels having 15 and 25 cogs work together. How many revolutions will the smaller wheel make before the same cogs touch each other again?

4. Two wheels having 24 (36, 30) and 30 (40, 42) cogs work together. How many revolutions will each make before the same cogs touch each other again?

5. Two wheels having 24 (28, 36) and 32 (35, 45) cogs work together. The larger makes 48 (36, 24) revolutions a second. How often will the same cogs touch each other?

6. Two wheels having 28 (32, 35), and 42 (40, 42) cogs work together. The larger wheel makes 40 (48, 30) revolutions a second. How often will the same cogs touch in running for five minutes?

7. A and B travel at the rate of 20, and 25, yards a second around a bicycle track, 300 yards in circumference. How far will each have travelled before they are again together at the starting point?

8. A, B, and C travel around a bicycle course, 240 yards in circumference, at the rate of 20, 24, and 30 yards a second. When will they be at the starting point together again?

9. A and B travel at the rate of 18 yards, and 24 yards, a second, around a bicycle course, 360 yards in circumference. How often will they be at the starting-point together?

Exercise 37.

1. Show two methods of finding the L.C.M. of three numbers.
2. Show that the two methods of finding the L.C.M. of two or more numbers are identical.
3. When is one number said to be the G.C.M. of two other numbers?
4. When is one number said to be the L.C.M. of two other numbers?
5. What is the largest number which can be the G.C.M. of any two numbers?
6. When are two numbers said to be prime to each other?
7. Find the least number which is divisible by the digits.
8. Show that a factor of two numbers is also a factor of their sum, and their difference.
9. Show that a factor of a number is a factor of all its multiples.
10. Show how to find the G.C.M. of two numbers by factoring.
11. The H.C.F. of two numbers is 3 (5, 7), and their L.C.M. is 36 (60, 210). One is 9 (15, 35). Find the other.
12. The G.C.M. of two numbers is 4 (7, 9), and their L.C.M. is 80 (441, 567). Find the numbers.
13. The G.C.M. of three numbers is 3 (2, 6) and their L.C.M. is 420 (560, 360). Two of the numbers are 12 (10, 18), and 15 (14, 24). Find the other.
14. The G.C.M. of three numbers is 6 (5, 25) and their L.C.M. is 360 (1575, 750). Find the numbers.
15. A grocer has 132 (85, 65) apples of one kind and 165 (187, 143) apples of another. Divide them into the largest lots possible, without mixing the kinds.
16. I have 81 (69, 87) black sheep, and 135 (92, 145) white sheep. I divide them into the largest flocks possible, without mixing the colors. Find the size of each flock. How many flocks of each kind have I?

VULGAR FRACTIONS.

An Integer is a whole number—a unit or collection of units.

A Fraction is a part of a unit.

The Terms, or parts, of a fraction are its numerator, and its denominator.

The Denominator tells into how many equal parts the unit is divided.

The Numerator tells how many of these equal parts are taken to form the fraction.

A Mixed Number is one that is composed of a whole number and a fraction.

There are two kinds of fractions—Vulgar and Decimal.

A Vulgar Fraction is one in which both numerator and denominator are expressed by figures.

A Decimal Fraction is one in which the denominator is merely indicated, and is 10, or a power of 10.

There are three kinds of **Vulgar Fractions** :—

- a. Simple Fractions—Proper, and Improper.
- b. Compound Fractions.
- c. Complex Fractions.

A Simple Fraction is one whose numerator and denominator are simple numbers. It is a **Proper Fraction** if the numerator is less than the denominator. It is an **Improper Fraction** if the numerator is equal to, or greater than the denominator.

A Compound Fraction is a fraction of a fraction.

A Complex Fraction is one that has a fraction, or a mixed number, for one, or both, of its terms.

Equivalent Fractions are those which are equal in value.

Exercise 38.

1. What name is given to each part, when an apple is divided into 2 equal parts? 3 equal parts? 4 equal parts? 5 equal parts?

2. An apple is divided into 4 equal parts. What is one part called? What are two of the parts called? three parts? four parts?

3. When an apple is divided into eight equal parts, what name is given to 1 part? 2 parts? 3 parts?
4. How would you get one-fourth of an apple? one-fifth? one-seventh? one-eighth? one-tenth?
5. How would you get two-thirds of an apple? three-fourths of an apple? four-fifths of an apple?
6. Which is the greater:—one-half, or one-third? one-third, or one-fourth?
7. Write in figures:—one-half, one-third, two-thirds, one-fourth, two-fourths, three-fourths, five-sixths.

Exercise 39.

1. Interpret these fractions: $-\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, $\frac{1}{9}$, $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{20}$.
2. Interpret these fractions: $-\frac{2}{3}$, $\frac{2}{3}$, $\frac{2}{4}$, $\frac{2}{5}$, $\frac{2}{7}$, $\frac{2}{8}$, $\frac{2}{9}$, $\frac{2}{11}$.
3. Express $\frac{2}{3}$, $\frac{1}{4}$, $\frac{2}{5}$, $\frac{3}{7}$, $\frac{4}{8}$, $\frac{5}{11}$ and $\frac{10}{11}$ in words.
4. What fraction of 4 is 1? 2? 3?
5. What fraction of 8 is 1? 3? 5? 7? 4? 6? 2?
6. What fraction of a week is 1 day? 2 days? 4 days?
7. A man can do a work in 7 days. How much of it can he do in 1 day? in 2 days? in 3 days? in 5 days?

Exercise 40.

1. How many halves in 1 apple? in 2 pears? in 3 oranges? in 5 yards? in 8 quarts? in 16 days?
2. How many thirds in one orange? in 3 plums? in 4 inches? in 5 feet? in 6 things? in 20 things?
3. How many quarters in 2, 3, 5, 8, 11, 16, and 20?
4. Reduce 5, 7, 9, 11, 16, 24, and 32 to sixths.
5. Express in sevenths 1, 5, 8, 11, 13, 15, and 25.
6. Convert 1, 2, 3, 7, 9, 11, and 12 into eighths.
7. Express 1, 2, 3, 5, 7, 9, and 11 as fractions with 2 (3, 4) for denominator.
8. How many boys could each get $\frac{1}{2}$ ($\frac{1}{3}$, $\frac{1}{4}$) of an apple out of 1 (2, 3, 5, 6, 7, 12) apples?

Exercise 41.

1. How many halves in $1\frac{1}{2}$ apples? in $2\frac{1}{2}$ apples? in $3\frac{1}{2}$ pears? in $5\frac{1}{2}$ things? in $7\frac{1}{2}$ dozen?
2. How many boys could each get $\frac{1}{3}$ of an apple from $1\frac{1}{3}$ ($1\frac{2}{3}$, $2\frac{2}{3}$, $3\frac{1}{3}$, $5\frac{1}{3}$, $6\frac{2}{3}$, $8\frac{1}{3}$) apples?
3. How many books at $\$1$ each could I buy with $\$1\frac{1}{2}$? $\$1\frac{3}{4}$? $\$2\frac{1}{4}$? $\$3\frac{1}{4}$? $\$5\frac{1}{4}$? $\$7\frac{3}{4}$? $\$9\frac{3}{4}$?
4. What improper fraction is equivalent to $1\frac{1}{2}$? $2\frac{2}{3}$? $3\frac{1}{3}$? $4\frac{1}{5}$? $5\frac{1}{8}$? $7\frac{1}{8}$? $9\frac{1}{10}$?
5. Reduce these mixed numbers to improper fractions: $-2\frac{1}{2}$, $3\frac{2}{3}$, $5\frac{1}{6}$, $6\frac{2}{3}$, $8\frac{1}{8}$, $9\frac{1}{8}$, and $12\frac{1}{10}$.
6. Express as simple fractions:—
 $1\frac{1}{2}$, $2\frac{2}{3}$, $3\frac{1}{6}$, $4\frac{1}{8}$, $5\frac{1}{11}$, $6\frac{1}{4}$, and $7\frac{1}{12}$.
7. Convert $1\frac{1}{6}$, $2\frac{1}{4}$, $4\frac{1}{10}$, $5\frac{1}{2}$, $6\frac{2}{3}$, $9\frac{1}{2}$, and 6, to equivalent fractions.

Exercise 42.

1. How many pears would give $\frac{1}{2}$ a pear to each of 4 (6, 10, 12, 18, 24, 36) boys?
2. How many apples would give half an apple to each of 5 (7, 11, 15, 21, 33, 45) girls?
3. At $\$1$ each, how much must I pay for 4 (8, 16, 24, 36, 48, 60) books?
4. Find the cost of 5 (7, 11, 17, 25, 38, 42) pails at $\$1\frac{1}{2}$ each?
5. What whole, or mixed, number is equivalent to $\frac{8}{2}$? $\frac{10}{2}$? $\frac{9}{3}$? $\frac{11}{2}$? $\frac{15}{4}$? $\frac{16}{3}$? $\frac{20}{3}$? $\frac{24}{5}$? $\frac{36}{7}$?
6. How many boys could each receive $\frac{2}{3}$ of an apple from $1\frac{1}{3}$ apples? $2\frac{2}{3}$ apples? 3 apples? $5\frac{1}{3}$ apples?
7. How many lots, each $\frac{3}{4}$ of an acre, can be made of 3 acres? $5\frac{1}{4}$ acres? $9\frac{1}{4}$ acres? $7\frac{1}{2}$ acres? 8 acres?

Exercise 43.

1. What part of a dollar is 50c.? 25c.? 20c.? 10c.? 40c.? 60c.? 80c.? 75c.? 90c.?
2. What fraction of a pound of tea, is 8 oz.? 4 oz.? 2 oz.? 6 oz.? 12 oz.? 7 oz.? 9 oz.?

3. What part of a day is 6 hours? 12 hours? 18 hours? 8 hours? 16 hours? 20 hours?
4. What fraction of a ton, is 1,000 lbs.? 500 lbs.? 400 lbs.? 800 lbs.? 1,200 lbs.?
5. What part of an acre is 40 sq. rds.? 20 sq. rds.? 80 sq. rds.?
6. What part of an acre is a garden [8 rds. x 10 rds.]? [5 rds. x 16 rds.]? [9 rds. x 16 rds.]?
7. What part of a bushel is 1 pk.? 3 pks.? 2 gal.? 1 gal.? 1 qt.? 1 pt.?

Exercise 44.

1. How much of an apple is left after giving away $\frac{1}{3}$? $\frac{1}{4}$? $\frac{2}{5}$? $\frac{3}{5}$? $\frac{4}{5}$? $\frac{5}{5}$?
2. Find that number $\frac{1}{5}$ of which is 2, 4, 6, 9, 17, 25.
3. Find the number $\frac{1}{5}$ of which is 2, 5, 7, 9, 12, 13.
4. Find the number $\frac{1}{3}$ of which is 4, 8, 10, 16, 24, 36.
5. Find the number $\frac{3}{4}$ of which is 9, 6, 12, 18, 24, 36.
6. Find the number of which 8 is the $\frac{4}{5}$, 9 is the $\frac{7}{9}$, 12 is the $\frac{4}{6}$, 18 is the $\frac{9}{9}$.
7. How much money have I, if $\frac{2}{5}$ of it is \$4? \$8? \$16?
8. How much money had I, if, after spending $\frac{7}{9}$ of it, I have \$8? \$10? \$12? \$16? \$28? \$48?

Exercise 45.

1. If $\frac{3}{4}$ ($\frac{2}{3}$, $\frac{4}{5}$) of my money is \$45 (\$36, \$48), how much money have I?
2. $\frac{4}{5}$ ($\frac{9}{7}$, $\frac{8}{9}$) of a number is 28 (42, 56). Find the number.
3. A man lost $\frac{1}{3}$ ($\frac{2}{3}$, $\frac{4}{7}$) of his money, and then had \$12. How much had he at first?
4. A man lost $\frac{1}{4}$ ($\frac{2}{3}$, $\frac{3}{8}$) of his flock, and then had 15 sheep. How many sheep did he lose?
5. A man's wages were increased $\frac{1}{4}$ ($\frac{1}{3}$, $\frac{2}{5}$), and he then got \$15 (\$12, \$14) a week. Find his former wages.
6. A man's flock increased $\frac{1}{4}$ ($\frac{2}{3}$, $\frac{3}{7}$) in a year, and then he had 25 (35, 40) sheep. Find the increase.
7. How many pupils are in a class, if $\frac{2}{5}$ ($\frac{3}{7}$, $\frac{5}{8}$) are boys and 24 are girls?

Exercise 46.

1. Show that $\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$. 2. Show that $\frac{2}{8} = \frac{2 \div 2}{6 \div 2} = \frac{1}{3}$.
3. When is a fraction reduced to its lowest terms?
4. Reduce $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}, \frac{5}{10}, \frac{6}{12}, \frac{7}{14}, \frac{8}{16}$, to their lowest terms.
5. Find other fractions equivalent to : $-\frac{15}{25}, \frac{21}{28}, \frac{36}{48}, \frac{44}{72}, \frac{48}{144}, \frac{96}{102}$.
6. Find the lowest terms for $\frac{15}{25}, \frac{18}{30}, \frac{26}{39}, \frac{51}{68}, \frac{36}{60}, \frac{54}{81}, \frac{46}{69}$.
7. From $\frac{15}{18}$ ($\frac{10}{24}, \frac{20}{48}$) take $\frac{8}{12}$ ($\frac{12}{27}, \frac{6}{20}$).

Exercise 47.

1. Reduce $\frac{1}{2}$ to fourths, sixths, eighths, twelfths, sixteenths, twenty-fourths.
2. Convert $\frac{1}{3}$ to sixths, ninths, twelfths, twenty-fourths, thirty-thirds.
3. Reduce $\frac{1}{2}$ to equivalent fractions having 4, 6, 8, 12, 18, 24, and 36 for denominators.
4. Reduce $\frac{2}{3}$ to equivalent fractions having 6, 9, 12, 15, 18, 24, and 36 for denominators.
5. $\frac{2}{4} = \frac{4}{8} = \frac{6}{12} = \frac{8}{16} = \frac{10}{20} = \frac{12}{24} = \frac{14}{28}$.
6. $\frac{3}{6} = \frac{4}{8} = \frac{6}{12} = \frac{8}{16} = \frac{10}{20} = \frac{12}{24} = \frac{14}{28}$.
7. Give four pairs of fractions, each pair having the same denominator, and equivalent to $\frac{1}{2}$ and $\frac{2}{3}$ ($\frac{1}{3}$ and $\frac{3}{4}$, $\frac{2}{4}$ and $\frac{4}{5}$).
8. Reduce $\frac{1}{2}$ and $\frac{2}{3}$ to sixths, twelfths, and eighteenths ; and $\frac{2}{3}$ and $\frac{3}{4}$ to twelfths, twenty-fourths, and thirty-sixths.

Exercise 48.

Reduce the following to equivalent fractions having a common denominator :—

- | | | |
|--------------------------------------|------------------------------------|--|
| 1. $\frac{1}{2}$ and $\frac{1}{3}$. | $\frac{2}{4}$ and $\frac{5}{6}$. | $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$. |
| 2. $\frac{1}{2}$ and $\frac{2}{3}$. | $\frac{1}{4}$ and $\frac{5}{6}$. | $\frac{1}{2}, \frac{2}{3}$ and $\frac{3}{4}$. |
| 3. $\frac{2}{3}$ and $\frac{1}{4}$. | $\frac{2}{3}$ and $\frac{8}{9}$. | $\frac{2}{3}, \frac{3}{4}$ and $\frac{4}{5}$. |
| 4. $\frac{1}{3}$ and $\frac{3}{4}$. | $\frac{3}{4}$ and $\frac{7}{10}$. | $\frac{3}{4}, \frac{2}{5}$ and $\frac{1}{2}$. |
| 5. $\frac{2}{3}$ and $\frac{3}{4}$. | $\frac{5}{6}$ and $\frac{8}{9}$. | $\frac{3}{4}, \frac{2}{5}$ and $\frac{3}{7}$. |

Exercise 49.

Reduce the following to equivalent fractions having the least common denominator:—

- | | | |
|--------------------------------------|-------------------------------------|--|
| 1. $\frac{1}{2}$ and $\frac{2}{3}$. | $\frac{2}{3}$ and $\frac{5}{8}$. | $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{5}{8}$. |
| 2. $\frac{2}{3}$ and $\frac{3}{7}$. | $\frac{3}{4}$ and $\frac{7}{8}$. | $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{8}$. |
| 3. $\frac{3}{4}$ and $\frac{4}{5}$. | $\frac{3}{5}$ and $\frac{7}{10}$. | $\frac{3}{4}$, $\frac{5}{8}$ and $\frac{3}{8}$. |
| 4. $\frac{3}{4}$ and $\frac{5}{7}$. | $\frac{8}{9}$ and $\frac{10}{12}$. | $\frac{2}{3}$, $\frac{5}{8}$ and $\frac{8}{9}$. |
| 5. $\frac{3}{4}$ and $\frac{5}{9}$. | $\frac{5}{8}$ and $\frac{11}{12}$. | $\frac{3}{4}$, $\frac{7}{8}$ and $\frac{5}{12}$. |

Exercise 50.

Compare these fractions as to value:—

- | | | | |
|--------------------------------------|-----------------------------------|------------------------------------|-----------------------------------|
| 1. $\frac{1}{2}$ and $\frac{2}{3}$. | $\frac{2}{3}$ and $\frac{3}{5}$. | $\frac{5}{8}$ and $\frac{1}{9}$. | $\frac{3}{9}$ and $\frac{4}{5}$. |
| 2. $\frac{2}{3}$ and $\frac{3}{4}$. | $\frac{4}{5}$ and $\frac{3}{4}$. | $\frac{3}{8}$ and $\frac{1}{4}$. | $\frac{3}{4}$ and $\frac{8}{9}$. |
| 3. $\frac{3}{4}$ and $\frac{5}{8}$. | $\frac{2}{3}$ and $\frac{5}{7}$. | $\frac{6}{7}$ and $\frac{1}{5}$. | $\frac{5}{8}$ and $\frac{8}{9}$. |
| 4. $\frac{4}{5}$ and $\frac{9}{7}$. | $\frac{3}{4}$ and $\frac{6}{7}$. | $\frac{3}{11}$ and $\frac{2}{7}$. | $\frac{3}{5}$ and $\frac{5}{9}$. |
| 5. $\frac{4}{5}$ and $\frac{5}{8}$. | $\frac{3}{5}$ and $\frac{4}{7}$. | $\frac{5}{9}$ and $\frac{1}{4}$. | $\frac{4}{7}$ and $\frac{5}{9}$. |

Exercise 51.

Arrange the following groups of fractions, in ascending order of magnitude:—

- | | |
|---|---|
| 1. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$. | $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$, and $\frac{3}{5}$. |
| 2. $\frac{1}{5}$, $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{7}$. | $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{7}{8}$. |
| 3. $\frac{2}{3}$, $\frac{2}{5}$, $\frac{3}{7}$, and $\frac{3}{4}$. | $\frac{4}{7}$, $\frac{2}{5}$, $\frac{3}{7}$, and $\frac{2}{9}$. |
| 4. $\frac{5}{6}$, $\frac{5}{9}$, $\frac{5}{8}$, and $\frac{5}{7}$. | $\frac{3}{4}$, $\frac{4}{7}$, $\frac{2}{3}$, and $\frac{2}{5}$. |
| 5. $\frac{7}{8}$, $\frac{7}{11}$, $\frac{7}{13}$, and $\frac{7}{15}$. | $\frac{4}{7}$, $\frac{3}{5}$, $\frac{1}{2}$, and $\frac{5}{8}$. |

Exercise 52.

Arrange the following fractions, in descending order of magnitude:—

- | | |
|---|---|
| 1. $\frac{1}{5}$, $\frac{1}{3}$, $\frac{1}{8}$, and $\frac{1}{8}$. | $\frac{2}{3}$, $\frac{3}{4}$, $\frac{2}{5}$, and $\frac{1}{2}$. |
| 2. $\frac{2}{3}$, $\frac{2}{5}$, $\frac{2}{4}$, and $\frac{2}{7}$. | $\frac{3}{8}$, $\frac{5}{9}$, $\frac{4}{9}$, and $\frac{2}{3}$. |
| 3. $\frac{3}{4}$, $\frac{3}{8}$, $\frac{3}{5}$, and $\frac{3}{8}$. | $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{2}$, and $\frac{5}{8}$. |
| 4. $\frac{4}{5}$, $\frac{4}{3}$, $\frac{4}{7}$, and $\frac{4}{9}$. | $\frac{4}{5}$, $\frac{9}{10}$, $\frac{3}{4}$, and $\frac{11}{12}$. |
| 5. $\frac{5}{8}$, $\frac{5}{7}$, $\frac{5}{11}$, and $\frac{5}{9}$. | $\frac{8}{9}$, $\frac{11}{12}$, $\frac{15}{18}$, and $\frac{19}{20}$. |

Addition.

Exercise 53.

Simplify :—

- | | | | | |
|----------------------------------|-------------------------------|--------------------------------|---------------------------------|---------------------------------|
| 1. $\frac{1}{2} + \frac{1}{3}$. | $\frac{1}{2} + \frac{2}{3}$. | $\frac{1}{2} + \frac{1}{4}$. | $\frac{1}{2} + \frac{5}{8}$. | $\frac{7}{8} + \frac{13}{14}$. |
| 2. $\frac{1}{2} + \frac{1}{5}$. | $\frac{2}{3} + \frac{1}{4}$. | $\frac{1}{2} + \frac{1}{8}$. | $\frac{3}{4} + \frac{5}{8}$. | $\frac{5}{6} + \frac{7}{9}$. |
| 3. $\frac{1}{2} + \frac{1}{7}$. | $\frac{2}{3} + \frac{3}{5}$. | $\frac{1}{2} + \frac{1}{5}$. | $\frac{3}{4} + \frac{7}{8}$. | $\frac{2}{4} + \frac{5}{8}$. |
| 4. $\frac{1}{3} + \frac{1}{4}$. | $\frac{2}{4} + \frac{3}{5}$. | $\frac{1}{3} + \frac{1}{8}$. | $\frac{5}{6} + \frac{11}{12}$. | $\frac{5}{6} + \frac{7}{8}$. |
| 5. $\frac{1}{3} + \frac{1}{5}$. | $\frac{2}{4} + \frac{5}{7}$. | $\frac{1}{3} + \frac{1}{6}$. | $\frac{2}{4} + \frac{7}{12}$. | $\frac{7}{9} + \frac{11}{12}$. |
| 6. $\frac{1}{3} + \frac{1}{7}$. | $\frac{1}{2} + \frac{1}{5}$. | $\frac{1}{5} + \frac{1}{10}$. | $\frac{5}{6} + \frac{5}{6}$. | $\frac{2}{4} + \frac{15}{16}$. |
| 7. $\frac{1}{5} + \frac{1}{6}$. | $\frac{2}{4} + \frac{5}{6}$. | $\frac{1}{4} + \frac{1}{8}$. | $\frac{7}{8} + \frac{5}{8}$. | $\frac{11}{12} + \frac{5}{8}$. |

Exercise 54.

1. A man had $\frac{2}{3}$ ($\frac{1}{3}$, $\frac{2}{3}$) of a dollar after spending $\frac{1}{6}$ ($\frac{1}{6}$, $\frac{5}{6}$) of a dollar. How much had he at first?
2. A man had $\frac{7}{8}$ ($1\frac{1}{2}$, $\frac{7}{8}$) of a ton of coal, and bought $\frac{5}{8}$ ($\frac{3}{8}$, $\frac{3}{8}$) of a ton. How much had he then?
3. A book cost $\$2\frac{1}{2}$ ($\$2\frac{1}{2}$, $\$2\frac{1}{2}$), and was sold to gain $\$1\frac{1}{2}$ ($\$1\frac{1}{2}$, $\$2\frac{1}{2}$). Find the selling price.
4. John spent $\$2\frac{2}{3}$ ($\$1\frac{1}{3}$, $\$2\frac{2}{3}$), and saved $\$5\frac{1}{2}$ ($\$10$, $\$11\frac{1}{2}$). How much did he earn?
5. I sold a book for $\$4\frac{1}{2}$ ($\$2\frac{1}{2}$, $\$5\frac{1}{2}$), and lost $\$1\frac{1}{2}$ ($\$1\frac{1}{2}$, $\$5\frac{1}{2}$). Find the cost of the book.
6. I mixed $\frac{5}{8}$ ($\frac{7}{8}$, $\frac{5}{8}$) lbs. black tea, with $\frac{3}{4}$ ($\frac{5}{8}$, $\frac{5}{8}$) lbs. green tea. How much was in the mixture?
7. I paid $\$5\frac{1}{2}$ ($\$7$, $\$11\frac{1}{2}$) for a hat, and $\$5\frac{1}{2}$ ($\$5$, $\$1\frac{1}{2}$) for a cane. Find the cost of both.

Exercise 55.

Find the value of :—

- | | | |
|--|---|---|
| 1. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4}$. | $\frac{2}{3} + \frac{2}{4} + \frac{1}{5}$. | $\frac{1}{7} + \frac{1}{8} + \frac{1}{9}$. |
| 2. $\frac{1}{2} + \frac{2}{3} + \frac{1}{4}$. | $\frac{1}{2} + \frac{2}{3} + \frac{5}{6}$. | $\frac{7}{8} + \frac{2}{3} + \frac{2}{5}$. |
| 3. $\frac{1}{2} + \frac{1}{4} + \frac{3}{5}$. | $\frac{2}{4} + \frac{2}{3} + \frac{3}{5}$. | $\frac{2}{7} + \frac{2}{3} + \frac{3}{5}$. |
| 4. $\frac{2}{3} + \frac{2}{4} + \frac{1}{5}$. | $\frac{4}{5} + \frac{2}{4} + \frac{5}{6}$. | $\frac{5}{7} + \frac{5}{8} + \frac{5}{9}$. |
| 5. $\frac{2}{4} + \frac{1}{3} + \frac{1}{5}$. | $\frac{1}{3} + \frac{1}{4} + \frac{1}{5}$. | $\frac{2}{3} + \frac{2}{4} + \frac{11}{12}$. |
| 6. $\frac{2}{4} + \frac{2}{3} + \frac{1}{5}$. | $\frac{2}{3} + \frac{2}{4} + \frac{2}{5}$. | $\frac{5}{6} + \frac{5}{8} + \frac{5}{12}$. |
| 7. $\frac{2}{3} + \frac{2}{4} + \frac{5}{6}$. | $\frac{2}{3} + \frac{2}{4} + \frac{2}{5}$. | $\frac{4}{5} + \frac{5}{12} + \frac{5}{6}$. |

s having

- $\frac{2}{3}$ and $\frac{5}{6}$.
- $\frac{3}{4}$ and $\frac{5}{6}$.
- $\frac{5}{6}$ and $\frac{3}{8}$.
- $\frac{5}{6}$ and $\frac{5}{6}$.
- $\frac{7}{8}$ and $1\frac{5}{12}$.

- $\frac{3}{8}$ and $\frac{4}{5}$.
- $\frac{3}{4}$ and $\frac{8}{9}$.
- $\frac{5}{6}$ and $\frac{8}{9}$.
- $\frac{3}{8}$ and $\frac{5}{9}$.
- $\frac{4}{7}$ and $\frac{5}{9}$.

in ascend-

ending order

- $1\frac{11}{12}$.
- $1\frac{19}{20}$.

Exercise 56.

What is the value of :—

- | | | | |
|------------------------------------|----------------------------------|---------------------------------|---------------------------------|
| 1. $1\frac{1}{2} + 1\frac{1}{3}$. | $3\frac{3}{4} + 2\frac{1}{5}$. | $8\frac{3}{4} + 6\frac{2}{3}$. | $3\frac{1}{2} + 4\frac{1}{7}$. |
| 2. $1\frac{1}{3} + 1\frac{1}{4}$. | $3\frac{2}{3} + 3\frac{5}{8}$. | $5\frac{1}{7} + 5\frac{1}{5}$. | $5\frac{2}{3} + 3\frac{5}{8}$. |
| 3. $1\frac{2}{3} + 2\frac{1}{4}$. | $3\frac{3}{4} + 4\frac{5}{8}$. | $8\frac{3}{7} + 2\frac{5}{8}$. | $6\frac{1}{7} + 2\frac{2}{5}$. |
| 4. $2\frac{2}{3} + 2\frac{3}{4}$. | $2\frac{1}{8} + 3\frac{1}{5}$. | $3\frac{5}{8} + 4\frac{1}{5}$. | $3\frac{1}{4} + 7\frac{1}{8}$. |
| 5. $2\frac{2}{3} + 2\frac{3}{5}$. | $4\frac{3}{8} + 2\frac{2}{5}$. | $5\frac{3}{4} + 4\frac{5}{8}$. | $1\frac{5}{8} + 3\frac{3}{7}$. |
| 6. $2\frac{1}{4} + 2\frac{2}{5}$. | $3\frac{5}{7} + 2\frac{1}{11}$. | $4\frac{1}{5} + 2\frac{2}{3}$. | $3\frac{3}{4} + 5\frac{1}{8}$. |
| 7. $3\frac{2}{3} + 2\frac{5}{8}$. | $4\frac{3}{4} + 2\frac{1}{5}$. | $3\frac{5}{8} + 2\frac{1}{5}$. | $4\frac{1}{5} + 1\frac{1}{8}$. |

Exercise 57.

1. A man mixed $2\frac{1}{2}$ ($3\frac{1}{3}$, $1\frac{3}{4}$) gal. water with $5\frac{2}{3}$ ($8\frac{3}{4}$, $6\frac{1}{3}$) gal. vinegar. How much was in the mixture?
2. A grocer mixed $3\frac{1}{5}$ ($3\frac{2}{3}$, $2\frac{1}{5}$) lbs. chicory with $8\frac{2}{3}$ ($9\frac{1}{3}$, $9\frac{5}{6}$) lbs. coffee. How many lbs. were in the mixture?
3. One field contains $8\frac{5}{8}$ ($9\frac{2}{3}$, $11\frac{1}{4}$) acres, and another $7\frac{3}{4}$ ($12\frac{2}{3}$, $9\frac{2}{3}$) acres. How much land do the two contain?
4. I walked $3\frac{2}{3}$ ($5\frac{1}{2}$, $6\frac{1}{4}$) miles one day and $5\frac{1}{4}$ ($6\frac{5}{8}$, $3\frac{2}{3}$) miles the next. How far did I walk in the two days?
5. A has $\$4\frac{5}{8}$ ($\$8\frac{1}{5}$, $\$9\frac{2}{3}$), and B has $\$6\frac{1}{5}$ ($\$4\frac{9}{10}$, $\$5\frac{4}{5}$). How much have the two?
6. A cow cost $\$16\frac{1}{4}$ ($\$25\frac{2}{3}$, $\$30\frac{1}{4}$), and a horse cost $\$28\frac{1}{2}$ ($\$35\frac{3}{4}$, $\$45\frac{5}{8}$). Find the cost of both.

Exercise 58.

1. I gained $\$1\frac{1}{2}$ ($\$2\frac{1}{4}$, $\$3\frac{3}{8}$), by selling an article that cost $\$3\frac{2}{3}$ ($\$5\frac{2}{3}$, $\$6\frac{1}{4}$). Find the selling price.
2. The cost of an article was $\$3\frac{1}{4}$ ($\$5\frac{1}{4}$, $\$6\frac{5}{8}$). The gain was $\$1\frac{5}{8}$ ($\$2\frac{1}{8}$, $\$1\frac{5}{8}$). Find the selling price.
3. James spends $\$1\frac{1}{8}$ ($\$1\frac{1}{3}$, $\$1\frac{5}{8}$) every day, and saves $\$1\frac{3}{4}$ ($\$5$, $\$3\frac{3}{8}$). Find his daily wages.
4. How much tea in a mixture of $3\frac{2}{3}$ ($4\frac{1}{2}$, $5\frac{5}{8}$) lbs. black tea, and $4\frac{1}{5}$ ($5\frac{2}{3}$, $6\frac{1}{4}$) lbs. green tea?
5. I owe John $\$3\frac{1}{2}$ ($\$5\frac{1}{4}$, $\$6\frac{3}{8}$) after paying him $\$5\frac{1}{4}$ ($\$9\frac{1}{2}$, $\$8\frac{1}{2}$). Find the original debt.
6. I paid $\$2\frac{1}{5}$ ($\$1\frac{3}{4}$, $\$1\frac{5}{8}$) for a book, and $\$3\frac{3}{4}$ ($\$2\frac{2}{3}$, $\$1\frac{1}{5}$) for paper. Find the cost of both.

Subtraction.

Exercise 59.

Find the value of :—

- | | | | | |
|----------------------------------|-------------------------------|-------------------------------|--------------------------------|-------------------------------|
| 1. $\frac{1}{2} - \frac{1}{3}$. | $\frac{2}{3} - \frac{1}{2}$. | $\frac{1}{3} - \frac{1}{4}$. | $\frac{3}{5} - \frac{3}{9}$. | $\frac{5}{9} - \frac{3}{7}$. |
| 2. $\frac{1}{3} - \frac{1}{4}$. | $\frac{1}{2} - \frac{2}{5}$. | $\frac{2}{3} - \frac{2}{7}$. | $\frac{4}{5} - \frac{1}{9}$. | $\frac{7}{8} - \frac{4}{5}$. |
| 3. $\frac{1}{3} - \frac{1}{5}$. | $\frac{3}{4} - \frac{2}{3}$. | $\frac{1}{4} - \frac{1}{5}$. | $\frac{5}{5} - \frac{5}{9}$. | $\frac{7}{9} - \frac{3}{8}$. |
| 4. $\frac{1}{3} - \frac{1}{7}$. | $\frac{1}{5} - \frac{3}{4}$. | $\frac{2}{4} - \frac{2}{5}$. | $\frac{3}{8} - \frac{3}{9}$. | $\frac{3}{4} - \frac{4}{7}$. |
| 5. $\frac{1}{4} - \frac{1}{5}$. | $\frac{3}{4} - \frac{2}{7}$. | $\frac{3}{4} - \frac{3}{5}$. | $\frac{7}{8} - \frac{7}{9}$. | $\frac{5}{6} - \frac{4}{9}$. |
| 6. $\frac{1}{4} - \frac{1}{7}$. | $\frac{5}{6} - \frac{3}{4}$. | $\frac{1}{5} - \frac{1}{9}$. | $\frac{2}{5} - \frac{2}{11}$. | $\frac{3}{4} - \frac{5}{8}$. |
| 7. $\frac{1}{5} - \frac{1}{9}$. | $\frac{3}{4} - \frac{5}{9}$. | $\frac{2}{5} - \frac{2}{9}$. | $\frac{4}{5} - \frac{4}{11}$. | $\frac{7}{8} - \frac{5}{6}$. |

Exercise 60.

1. If $\frac{3}{4}$ ($\frac{2}{4}$, $\frac{3}{4}$) of a number is 18, find the number.
2. If $\frac{3}{4}$ ($\frac{2}{6}$, $\frac{3}{7}$, $\frac{5}{8}$) of a number is 6 (8, 5) more than $\frac{2}{3}$ ($\frac{3}{4}$, $\frac{5}{6}$) of it, what is the number?
3. If $\frac{2}{3}$ ($\frac{5}{6}$, $\frac{9}{10}$) of my money is \$10 (\$5, \$9) more than $\frac{7}{9}$ ($\frac{5}{6}$, $\frac{2}{3}$) of it, how much money have I?
4. I spent $\frac{2}{5}$ of my money for a hat, and $\frac{3}{7}$ of it for a coat. Find the cost of each, if one cost \$1 more than the other.
5. Find $\frac{3}{4}$ ($\frac{2}{8}$, $\frac{4}{7}$) of my money, if $\frac{2}{3}$ ($\frac{5}{6}$, $\frac{5}{8}$) of it is \$8 (\$11, \$11) more than $\frac{4}{5}$ ($\frac{3}{8}$, $\frac{3}{7}$) of it.
6. If $\frac{3}{4}$ ($\frac{8}{8}$, $\frac{3}{4}$) doz. eggs cost 6 (9, 10) cents more than $\frac{1}{2}$ ($\frac{1}{3}$, $\frac{1}{4}$) doz., find the cost of 2 doz.
7. If $\frac{1}{2}$ ($\frac{3}{3}$, $\frac{2}{4}$) of my money is \$4 (\$5, \$7) more than $\frac{1}{3}$ ($\frac{3}{3}$, $\frac{2}{3}$) of it, how much have I?

Exercise 61.

Simplify :—

- | | | | | |
|-------------------------|---------------------|----------------------------------|---------------------------------|---------------------------------|
| 1. $3\frac{1}{2} - 2$. | $2 - \frac{1}{2}$. | $2\frac{2}{3} - \frac{1}{3}$. | $3\frac{2}{3} - 2\frac{1}{4}$. | $2\frac{1}{3} - 1\frac{1}{2}$. |
| 2. $2\frac{2}{4} - 1$. | $8 - \frac{1}{3}$. | $3\frac{3}{4} - \frac{1}{4}$. | $4\frac{3}{4} - 2\frac{3}{8}$. | $3\frac{1}{2} - 2\frac{3}{8}$. |
| 3. $5\frac{3}{8} - 3$. | $6 - \frac{1}{5}$. | $2\frac{4}{5} - \frac{3}{5}$. | $5\frac{4}{5} - 3\frac{3}{8}$. | $5\frac{3}{8} - 3\frac{3}{4}$. |
| 4. $2\frac{4}{5} - 2$. | $3 - \frac{1}{4}$. | $3\frac{5}{7} - \frac{6}{7}$. | $3\frac{3}{4} - 2\frac{3}{8}$. | $3\frac{3}{4} - 2\frac{4}{8}$. |
| 5. $3\frac{5}{8} - 2$. | $2 - \frac{2}{3}$. | $6\frac{1}{3} - \frac{2}{3}$. | $5\frac{4}{5} - 3\frac{3}{4}$. | $3\frac{3}{8} - 2\frac{7}{8}$. |
| 6. $4\frac{2}{8} - 2$. | $5 - \frac{2}{4}$. | $9\frac{3}{8} - \frac{5}{8}$. | $3\frac{7}{8} - 2\frac{5}{8}$. | $3\frac{3}{8} - 2\frac{5}{8}$. |
| 7. $4\frac{5}{9} - 3$. | $6 - \frac{1}{5}$. | $6\frac{4}{11} - \frac{8}{11}$. | $4\frac{5}{9} - 3\frac{3}{8}$. | $2\frac{3}{8} - 1\frac{7}{8}$. |

Exercise 62.

1. A man had $\$2\frac{1}{4}$ ($\$2\frac{1}{2}$, $\$2\frac{3}{4}$) and spent $\$2\frac{3}{4}$ ($\$2\frac{1}{2}$, $\$2\frac{5}{8}$). How much was left?
2. I owned $\frac{5}{8}$ ($\frac{1}{2}$, $\frac{3}{4}$) of a mill and sold $\frac{3}{8}$ ($\frac{1}{4}$, $\frac{1}{2}$) of it. How much have I left?
3. A boy earns $\$1\frac{1}{2}$ ($\$1\frac{1}{4}$, $\$1\frac{3}{4}$) a day, and spends $\$2\frac{1}{2}$ ($\$2$, $\$2\frac{1}{4}$). How much does he save?
4. John earns $\$1\frac{1}{6}$ ($\$1\frac{1}{3}$, $\$1\frac{1}{2}$) a day, and saves $\$1\frac{1}{3}$ ($\$1\frac{1}{6}$, $\$1\frac{1}{2}$). How much does he spend?
5. A man sold $\frac{3}{4}$ ($\frac{1}{2}$, $\frac{3}{4}$) of his farm. How much less than that had he left?
6. What number added to $\frac{5}{12}$ ($\frac{1}{3}$, $\frac{1}{4}$) will make $\frac{2}{3}$ ($\frac{1}{2}$, $\frac{3}{4}$)?
7. What number taken from $\frac{5}{8}$ ($\frac{1}{2}$, $\frac{3}{4}$) will leave a remainder of $\frac{1}{4}$ ($\frac{1}{8}$, $\frac{3}{8}$)?

Exercise 63.

1. The sum of two numbers is $3\frac{3}{4}$ ($5\frac{1}{2}$, $6\frac{1}{4}$). One of them is $1\frac{3}{4}$ ($2\frac{1}{4}$, $3\frac{3}{4}$). Find the other.
2. I had $\$3\frac{1}{2}$ ($\$6\frac{1}{2}$, $\$7\frac{1}{2}$) and spent $\$1\frac{1}{4}$ ($\$2\frac{1}{4}$, $\$3\frac{3}{4}$). How much have I left?
3. How much wood can I sell out of $8\frac{1}{4}$ ($9\frac{1}{8}$, $11\frac{1}{8}$) cords, and have $2\frac{1}{4}$ ($3\frac{1}{8}$, $8\frac{3}{8}$) cords left?
4. I bought $6\frac{1}{2}$ ($7\frac{1}{4}$, $8\frac{3}{4}$) tons of coal, and now I have only $3\frac{3}{4}$ ($4\frac{1}{8}$, $3\frac{3}{4}$) tons. How much have I used?
5. I sold a watch for $\$5\frac{3}{4}$ ($\$9\frac{3}{4}$, $\$8\frac{3}{4}$) and gained $\$2\frac{1}{2}$ ($\$1\frac{1}{4}$, $\$2\frac{1}{8}$). Find the cost of the watch.
6. I sold a clock which cost $\$6\frac{3}{4}$ ($\$5\frac{1}{4}$, $\$7\frac{1}{8}$) for $\$8\frac{1}{4}$ ($\$8\frac{1}{8}$, $\$8\frac{1}{4}$). Find the gain, or loss.
7. I earn $\$2\frac{1}{3}$ ($\$3\frac{1}{3}$, $\$5\frac{1}{3}$) and spend $\$1\frac{1}{4}$ ($\$2\frac{1}{3}$, $\$3\frac{1}{3}$). How much do I save?
8. I earn $\$1\frac{1}{2}$ ($\$3\frac{1}{4}$, $\$3\frac{1}{2}$) and save $\$1\frac{1}{4}$ ($\$2\frac{1}{3}$, $\$2\frac{1}{2}$). How much do I spend?
9. I spend $\$2\frac{1}{2}$ ($\$3\frac{1}{2}$, $\$2\frac{1}{8}$) a day, and save $\$2\frac{1}{4}$ ($\$1\frac{1}{4}$, $\$1\frac{1}{8}$). How much do I earn in a working week?
10. I bought a hat for $\$1\frac{1}{4}$ ($\$1\frac{1}{8}$, $\$1\frac{1}{2}$) and sold it to gain $\$2\frac{1}{4}$ ($\$3$, $\$2\frac{1}{4}$). How much did I get for it?

Exercise 64.

1. Three men own a farm. One owns $\frac{1}{3}$ of it and another owns $\frac{2}{3}$ of it. Find the third man's share.

2. How much must be added to $\frac{2}{3}$ and $\frac{1}{4}$ to make unity?

3. A, B, and C can do a work in a day. A does $\frac{2}{3}$ of the work. B does $\frac{1}{2}$ ($\frac{1}{3}$, $\frac{1}{4}$) of it. How much does C do?

4. A keg which would hold $9\frac{5}{8}$ gallons contains $4\frac{2}{3}$ ($3\frac{1}{2}$, $4\frac{1}{4}$) gallons. How much water would fill it?

5. A can do a work in 2 (3, 4) days, and B in 3 (4, 5) days. How much will the two do in a day?

6. A can do a work in 3 (4, 6) days, and B in 4 (5, 9) days. How much does A do in a day more than B?

7. A can do a work in 3 (2, 3) days, and B in 5 (4, 4) days. Find the share of each for doing the work together for \$15 (\$6.40, \$3.00).

Exercise 65.

1. After spending $\frac{2}{3}$ ($\frac{3}{4}$, $\frac{5}{8}$) of my money, I have \$12. How much had I at first?

2. Spending $\frac{4}{5}$ ($\frac{7}{8}$, $\frac{7}{8}$) of my daily wages, I save 25 cents. How much do I earn in a week?

3. After selling $\frac{2}{3}$ ($\frac{5}{8}$, $\frac{5}{8}$) of my farm, I have 18 acres. Find the value of the farm at \$25 an acre.

4. A does $\frac{2}{3}$ ($\frac{1}{2}$, $\frac{2}{3}$) of a work. B does $\frac{1}{2}$ ($\frac{7}{8}$, $\frac{2}{3}$) of the remainder. How much is left for C to do?

5. I spent $\frac{2}{3}$ ($\frac{3}{8}$, $\frac{4}{8}$) of my money, and then $\frac{2}{4}$ ($\frac{5}{8}$, $\frac{2}{8}$) of the remainder, and have 25 (75, 48) cents left. How much had I at first?

6. A can do a work in 2 (4, 5) days, and B in 3 (5, 6) days. They do the work together. What part does each do?

7. A can do a work in 3 (2, 4) days, and B in 4 (3, 6) days. How long will it take the two together? How much does A do more than B?

Multiplication.**Exercise 66.**

Simplify :—

1. $\frac{1}{2} \times 4.$

2. $\frac{1}{3} \times 9.$

3. $\frac{1}{4} \times 12.$

4. $\frac{1}{5} \times 10.$

5. $\frac{1}{6} \times 18.$

6. $\frac{1}{7} \times 27.$

Find the product of :—

$\frac{2}{3} \times 6.$

$\frac{3}{4} \times 8.$

$\frac{5}{6} \times 12.$

$\frac{1}{5} \times 15.$

$\frac{5}{8} \times 16.$

$\frac{7}{9} \times 36.$

$2\frac{1}{2} \times 4.$

$1\frac{1}{3} \times 6.$

$2\frac{1}{4} \times 12.$

$3\frac{2}{5} \times 20.$

$2\frac{3}{7} \times 21.$

$4\frac{1}{9} \times 18.$

$\frac{3}{4} \times \frac{5}{6}.$

$\frac{2}{3} \times \frac{3}{4}.$

$\frac{3}{4} \times \frac{7}{9}.$

$\frac{4}{5} \times \frac{5}{8}.$

$\frac{3}{5} \times \frac{10}{21}.$

$\frac{5}{6} \times \frac{9}{10}.$

Exercise 67.

Find the cost of :—

1. $\frac{2}{3}$ lbs. nails @ 6c., 9c., or 15c.

2. $\frac{1}{4}$ lbs. sugar @ 8c., 10c., or 12c.

3. $\frac{1}{2}$ lbs. starch @ 10c., 11c., or 12c.

4. $\frac{1}{3}$ lbs. cheese @ 12c., 13c., or 15c.

5. $\frac{1}{5}$ lbs. biscuits @ 12c., 14c., or 15c.

6. $\frac{1}{7}$ lbs. tea @ 28c., 35c., or 50c.

Exercise 68.

Find the value of :—

1. $1\frac{1}{4}$ yards ribbons @ 4c., 6c., or 8c.

2. $1\frac{1}{3}$ yards elastic @ 6c., 7c., or 10c.

3. $2\frac{1}{2}$ yards cotton @ 10c., 12c., or 15c.

4. $3\frac{1}{4}$ yards flannel @ 20c., 24c., or 30c.

5. $3\frac{3}{5}$ yards silk @ 30c., 36c., or 40c.

6. $3\frac{3}{8}$ yards dress goods @ 45c., 50c., or 60c.

Exercise 69.

Find the value of :—

1. $\frac{2}{3} \times 1\frac{1}{2}.$

2. $\frac{3}{4} \times 2\frac{2}{3}.$

3. $\frac{2}{5} \times 1\frac{3}{5}.$

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

5. $\frac{4}{5} \times 2\frac{1}{2}.$

6. $\frac{3}{7} \times 4\frac{2}{3}.$

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

$5\frac{1}{2} \times \frac{6}{11}.$

$8\frac{1}{3} \times \frac{2}{5}.$

$3\frac{3}{4} \times \frac{4}{5}.$

$2\frac{4}{5} \times \frac{6}{7}.$

$4\frac{3}{5} \times \frac{12}{13}.$

$2\frac{1}{4} \times \frac{8}{9}.$

$3\frac{8}{9} \times \frac{3}{7}.$

$2\frac{2}{3} \times 1\frac{1}{5}.$

$3\frac{1}{3} \times 1\frac{1}{5}.$

$2\frac{4}{5} \times 2\frac{1}{7}.$

$2\frac{1}{2} \times 1\frac{2}{5}.$

$2\frac{5}{8} \times 2\frac{2}{3}.$

$1\frac{7}{8} \times 1\frac{1}{4}.$

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

$2\frac{1}{3} \times 1\frac{2}{7}.$

$1\frac{1}{4} \times 5\frac{1}{4}.$

$1\frac{1}{5} \times 3\frac{3}{4}.$

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

$2\frac{1}{5} \times 1\frac{4}{11}.$

$1\frac{1}{8} \times 5\frac{1}{3}.$

$1\frac{1}{8} \times 1\frac{7}{11}.$

Exercise 70.

How much must I pay for :—

1. $\frac{2}{3}$ yd. cotton @ $7\frac{1}{2}$ c. ? $5\frac{1}{4}$ c. ? $8\frac{3}{8}$ c. ?
2. $\frac{3}{4}$ yd. print @ $5\frac{3}{8}$ c. ? $6\frac{3}{8}$ c. ? $5\frac{1}{4}$ c. ?
3. $\frac{4}{5}$ yd. calico @ $12\frac{1}{2}$ c. ? $7\frac{1}{2}$ c. ? $11\frac{1}{4}$ c. ?
4. $\frac{7}{8}$ yd. ribbon @ $5\frac{1}{3}$ c. ? $10\frac{2}{3}$ c. ? $4\frac{1}{4}$ c. ?
5. $\frac{5}{6}$ yd. braid @ $3\frac{3}{8}$ c. ? $4\frac{1}{2}$ c. ? $5\frac{3}{8}$ c. ?
6. $\frac{4}{5}$ yd. lace @ $5\frac{1}{4}$ c. ? $10\frac{1}{2}$ c. ? $5\frac{5}{8}$ c. ?
7. $\frac{5}{6}$ yd. lining @ $4\frac{1}{2}$ c. ? $3\frac{3}{8}$ c. ? $4\frac{7}{8}$ c. ?

Exercise 71.

Find the value of the following fractions :—

- | | | | |
|-------------------------|------------------------------------|------------------------------------|------------------------------------|
| 1. $\frac{1}{2}$ of 6. | $\frac{1}{2}$ of $\frac{2}{3}$. | $\frac{1}{3}$ of $1\frac{1}{2}$. | $1\frac{1}{8}$ of $2\frac{3}{8}$. |
| 2. $\frac{1}{3}$ of 12. | $\frac{1}{2}$ of $\frac{1}{4}$. | $\frac{2}{3}$ of $1\frac{1}{2}$. | $1\frac{1}{4}$ of $1\frac{3}{8}$. |
| 3. $\frac{2}{3}$ of 9. | $\frac{2}{3}$ of $\frac{5}{8}$. | $\frac{5}{8}$ of $1\frac{1}{2}$. | $2\frac{1}{4}$ of $1\frac{1}{8}$. |
| 4. $\frac{3}{4}$ of 8. | $\frac{3}{4}$ of $\frac{8}{9}$. | $\frac{3}{8}$ of $2\frac{3}{8}$. | $4\frac{1}{2}$ of $3\frac{1}{3}$. |
| 5. $\frac{4}{5}$ of 20. | $\frac{5}{8}$ of $1\frac{2}{3}$. | $\frac{7}{8}$ of $1\frac{3}{4}$. | $2\frac{3}{8}$ of $3\frac{3}{4}$. |
| 6. $\frac{5}{8}$ of 18. | $\frac{7}{8}$ of $1\frac{6}{11}$. | $\frac{5}{8}$ of $3\frac{1}{2}$. | $4\frac{1}{8}$ of $5\frac{5}{8}$. |
| 7. $\frac{2}{7}$ of 14. | $\frac{6}{5}$ of $1\frac{2}{10}$. | $\frac{7}{11}$ of $3\frac{3}{8}$. | $5\frac{5}{8}$ of $6\frac{7}{8}$. |

Exercise 72.

1. Rob had $\$2\frac{1}{2}$ ($\$5\frac{5}{8}$, $\$7$), and spent $\frac{2}{3}$ ($\frac{2}{3}$, $\frac{4}{3}$) of his money. How much did he spend? How much had he left?
2. A man had $\frac{1}{4}$ ($\frac{5}{8}$, $\frac{9}{10}$) of an acre of land, and sold $\frac{1}{2}$ ($\frac{3}{8}$, $\frac{5}{8}$) of his lot. How much land had he left?
3. A man earns $\$1\frac{1}{4}$ ($\$2\frac{3}{8}$, $\$3\frac{3}{4}$) a day, and spends $\frac{1}{3}$ ($\frac{1}{3}$, $\frac{2}{3}$) of it. How much does he save in a week?
4. I owned $\frac{3}{4}$ ($\frac{4}{5}$, $\frac{5}{8}$) of a mill, and sold $\frac{2}{3}$ ($\frac{2}{4}$, $\frac{2}{3}$) of my share for \$900. Find the value of the mill.
5. I owned $\frac{3}{4}$ ($\frac{2}{3}$, $\frac{5}{8}$) of a farm. I sold $\frac{1}{2}$ ($\frac{1}{4}$, $\frac{2}{3}$) of my share for \$600. Find value of my former share.
6. I owned $\frac{4}{7}$ ($\frac{5}{8}$, $\frac{6}{11}$) of a boat, and sold $\frac{3}{4}$ ($\frac{4}{5}$, $\frac{2}{3}$) of my share for \$120. Find value of my present share.
7. I owned $\frac{5}{8}$ ($\frac{2}{3}$, $\frac{4}{5}$) of a farm, and sold $\frac{4}{5}$ ($\frac{2}{3}$, $\frac{5}{8}$) of my share for \$8,400. Find value of the farm.

$\times \frac{5}{8}$.
 $\times \frac{3}{4}$.
 $\times \frac{7}{5}$.
 $\times \frac{5}{8}$.
 $\times \frac{10}{21}$.
 $\times \frac{9}{10}$.

$\frac{1}{3} \times 1\frac{7}{8}$.
 $\frac{1}{4} \times 5\frac{1}{4}$.
 $\frac{1}{5} \times 3\frac{3}{4}$.
 $\frac{1}{4} \times 1\frac{1}{3}$.
 $\frac{1}{5} \times 1\frac{4}{11}$.
 $\frac{1}{8} \times 5\frac{1}{3}$.
 $\frac{5}{8} \times 1\frac{7}{11}$.

Division.

Exercise 73.

Simplify :—

- | | | | |
|------------------|-------------------------|------------------------|-------------------------|
| 1. $2 \div 3$. | $\frac{2}{3} \div 2$. | $\frac{1}{2} \div 2$. | $1\frac{1}{3} \div 2$. |
| 2. $4 \div 5$. | $\frac{2}{4} \div 3$. | $\frac{1}{3} \div 2$. | $3\frac{1}{3} \div 2$. |
| 3. $5 \div 7$. | $6 \div 3$. | $\frac{1}{3} \div 3$. | $2\frac{1}{2} \div 5$. |
| 4. $8 \div 9$. | $\frac{5}{9} \div 5$. | $\frac{1}{4} \div 3$. | $3\frac{1}{3} \div 5$. |
| 5. $6 \div 11$. | $\frac{8}{9} \div 4$. | $\frac{1}{5} \div 4$. | $2\frac{2}{3} \div 4$. |
| 6. $5 \div 9$. | $\frac{12}{8} \div 6$. | $\frac{1}{5} \div 8$. | $3\frac{3}{4} \div 5$. |
| 7. $8 \div 17$. | $\frac{12}{8} \div 9$. | $\frac{1}{6} \div 9$. | $6\frac{2}{3} \div 4$. |

Exercise 74.

- Two hens cost \$ $\frac{1}{2}$. Find the cost of 1 (3, 8) hens.
- Three geese cost \$ $\frac{9}{10}$ ($\frac{6}{11}$, $\frac{11}{10}$). Find the cost of 1 (4, 7) geese.
- Divide $\frac{9}{10}$ ($\frac{4}{10}$, $\frac{1}{10}$) of an orange among three boys.
- Four men do $\frac{8}{11}$ ($\frac{4}{11}$, $\frac{1}{11}$) of a work in a day. How much will 1 (2, 3) men do in a day?
- Eight men can do $\frac{1}{2}$ ($\frac{4}{8}$, $\frac{8}{8}$) of a work in a day. How much will a man do in 1 (3, 4, 5, 7) days?
- I can walk $\frac{5}{8}$ ($\frac{1}{8}$, $\frac{1}{2}$) of a mile in 10 minutes. Find the rate per hour.
- Four men owned $\frac{3}{5}$ ($\frac{8}{15}$, $\frac{1}{5}$) of a farm worth \$6,000. Find the value of each man's share.

Exercise 75.

Find the value of :—

- | | | | |
|-------------------------------------|----------------------------------|-----------------------------------|-----------------------------------|
| 1. $\frac{2}{3} \div \frac{1}{3}$ | $\frac{4}{5} \div 2\frac{1}{2}$ | $3\frac{3}{4} \div \frac{5}{8}$ | $3\frac{3}{4} \div 1\frac{1}{4}$ |
| 2. $\frac{3}{4} \div \frac{1}{2}$ | $\frac{3}{4} \div 1\frac{1}{2}$ | $2\frac{3}{4} \div \frac{4}{9}$ | $7\frac{1}{2} \div 2\frac{1}{2}$ |
| 3. $\frac{6}{8} \div \frac{2}{3}$ | $\frac{5}{6} \div 3\frac{1}{4}$ | $4\frac{1}{2} \div \frac{3}{4}$ | $9 \div 2\frac{1}{4}$ |
| 4. $\frac{8}{9} \div \frac{2}{3}$ | $\frac{8}{9} \div 2\frac{2}{3}$ | $6\frac{2}{3} \div \frac{5}{8}$ | $6\frac{1}{4} \div 1\frac{1}{4}$ |
| 5. $1\frac{1}{2} \div \frac{3}{4}$ | $\frac{9}{16} \div 2\frac{1}{4}$ | $5\frac{5}{8} \div \frac{7}{8}$ | $8\frac{1}{2} \div 1\frac{2}{3}$ |
| 6. $1\frac{5}{16} \div \frac{3}{4}$ | $\frac{7}{12} \div 1\frac{3}{4}$ | $6\frac{3}{4} \div 1\frac{9}{10}$ | $2\frac{2}{3} \div 5\frac{1}{3}$ |
| 7. $1\frac{4}{8} \div \frac{4}{5}$ | $1\frac{9}{5} \div 2\frac{2}{3}$ | $7\frac{4}{5} \div 1\frac{3}{8}$ | $7\frac{1}{2} \div 12\frac{1}{2}$ |

Exercise 76.

Simplify these complex fractions :—

In what other way could they be expressed ?

1.	$\frac{\frac{4}{8}}{\frac{10}{8}}$	$\frac{\frac{25}{48}}{\frac{48}{38}}$	$\frac{\frac{27}{81}}{\frac{74}{72}}$	$\frac{\frac{45}{27}}{\frac{30}{68}}$	$\frac{\frac{27}{90}}{\frac{9}{33}}$	$\frac{\frac{32}{38}}{\frac{48}{63}}$	$\frac{\frac{48}{64}}{\frac{50}{72}}$
2.	$\frac{6}{\frac{2}{8}}$	$\frac{8}{\frac{4}{8}}$	$\frac{9}{\frac{2}{4}}$	$\frac{7}{\frac{3}{8}}$	$\frac{5}{\frac{7}{8}}$	$\frac{12}{\frac{8}{8}}$	$\frac{15}{\frac{10}{8}}$
3.	$\frac{\frac{2}{4}}{4}$	$\frac{\frac{6}{8}}{10}$	$\frac{\frac{8}{8}}{4}$	$\frac{\frac{10}{10}}{15}$	$\frac{\frac{7}{8}}{14}$	$\frac{\frac{9}{10}}{27}$	$\frac{\frac{8}{11}}{24}$
4.	$\frac{8}{1\frac{2}{8}}$	$\frac{6}{2\frac{1}{4}}$	$\frac{8}{3\frac{3}{8}}$	$\frac{9}{2\frac{1}{4}}$	$\frac{7}{1\frac{3}{4}}$	$\frac{12}{2\frac{2}{8}}$	$\frac{16}{5\frac{3}{8}}$
5.	$\frac{3\frac{2}{8}}{18}$	$\frac{4\frac{3}{8}}{14}$	$\frac{6\frac{1}{8}}{38}$	$\frac{2\frac{1}{4}}{6}$	$\frac{4\frac{2}{8}}{38}$	$\frac{4\frac{1}{8}}{28}$	$\frac{6\frac{3}{8}}{36}$
6.	$\frac{\frac{27}{10}}{5\frac{8}{8}}$	$\frac{\frac{48}{88}}{6\frac{7}{7}}$	$\frac{\frac{27}{33}}{6\frac{1}{4}}$	$\frac{\frac{46}{46}}{6\frac{7}{7}}$	$\frac{\frac{20}{33}}{2\frac{7}{11}}$	$\frac{\frac{24}{44}}{4\frac{0}{7}}$	$\frac{\frac{27}{46}}{4\frac{0}{7}}$
7.	$\frac{3\frac{1}{4}}{10\frac{1}{2}}$	$\frac{6\frac{2}{7}}{7\frac{1}{2}}$	$\frac{5\frac{5}{8}}{8\frac{7}{7}}$	$\frac{4\frac{2}{4}}{5\frac{1}{4}}$	$\frac{3\frac{0}{8}}{2\frac{3}{8}}$	$\frac{2\frac{1}{4}}{3\frac{0}{8}}$	$\frac{5\frac{7}{8}}{7\frac{1}{8}}$

Exercise 77.

1. A man owed \$ $\frac{3}{4}$ (\$ $\frac{5}{8}$, \$ $1\frac{1}{2}$) and paid \$ $\frac{2}{8}$ (\$ $\frac{1}{4}$, \$ $\frac{1}{8}$).
What fraction of the debt did he pay?

2. A man had \$24 (\$29, \$43), and spent \$ $2\frac{2}{7}$ (\$ $5\frac{1}{8}$, \$ $5\frac{3}{8}$).
What fraction of his money did he spend?

3. A man has to walk 28 (39, 51) miles. What part of the distance is over, when he has walked $5\frac{1}{4}$ ($8\frac{2}{8}$, $6\frac{1}{4}$) miles?

4. How many bags, each containing $7\frac{1}{4}$ ($8\frac{2}{4}$, $5\frac{8}{8}$) lbs., will weigh 29 (35, 35) lbs.?

5. I had \$45 (\$65, \$20) and spent \$ $2\frac{1}{4}$ (\$ $6\frac{1}{2}$, $6\frac{3}{8}$). What fraction of my money have I saved?

6. A has \$ $7\frac{7}{8}$ (\$ $7\frac{1}{8}$, \$ $5\frac{7}{8}$). B has \$ $8\frac{2}{8}$ (\$ $8\frac{4}{8}$, \$ $9\frac{2}{8}$). What fraction of B's money is A's?

7. I owed \$26 (\$44, \$60), and paid \$ $5\frac{7}{8}$ (\$ $9\frac{2}{8}$, \$ $6\frac{7}{8}$).
What part of the debt remains unpaid?

$1\frac{1}{3} \div 2.$

$3\frac{1}{3} \div 2.$

$2\frac{1}{2} \div 5.$

$3\frac{1}{3} \div 5.$

$2\frac{2}{3} \div 4.$

$3\frac{3}{4} \div 5.$

$6\frac{2}{3} \div 4.$

8) hens.

cost of

ee boys.

. How

n a day.

s. Find

\$6,000.

$3\frac{3}{4} \div 1\frac{1}{4}$

$7\frac{1}{2} \div 2\frac{1}{2}$

$9 \div 2\frac{1}{4}$

$6\frac{1}{4} \div 1\frac{1}{4}$

$8\frac{1}{3} \div 1\frac{2}{3}$

$2\frac{2}{3} \div 5\frac{1}{3}$

$7\frac{1}{2} \div 12\frac{1}{2}$

Exercise 78.

1. If a pound of tea costs $\$3\frac{1}{2}$ ($\$2\frac{1}{2}$, $\$4\frac{1}{2}$), how much could you get for $\$3\frac{1}{2}$ ($\$2\frac{1}{2}$, $\$4\frac{1}{2}$)?
2. How much wheat can you buy for $\$5\frac{1}{2}$ if the price be $\$2\frac{1}{2}$ ($\$1\frac{1}{2}$, $\$3\frac{1}{2}$) a bushel?
3. How many lots each containing $\frac{3}{4}$ of an acre can be made from $3\frac{3}{4}$ ($5\frac{3}{4}$, $6\frac{3}{4}$) acres?
4. The product of two numbers is $1\frac{1}{2}$ ($\frac{1}{2}$, $\frac{3}{2}$). One is $1\frac{1}{2}$ ($1\frac{2}{3}$, $2\frac{2}{3}$). Find the other.
5. What fraction divided by $\frac{1}{2}$ ($\frac{2}{3}$, $\frac{3}{4}$) will give a quotient of $\frac{1}{2}$ ($\frac{1}{3}$, $\frac{2}{3}$)?
6. If $\frac{3}{4}$ ($\frac{1}{2}$, $\frac{5}{8}$) of a cord of wood cost $\$4\frac{1}{2}$ ($\$6\frac{3}{4}$, $\$6\frac{3}{4}$) find the cost of a cord.
7. How many books at $\$2.25$ ($\$.66\frac{2}{3}$, $\$.87\frac{1}{2}$) can be bought for $\$36$ ($\$24$, $\$49$)?

Exercise 79.

1. Divide $\frac{1}{2}$ ($\frac{2}{3}$, $\frac{3}{4}$) into two equal parts.
2. Divide $\$4\frac{1}{2}$ ($\$2\frac{2}{3}$, $\$3\frac{3}{4}$) into two equal shares.
3. Divide $\frac{3}{4}$ ($\frac{1}{2}$, $\frac{1}{3}$) into two parts, one being $\frac{1}{2}$ ($\frac{1}{2}$, $\frac{1}{3}$) more than the other.
4. Divide $\$3\frac{1}{2}$ ($\$4\frac{1}{2}$, $\$6\frac{3}{4}$) between two men, giving one $\$2\frac{1}{2}$ ($\$3\frac{3}{4}$, $\$5\frac{1}{2}$) more than the other.
5. A man earns $\$3\frac{1}{2}$ ($\$2\frac{2}{3}$, $\$3\frac{1}{2}$) a day, and he spends $\$2\frac{1}{4}$ a day more than he saves. How much does he save in a day? How much does he spend in a week?
6. A man owns $7\frac{1}{2}$ ($8\frac{3}{4}$, $9\frac{1}{4}$) acres, and he sells $2\frac{1}{2}$ ($2\frac{1}{4}$, $3\frac{3}{4}$) acres more than he keeps. How many acres does he keep? How many does he sell?

Exercise 80.

1. From the sum of $\frac{2}{3}$ and $\frac{3}{4}$ ($\frac{2}{3}$ and $\frac{3}{4}$) take their difference.
2. To the sum of $\frac{2}{3}$ and $\frac{3}{4}$ ($\frac{2}{3}$ and $\frac{3}{4}$) add their difference.

3. From the sum of $1\frac{3}{4}$ and $3\frac{1}{4}$ ($2\frac{1}{2}$ and $3\frac{3}{4}$), take their difference.

4. To the sum of $3\frac{1}{4}$ and $2\frac{3}{4}$ ($5\frac{1}{4}$ and $2\frac{1}{4}$), add their difference.

5. A has $\$3\frac{3}{4}$ ($\$3\frac{3}{4}$, $\$5\frac{1}{4}$), and B has $\$2\frac{1}{4}$ ($\$2\frac{1}{4}$, $\$1\frac{1}{2}$) less. How much have both?

6. A has $\$2\frac{3}{4}$ ($\$3\frac{1}{4}$, $\$5\frac{1}{4}$), and B has $\$1\frac{1}{4}$ ($\$2\frac{1}{4}$, $\$3\frac{1}{4}$) more. How much have both?

Exercise 81.

What is the value of:—

1. $\frac{\$8}{\$4}$? $\frac{\pounds 15}{\pounds 5}$? $\frac{\pounds 15}{\pounds 10}$? $\frac{12 \text{ gals.}}{6 \text{ gals.}}$? $\frac{4 \text{ days}}{3 \text{ days}}$?
2. $\frac{\$12}{6}$? $\frac{\pounds 24}{8}$? $\frac{35 \text{ wks.}}{7}$? $\frac{36 \text{ ft.}}{9}$? $\frac{39 \text{ lbs.}}{13}$? $\frac{45 \text{ gals.}}{6}$?
3. $\frac{\$5}{50c.}$? $\frac{2 \text{ dys.}}{12 \text{ hrs.}}$? $\frac{3 \text{ bush.}}{2 \text{ pks.}}$? $\frac{8 \text{ yds.}}{2 \text{ ft.}}$? $\frac{5s}{6d}$?
4. $\frac{3 \text{ yds., } 2 \text{ ft.}}{4 \text{ ft.}}$? $\frac{7s., 6d.}{2s., 6d.}$? $\frac{8a., 120 \text{ sq. rds.}}{2a., 30 \text{ sq. rds.}}$? $\frac{12 \text{ lbs. } 8 \text{ oz.}}{2 \text{ lbs., } 8 \text{ oz.}}$?
5. $\frac{17 \text{ gals.}}{4\frac{1}{4} \text{ gals.}}$? $\frac{16 \text{ doz.}}{3\frac{1}{2} \text{ doz.}}$? $\frac{\pounds 4\frac{3}{4}}{\pounds 19}$? $\frac{6\frac{3}{4}d.}{20d.}$? $\frac{\$28}{\$5\frac{3}{4}}$?

Exercise 82.

Find, in lower denominations, the value of:—

1. $\frac{2}{3}$ of a yd. $\frac{2}{3}$ of a ton. $\frac{1}{3}$ of 2s., 6d.
2. $\frac{3}{4}$ of a bush. $\frac{2}{4}$ of a cwt. $\frac{2}{3}$ of 2 gal., 1 qt.
3. $\frac{5}{6}$ of a fath. $\frac{1}{3}$ of a gal. $\frac{2}{4}$ of $\pounds 1. 12s.$
4. $\frac{2}{3}$ of a mile. $\frac{2}{3}$ of a bush. $\frac{4}{5}$ of 1 ton, 15 cwt.
5. $\frac{4}{8}$ of a gal. $\frac{2}{3}$ of a \pounds . $\frac{3}{4}$ of 2 lbs., 4 oz.
6. $\frac{7}{8}$ of an acre. $\frac{4}{5}$ of a yd. $\frac{5}{6}$ of 2 wks., 4 da.
7. $\frac{7}{8}$ of a wk. $\frac{3}{4}$ of a league. $\frac{2}{8}$ of 2 yrs., 4 ms.

Exercise 83.

Find the G.C.M. of:—

- | | | | |
|---------------------------------------|--------------------------------------|-------------------------------------|------------------------|
| 1. $\frac{1}{2}$ and $\frac{1}{3}$. | $\frac{2}{3}$ and $\frac{5}{9}$. | $2\frac{1}{2}$ and $3\frac{3}{4}$. | $4\frac{1}{2}$ and 6. |
| 2. $\frac{1}{3}$ and $\frac{1}{4}$. | $\frac{3}{4}$ and $\frac{7}{9}$. | $3\frac{3}{4}$ and $6\frac{3}{4}$. | $7\frac{1}{2}$ and 10. |
| 3. $\frac{1}{4}$ and $\frac{1}{5}$. | $\frac{4}{5}$ and $\frac{8}{15}$. | $6\frac{1}{4}$ and $7\frac{1}{2}$. | $6\frac{3}{4}$ and 9. |
| 4. $\frac{1}{8}$ and $\frac{1}{9}$. | $\frac{7}{9}$ and $1\frac{1}{3}$. | $6\frac{3}{4}$ and $4\frac{1}{2}$. | $8\frac{3}{4}$ and 7. |
| 5. $\frac{1}{8}$ and $1\frac{1}{2}$. | $\frac{3}{10}$ and $2\frac{0}{10}$. | $8\frac{3}{4}$ and $3\frac{3}{4}$. | $5\frac{5}{8}$ and 10. |
| 6. $\frac{1}{9}$ and $1\frac{1}{3}$. | $1\frac{0}{5}$ and $1\frac{5}{5}$. | $3\frac{3}{8}$ and $5\frac{3}{8}$. | $3\frac{3}{8}$ and 9. |

Exercise 84.

Find the L.C.M. of:—

- | | | | |
|--|--------------------------------------|-------------------------------------|------------------------|
| 1. $\frac{1}{2}$ and $\frac{1}{3}$. | $\frac{5}{6}$ and $1\frac{5}{3}$. | $2\frac{1}{4}$ and $3\frac{3}{4}$. | $4\frac{2}{3}$ and 6. |
| 2. $\frac{1}{3}$ and $\frac{1}{4}$. | $\frac{6}{7}$ and $1\frac{1}{4}$. | $3\frac{3}{4}$ and $4\frac{1}{2}$. | $3\frac{1}{3}$ and 5. |
| 3. $\frac{1}{4}$ and $\frac{1}{5}$. | $\frac{5}{6}$ and $1\frac{0}{2}$. | $3\frac{1}{3}$ and $8\frac{1}{3}$. | $3\frac{1}{8}$ and 5. |
| 4. $\frac{2}{3}$ and $\frac{2}{5}$. | $1\frac{0}{2}$ and $1\frac{5}{4}$. | $4\frac{1}{5}$ and $5\frac{2}{5}$. | $5\frac{2}{5}$ and 7. |
| 5. $\frac{2}{4}$ and $\frac{2}{7}$. | $1\frac{0}{6}$ and $1\frac{5}{6}$. | $5\frac{1}{4}$ and $6\frac{3}{4}$. | $3\frac{1}{5}$ and 8. |
| 6. $\frac{5}{9}$ and $1\frac{1}{11}$. | $1\frac{5}{15}$ and $1\frac{2}{5}$. | $1\frac{1}{8}$ and $2\frac{1}{2}$. | $4\frac{1}{5}$ and 10. |

Exercise 85.

Simplify:—

- $(\frac{1}{2} + \frac{1}{3}) + (\frac{1}{3} + \frac{1}{4}) + (\frac{2}{3} + \frac{1}{4}).$ $(\frac{2}{3} + \frac{2}{4}) + (\frac{2}{3} + \frac{1}{2}) + (\frac{2}{3} + \frac{2}{4}).$
- $(\frac{1}{2} - \frac{1}{3}) + (\frac{1}{3} - \frac{1}{4}) + (\frac{1}{4} - \frac{1}{5}).$ $(\frac{2}{4} - \frac{2}{6}) + (\frac{2}{6} - \frac{1}{2}) + (\frac{2}{4} - \frac{1}{2}).$
- $(\frac{1}{2} - \frac{1}{3}) + (\frac{2}{3} - \frac{1}{4}) - (\frac{1}{3} - \frac{1}{4}).$ $(\frac{4}{6} - \frac{2}{6}) + (\frac{2}{3} - \frac{2}{6}) - (\frac{2}{6} - \frac{2}{6}).$
- $(\frac{2}{3} - \frac{1}{4}) - (\frac{2}{4} - \frac{2}{3}) + (\frac{2}{4} - \frac{2}{3}).$ $(\frac{4}{6} + \frac{2}{6}) + (\frac{6}{6} - \frac{2}{6}) - (\frac{2}{4} + \frac{2}{6}).$
- $(1\frac{1}{2} - 1\frac{1}{3}) - (2\frac{2}{3} - 2\frac{1}{4}) + (\frac{2}{4} - \frac{2}{3}).$ $(\frac{6}{2} - \frac{6}{3}) - (\frac{4}{2} - \frac{5}{4}) + (\frac{1}{2} + \frac{2}{3}).$
- $(3\frac{3}{4} + 2\frac{2}{3}) - (1\frac{2}{3} + \frac{3}{4}) - (2\frac{1}{4} + \frac{2}{3}).$ $(\frac{7}{2} + \frac{9}{6}) - (\frac{2}{3} + \frac{3}{4}) - (\frac{1}{2} + \frac{2}{3}).$

Exercise 86.

Simplify:—

- $\frac{2}{3} - \frac{2}{4}$ of $\frac{8}{5} + \frac{5}{6}$ of $1\frac{0}{10}$.
 - $\frac{3}{4} \times \frac{8}{9} + \frac{5}{6} \times \frac{1}{2} - \frac{7}{8} \times \frac{1}{4}$.
 - $\frac{2}{4}$ of $\frac{4}{5} \times \frac{5}{6}$ of $1\frac{2}{3} \times \frac{2}{4}$ of $1\frac{5}{2}$.
 - $\frac{2}{3}$ of $1\frac{0}{10} \div \frac{5}{7}$ of $1\frac{1}{4} \times \frac{2}{4}$ of $\frac{8}{5}$.
 - $\frac{2}{4} \div \frac{5}{6} \times \frac{5}{6} + \frac{2}{3} \times \frac{5}{6} \div \frac{8}{9}$.
 - $\frac{5}{8} + \frac{2}{3} \div \frac{2}{4} - \frac{5}{8} \times \frac{1}{5} + \frac{2}{3}$.
- | | |
|--|---|
| $\frac{2}{4}$ of $\frac{8}{5} + \frac{5}{6}$ of $1\frac{0}{10}$. | $\frac{2}{4}$ of $\frac{8}{5} + \frac{5}{6}$ of $1\frac{0}{10} - \frac{4}{5}$ of $1\frac{5}{6}$. |
| $\frac{3}{4} \times \frac{8}{9} + \frac{5}{6} \times \frac{1}{2} - \frac{7}{8} \times \frac{1}{4}$. | $\frac{2}{4} - \frac{2}{3}$ of $\frac{5}{6} \times \frac{2}{3} \div \frac{2}{3}$ of $1\frac{1}{4}$. |
| $\frac{2}{4}$ of $\frac{4}{5} \times \frac{5}{6}$ of $1\frac{2}{3} \times \frac{2}{4}$ of $1\frac{5}{2}$. | $\frac{2}{3} \div 1\frac{1}{3} \times 1\frac{1}{2} - \frac{5}{6} \times 1\frac{4}{5} \div 1\frac{1}{3}$. |
| $\frac{2}{3}$ of $1\frac{0}{10} \div \frac{5}{7}$ of $1\frac{1}{4} \times \frac{2}{4}$ of $\frac{8}{5}$. | $\frac{2}{4} - \frac{4}{5} \div 1\frac{0}{10} + 1\frac{0}{10}$ of $1\frac{3}{8}$. |
| $\frac{2}{4} \div \frac{5}{6} \times \frac{5}{6} + \frac{2}{3} \times \frac{5}{6} \div \frac{8}{9}$. | $(\frac{1}{2} + \frac{2}{3})(\frac{2}{4} - \frac{1}{3}) \div (\frac{2}{3}$ of $\frac{7}{8})$. |
| $\frac{5}{8} + \frac{2}{3} \div \frac{2}{4} - \frac{5}{8} \times \frac{1}{5} + \frac{2}{3}$. | $(\frac{4}{5} - \frac{2}{4})(\frac{2}{4} \times \frac{2}{3}) \div (\frac{2}{4} \div \frac{2}{3})$. |

Exercise 87.

1. Find the sum of the proper fractions with one figure in each term which can be written with the first three digits.

2. How can you show, by inspection, whether a number is exactly divisible by 2? 4? 8? 3? 6? 9? 5? 10? 25? 50? 100?

3. Find the number whose half $- 2 =$ its third $+ 7$.

4. Find the product and the two quotients of $\frac{3}{8}$ and $\frac{2}{3}$.

5. What length of wire will be required to make a 5-strand wire fence around a field $\frac{3}{4}$ mile \times $\frac{1}{2}$ miles?

6. Of what two numbers is 18 (24, 30) the L.C.M.?

7. The bells of a chime strike each second, two seconds, three seconds, and four seconds, respectively. How often will they strike together each minute?

8. Find the square root of:—

(1) $\frac{1}{4}, \frac{1}{9}, \frac{1}{25}, \frac{1}{16}, \frac{1}{36}, \frac{1}{49}, \frac{1}{81}, \frac{1}{64}, \frac{1}{100}$.

(2) $\frac{4}{9}, \frac{4}{25}, \frac{9}{16}, \frac{1}{36}, \frac{1}{25}, \frac{9}{16}, \frac{1}{100}, \frac{81}{64}, \frac{25}{16}$.

(3) $2\frac{1}{4}, 1\frac{1}{9}, 1\frac{9}{16}, 2\frac{7}{9}, 3\frac{1}{16}, 6\frac{1}{4}, 12\frac{1}{4}, 32\frac{6}{25}, 11\frac{1}{9}$.

Exercise 88.

1. How many books at $6\frac{1}{4}$ ($8\frac{1}{3}$, $11\frac{1}{3}$) cents will cost \$5?

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

3. How many boxes $4\frac{1}{2}'' \times 3\frac{3}{4}'' \times 5\frac{1}{2}''$ will hold as much as 60 boxes $2\frac{1}{4}'' \times 2\frac{3}{4}'' \times 1\frac{1}{4}''$?

4. Divide \$35 (\$85, \$108) between A and B so that $\frac{1}{3}$ ($\frac{2}{3}$, $\frac{2}{3}$) of A's share $= \frac{1}{4}$ ($\frac{3}{8}$, $\frac{3}{4}$) of B's share.

5. The sum of two numbers is $\frac{3}{4}$ ($2\frac{1}{4}$, $3\frac{3}{4}$) and their difference is $\frac{7}{8}$ ($\frac{5}{8}$, $\frac{2}{3}$). Find the numbers.

6. Minuend $\frac{3}{4}$ ($\frac{5}{8}$). Subtrahend $\frac{2}{3}$ ($\frac{1}{4}$). Find difference.

7. Subtrahend $\frac{4}{5}$ ($\frac{7}{8}$). Difference $\frac{2}{3}$ ($\frac{2}{3}$). Find minuend.

8. Dividend $\frac{5}{6}$ ($\frac{7}{8}$, $\frac{8}{9}$). Quotient $\frac{7}{8}$ ($\frac{4}{5}$, $1\frac{2}{3}$). Find divisor.

9. Quotient $\frac{7}{8}$ ($\frac{8}{9}$, $2\frac{1}{4}$). Divisor $\frac{7}{8}$ ($\frac{3}{4}$, $\frac{1}{4}$). Find dividend.

10. Product $\frac{4}{5}$ ($\frac{7}{8}$). Multiplier $\frac{2}{3}$ ($\frac{7}{8}$). Find multiplicand.

Exercise 89.

1. How is a vulgar fraction written, or expressed?
2. Name the terms of a fraction. Give the function of each.
3. When is a vulgar fraction greater than unity? Why is an improper fraction so named?
4. How could you compare two or more fractions?
5. How do you reduce a fraction to its lowest terms? State the theorem on which this depends.
6. Give the steps necessary to find the sum (1) of two fractions, (2) of two mixed numbers.
7. How may a fraction be (1) multiplied? (2) divided?
8. Prove that $\frac{1}{3}$ of $2 = \frac{2}{3}$ of 1 ; $\frac{1}{2} = \frac{2}{4}$; and $\frac{1}{2}$ of $\frac{1}{3} = \frac{1}{6}$.
9. Prove that the value of a fraction is not altered by multiplying or dividing its terms by the same number.
10. What effect does adding, or subtracting, the same number from both terms of a fraction have upon the value of the fraction?
11. Show that multiplying the numerator of a fraction multiplies the value of the fraction, and multiplying the denominator divides its value.
12. Show that the value of a fraction is decreased or increased as you divide the numerator or multiply the denominator.
13. Supply denominators :— $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{15}{20} = \frac{21}{28} = \frac{36}{48}$.
14. Supply numerators :— $\frac{5}{6} = \frac{3}{2} = \frac{4}{8} = \frac{6}{9} = \frac{10}{15}$.
15. By inspection, arrange in order of magnitude :—
 $\frac{1}{2}, \frac{1}{8}, \frac{1}{7}, \frac{1}{15}, \frac{1}{3}, \frac{1}{18}, \frac{1}{30}, \frac{1}{25}, \frac{1}{24}, \frac{1}{17}, \frac{1}{10}, \frac{1}{27}$.
 $\frac{3}{8}, \frac{3}{4}, \frac{3}{7}, \frac{3}{10}, \frac{3}{13}, \frac{3}{16}, \frac{3}{23}, \frac{3}{25}, \frac{3}{22}, \frac{3}{19}, \frac{3}{35}, \frac{3}{17}$.
 $\frac{3}{4}, \frac{5}{6}, \frac{3}{8}, \frac{11}{12}, \frac{7}{8}, \frac{15}{16}, \frac{9}{10}, \frac{23}{24}, \frac{21}{19}, \frac{18}{18}, \frac{17}{20}$.
 $\frac{5}{7}, \frac{7}{6}, \frac{3}{5}, \frac{17}{19}, \frac{27}{11}, \frac{9}{13}, \frac{21}{23}, \frac{15}{17}, \frac{19}{21}, \frac{25}{27}, \frac{31}{33}$.
16. Show that additions and subtractions, or multiplications and divisions, may be made in any order.
17. How do you find the G.C.M. and the L.C.M. of two or more fractions?

DECIMAL FRACTIONS.

A Decimal Fraction is one whose denominator is merely indicated, and is 10, or a power of 10. It is generally called a **decimal**.

The decimal point, by its position, indicates the denominator of the fraction.

A Pure decimal is one that is made up of decimal figures only; as .4, .48.

A Mixed decimal is one that is made up of a whole number and a decimal; as 4.3, 2.47.

A Complex decimal is one that has a vulgar fraction to the right of the decimal; as $.3\frac{1}{2}$, $.5\frac{1}{2}$.

There are two kinds of decimal fractions:—

Terminating decimals, and **Circulating decimals**.

Terminating decimals are those whose division is complete.

Circulating, Repeating, Recurring, or Interminate decimals are those whose division cannot be completed.

A Pure Circulating decimal is one in which all the figures of the decimal part repeat.

A Mixed Circulating decimal is one in which some of the figures of the decimal part do not repeat.

The Repetend is that part of the decimal fraction which repeats.

Numeration and Notation.

Exercise 90.

1. Show the relation of 100 to 10, of 200 to 20, of 400 to 40, of 700 to 70, of 900 to 90.
2. Show the relation of 10 to 1, of 20 to 2, of 40 to 4, of 70 to 7, of 90 to 9.
3. Show the relation of 1 to .1, of 2 to .2, of 4 to .4, of 7 to .7, of 9 to .9.
4. Show the relation of .1 to .01, of .2 to .02, of .4 to .04, of .7 to decimal .07.

5. Compare the value of each of the figures of 11.11 to the others.

6. Show the relation of the figures of 555.55 to each other.

7. Show the relation of the figures of 777.77 to each other.

Exercise 91.

1. An apple is divided into ten equal parts. What is one part called? two parts? four parts? seven parts? Write these fractions in two ways.

2. Interpret:—.1 apple, .2 pear, .3 pie, .5 dollar, .7 loaf, .8 quart, .9 gallon.

3. Read, and interpret:—.1, .2, .4, .6, .3, .9, .5, .8, .7.

4. Read, and interpret:—.40, .50, .70, .83, .25, .67.

5. How could you change tenths to hundredths? How many hundredths are in .1? .2? .3? .5?

6. $\frac{1}{10} = \frac{100}{1000} = \frac{1000}{10000}$; $\frac{2}{10} = \frac{200}{1000} = \frac{2000}{10000}$; $\frac{5}{10} = \frac{500}{1000} = \frac{5000}{10000}$.
 $.2 = \frac{\quad}{\quad}$; $.4 = \frac{\quad}{\quad}$; $.7 = \frac{\quad}{\quad}$.
 Show that $.3 = .30$; $.5 = .50$; $.7 = .70$; $.9 = .90$.

7. How could you change hundredths to thousandths? How many thousandths are in '24? '37? '45?

Exercise 92.

Read the following decimal fractions:—

Write them in words.

Pupils will write decimally as the teacher dictates.

1. .1	.23	.124	.3546	.47683	.30765
2. .4	.44	.303	.0367	.50047	.81207
3. .6	.35	.548	.2059	.98035	.60509
4. .7	.97	.082	.6004	.67309	.49032
5. .3	.62	.865	.0083	.03452	.02345
6. .8	.86	.297	.0796	.00908	.70086
7. .9	.59	.006	.0005	.36004	.53094

Exercise 93.

Express decimally :—

1. One tenth, three tenths, five tenths, eight tenths, twelve tenths, twenty-five tenths.

2. Seven hundredths, two hundredths, nine hundredths, twenty-four hundredths, thirty-eight hundredths, forty-seven hundredths, ninety-six hundredths.

3. Five thousandths, eight thousandths, four thousandths, sixteen thousandths, fifty-eight thousandths, eighty-five thousandths, seventy-two thousandths, three hundred and sixty-one thousandths, four hundred and three thousandths, five hundred and seventy-nine thousandths.

4. Eight ten-thousandths, twelve ten-thousandths, one hundred and nine ten-thousandths, seven thousand and ninety-four ten-thousandths, nine hundred and three ten-thousandths.

5. Eleven hundred-thousandths, six millionths, twenty-one ten-millionths, three hundred and four millionths, seven thousand and six millionths.

6. $\frac{5}{10}, \frac{6}{10}, \frac{9}{10}, \frac{8}{10}, \frac{15}{10}, \frac{18}{10}, \frac{24}{10}, \frac{35}{10}, \frac{50}{10}, \frac{80}{10}, \frac{37}{10}$.

7. $\frac{45}{100}, \frac{36}{100}, \frac{37}{100}, \frac{125}{100}, \frac{234}{100}, \frac{526}{100}, \frac{3}{100}, \frac{9}{100}, \frac{7}{100}, \frac{40}{100}, \frac{50}{100}$.

8. $\frac{458}{1000}, \frac{285}{1000}, \frac{28}{1000}, \frac{34}{1000}, \frac{5}{1000}, \frac{8}{1000}, \frac{9648}{1000}, \frac{73896}{1000}$.

Exercise 94.

Read the following mixed decimals :—

Write the following decimals in words :—

Pupils, write decimally as the teacher dictates.

1. 2.3	35.46	345.687	3.004	63.4708
2. 4.7	9.35	58.076	53.07	9.0305
3. 9.6	20.08	526.35	6.3	70.9006
4. 7.8	48.62	603.009	80.045	837.326
5. 3.5	63.7	700.562	204.09	300.04
6. 5.9	87.54	860.045	.008	42.8507
7. 8.2	12.91	497.803	126.	301.0001

Exercise 95.

Express as decimals :—

1. Three and five tenths, seven and one tenth, twelve and nine tenths, sixteen and twenty-nine hundredths.

2. Seven and four hundredths, nine and forty seven thousandths, forty and five hundred and ninety-eight thousandths.

3. Twenty four and thirty-seven hundredths, forty-seven and twenty-nine thousandths ; one hundred and eight and three hundred and twenty-five thousandths.

4. Two thousand and three, and seven ten thousandths ; four, and eight hundred-thousandths ; five hundred, and nineteen millionths ; forty-five, and sixty-seven millionths ; seven hundred, and four ten-thousandths ; nine thousand and fourteen hundred-thousandths.

5. $6\frac{4}{10}$, $9\frac{3}{10}$, $12\frac{4}{10}$, $20\frac{6}{10}$, $35\frac{7}{10}$, $408\frac{5}{10}$, $600\frac{5}{10}$.

6. $5\frac{34}{100}$, $8\frac{46}{100}$, $16\frac{33}{100}$, $37\frac{88}{100}$, $55\frac{34}{1000}$, $66\frac{88}{1000}$.

7. $7\frac{86}{1000}$, $4\frac{58}{1000}$, $17\frac{4}{10000}$, $307\frac{307}{10000}$, $1\frac{1}{100000}$.

Exercise 96.

The value of a figure in decimal notation depends on its position in the number. Show this.

Read each figure in the following numbers :—

Read each two consecutive figures :—

Read any three consecutive figures :—

Read the three numbers :—

Express them in words, paying attention to the spelling, punctuation, hyphens and periods.

463,897,125.579,286,714 325,546.897.638,454,789

309,620,087.045,403,078 403,024,710.505,860,076

500,064,000.379,000,208 500,030,004.720,064,080

Exercise 97.

Read the following decimal fractions :—

Show how each differs from the preceding fraction.

How is each obtained from its predecessor?

Express decimally as the teacher dictates.

1. 350, 35, 3.5, .35, .035, .0035, .035, .35, 3.5.
2. 47, 4.7, .47, .047, .0047, .47, 4.7, 470.
3. 45, 450, 4.5, .045, .00045, .45, 450.
4. 475, 4.75; 47.5, 4750, 4.75, .0475, 47.5, 4750.
5. 3.08, 30.8, .308, 308, 3.08, .0308, .00308, 3.08.

Exercise 98.

Write the successive answers in a column.

Read each answer.

How does each compare with the other?

1. $3708 \times 10 \times 10 \times 10 \div 10 \div 10 \div 10 \div 10 \div 100$.
2. $5036 \div 10 \div 10 \div 10 \times 100 \div 10 \div 100 \div 10$.
3. $50.69 \times 10 \div 100 \times 10 \times 10 \times 10 \times 10 \div 1000 \div 100$.
4. $400.2 \times 100 \div 1000 \div 1000 \times 10,000 \times 100 \div 1,000,000$.
5. $7.345 \times 10 \times 100 \div 10 \div 100 \times 1000 \div 100 \times 1000 \div 10000$.

Exercise 99.

Express as vulgar fractions in their lowest terms :—

- | | | | | | |
|-------|-----|------|-------|--------|------|
| 1. .1 | .25 | .125 | .0625 | .03125 | .064 |
| 2. .3 | .75 | .375 | .1875 | .09375 | .032 |
| 3. .4 | .45 | .625 | .3125 | .15625 | .096 |
| 4. .6 | .35 | .875 | .4375 | .34375 | .048 |
| 5. .5 | .65 | .128 | .5625 | .46875 | .024 |
| 6. .8 | .85 | .256 | .6875 | .21875 | .072 |
| 7. .7 | .95 | .512 | .8125 | .28125 | .144 |

What vulgar fractions are equivalent to :—

- .256, .128, .064, .192, .384, .096, .048, .024, .012,
 .036, .084, .108, .216, .072, .288, .576, .192, .096, .96,
 .048, .24, .08, .04, .004?

Addition.**Exercise 100.**

Read the following questions :—
Give the answers at sight.

1. .4+.3	\$.3+\$.4	.32+.45	\$2.3+\$4.5
2. .5+.6	\$.5+\$.2	.64+.34	\$4.6+\$3.2
3. .8+.7	\$.7+\$.6	.75+.23	\$5.2+\$6.8
4. .3+.9	\$.9+\$.3	.83+.15	\$3.8+\$5.6
5. .9+.4	\$.8+\$.5	.48+.21	\$6.5+\$2.3
6. .7+.8	\$.6+\$.9	.27+.42	\$7.9+\$9.8
7. .6+.4	\$.4+\$.8	.19+.6	\$8.4+\$7.9

Exercise 101.

1. Find the amount of :—

$$.4+.3+.8+.6+.9+.2+.5$$

$$.6+.4+.9+.3+.8+.5+.7$$

$$.7+.2+.8+.5+.4+.9+.3$$

2. Find the sum of :—

$$.23, .24, .25, .53, .62, .27 \text{ and } .32$$

$$.35, .47, .84, .63, .72, .56 \text{ and } .98$$

$$.68, .34, .73, .26, .95, .42 \text{ and } .57$$

3. Find the aggregate of :—

$$.824, .213, .342, .657, .448, .576 \text{ and } .384$$

$$.487, .568, .359, .625, .834, .293 \text{ and } .946$$

$$.329, .248, .765, .856, .935, .674 \text{ and } .583$$

4. Find the amount or total of :—

$$6.37+2.45+3.39+5.64$$

$$3.09+3.54+2.3+3.67$$

$$5.48+3+3.04+6.7+.345$$

5. Find the sum of :—

$$3.245+1.0008+3.04+.0025+3.403$$

$$2.326+32.24+25.009+304.405$$

$$3.0256+2.3004+5.0045+.3045$$

Subtraction.**Exercise 102.**

1. .3 - .2	\$1.3 - \$.4	\$3.4 - \$2.9	\$4.37 - \$2.57
2. .4 - .2	\$2.4 - \$.5	\$5.6 - \$3.8	\$6.25 - \$3.75
3. .6 - .4	\$3.5 - \$.8	\$2.3 - \$1.4	\$7.43 - \$5.63
4. .9 - .5	\$1.6 - \$.7	\$6.1 + \$5.6	\$3.92 - \$1.82
5. .5 - .3	\$2.3 - \$.6	\$4.5 - \$3.7	\$9.68 - \$6.54
6. .8 - .6	\$4.7 - \$.9	\$9.2 - \$4.5	\$5.74 - \$2.37
7. .7 - .4	\$3.2 - \$.3	\$7.8 - \$3.9	\$8.56 - \$4.28

Exercise 103.

1. A boy had \$3.4, and paid \$1.6 (\$2.3, \$2.8) for a hat. How much had he left?
2. A man who had 9.63 acres of land sold 4.05 (2.78, 3.005) acres. How much had he left?
3. Find the difference between .8 and .65, .45 and .325, .48 and .279, 3.4 and 1.347, 2.004 and 1.568.
4. From 6.3876 take 2.3063 (1.4238, 1.5284).
5. Find the remainder after taking:—
.8 from 1.4, 2.6, 3.5, 2.9, 3.7, 4.3 and 6.
.46 from 3.58, 2.79, 3.82, 4.29, 3.24, 3.05 and 6.4.
.537 from 2.638, 3.205, 1.742, .836, .82, .9 and 6.
6. How much does 4.83 exceed 2.54 2.487? and 1.00834?
7. Fill the blanks in the following:—

Minuend	3.56	6.09	....	.....	\$3.067	\$5.203
Subtrahend	1.49	....	3.86	5.037	\$1.549	.....
Difference	....	2.35	2.54	3.325	.....	\$2.565

Exercise 104.

1. What decimal added to .4, .35 or .428 will make unity?
2. Find the difference between unity and the sum of:—
.3 and .45, .4 and .38, $\frac{2}{4}$ and .38.

3. How much does unity exceed the sum of :—
.3, .249 and .133 ; .34, .522 and .026 ; .76, .025, .075?
4. Find the difference between unity and the sum of :—
.3, .249 and .234 ; .34, .522 and .348.
5. How much must be added to the sum of .45, .36 and .96 to make 2?
6. How much does the sum of .56, .386 and .434 exceed unity?
7. What decimal fraction added to the sum of .45, .67 and .38 will make a whole number?

Exercise 105.

1. Find the sum of, and the difference between :—
.5 and .6 ; .46 and .34 ; 3.2 and 1.6 ; 4.56 and 2.34.
2. Find the difference between the sum and the difference between :— .4 and .9 ; .45 and .63 ; 3.4 and 5.9.
3. The sum of two numbers is 4.5. One of them is 2.3 (3.8, 2.9). Find the other.
4. The sum of two numbers is 3.8. One is .6 (1.2, .9) greater than the other. Find the two numbers.
5. .5 (.25, .05) of my money is \$4. How much have I?
6. .247 of my money is \$8.00 more than 1.22 of it. How much money have I?
7. Find the result of :—

$.64 + 3.2 - 1.44$	$\$3.56 + \$2.33 - \$1.36$
$3.24 + 2.76 - 3.25$	$\$5.49 + \$2.51 - \$3.67$
$4.56 - 3.25 + 3.44$	$\$3.35 + \$2.36 - \$4.71$

Exercise 106.

Simplify, or give the result of :—

1. $(2.3 - 1.4) + (1.3 + 1.4)$.
2. $(3.4 - 2.6) + (2.8 + 1.9)$.
3. $(5.3 - 1.8) - (1.2 + 1.3)$.
4. $(3.4 + 2.6) - (3.5 - 2.8)$.
5. $(3.8 + 2.7) - (3.6 - 1.25)$.
6. $(3.5 - 2.7) - (3.4 - 2.85)$.
7. $(3.46 - 2.25) - (4.48 - 3.98)$.

Multiplication.**Exercise 107.**

Simplify and verify by using vulgar fractions.
Show the reason for fixing the decimal point.

- | | | | | |
|------------------|----------------|---------------|----------------|------------------|
| 1. $.4 \times 2$ | 1.2 $\times 2$ | 3 $\times .2$ | .3 $\times .2$ | 1.2 $\times 1.8$ |
| 2. $.7 \times 2$ | 2.4 $\times 3$ | 5 $\times .3$ | .4 $\times .6$ | 2.3 $\times 2.7$ |
| 3. $.6 \times 3$ | 3.5 $\times 4$ | 4 $\times .4$ | .8 $\times .5$ | 2.4 $\times 2.6$ |
| 4. $.5 \times 3$ | 2.6 $\times 5$ | 8 $\times .6$ | .5 $\times .3$ | 3.5 $\times 3.5$ |
| 5. $.8 \times 4$ | 3.7 $\times 6$ | 6 $\times .9$ | .7 $\times .7$ | 4.4 $\times 4.6$ |
| 6. $.9 \times 4$ | 2.8 $\times 7$ | 7 $\times .5$ | .6 $\times .4$ | 2.9 $\times 2.1$ |

Exercise 108.

Find the cost of:—

- | | |
|-------------------------|-------------------------|
| 1. .3 lb. sugar @ 6c. | .4 lb. rice @ 7.5c. |
| 2. .8 lb. rice @ 5c. | .6 lb. barley @ 8.4c. |
| 3. .4 lb. sago @ 9c. | .3 lb. sago @ 9.3c. |
| 4. .9 lb. starch @ 8c. | .9 lb. butter @ 12.5c. |
| 5. .5 lb. cheese @ 12c. | .5 lb. cheese @ 10.7c. |
| 6. .7 lb. butter @ 15c. | .8 lb. currants @ 6.8c. |

Exercise 109.

What is the cost of:—

- | | |
|-----------------------------|---------------------------|
| 1. 2.5 lbs. cocoa @ \$.35? | .34 lbs. butter @ \$.26. |
| 2. 2.8 lbs. cheese @ \$.12? | .48 lbs. cake @ \$.25? |
| 3. 2.4 lbs. butter @ \$.25? | .75 doz. oranges @ \$.32? |
| 4. 3.9 lbs. coffee @ \$.41? | .25 doz. eggs @ \$.16? |
| 5. 4.8 lbs. lard @ \$.15? | .63 lbs. tea @ \$.77? |
| 6. 9.6 lbs. tea @ \$.94? | .55 lbs. coffee @ \$.45? |

Exercise 110.

Find the area of fields:—

- | | | |
|----------------------------|-------------------|---------------------------|
| 1. [1.2 \times 1.8] ch. | 2.5 rds. square. | [3.8 \times 4.2] yds. |
| 2. [1.4 \times 1.6] rds. | 3.5 rds. square. | [9.3 \times 8.7] yds. |
| 3. [1.5 \times 1.5] mi. | 4.5 rds. square. | [3.6 \times 44] yds. |
| 4. [2.4 \times 26] ch. | 9.5 yds. square. | [5.5 \times 4.5] ft. |
| 5. [3.5 \times 35] rds. | 12.5 yds. square. | [4.7 \times 53] ft. |
| 6. [.33 \times .37] mi. | 19.5 yds. square. | [10.3 \times 97] yds. |
| 7. [4.8 \times 4.2] rds. | 39.5 ft. square. | [29.2 \times 3.08] rds. |

Exercise 111.

- How many feet of inch lumber will cover a floor :—
 $12.3' \times 12.7'?$ $19.5' \times 20.5'?$ $13.7 \text{ yds.} \times 1.1 \text{ yds.}?$
 $9.4' \times 9.6'?$ $14.5' \times 15.5'?$ $2.48 \text{ yds.} \times 2.1 \text{ yds.}?$
 $28' \times 2.2'?$ $29.3' \times 30.7'?$ $34.5 \text{ yds.} \times 3.1 \text{ yds.}?$
- How many cords of wood are in a pile :—
 $3.2' \times 6.4' \times 16'?$ $2.4' \times 3.2' \times 12.3'?$ $48' \times 3.6' \times 7.2'?$
- Find the volume of a pile of stones :—
 $2.5' \times 3.6' \times 6.4'?$; $1.25' \times 2.4' \times 4.3'?$; $3.75' \times 1.6' \times 3.6'.$

Exercise 112.

Find the product of :—

- | | | | |
|---------------------|------------------|-----------------|------------------|
| 1. 2.5×2.4 | 2.4×3.5 | $32 \times .38$ | $95 \times .95$ |
| 2. 3.6×2.5 | 4.2×3.5 | $46 \times .44$ | $4.9 \times .51$ |
| 3. 4.7×2.5 | 35×6.4 | $53 \times .57$ | $3.6 \times .25$ |
| 4. 6.3×2.5 | 45×6.4 | $62 \times .68$ | 7.4×8.6 |
| 5. 25×7.5 | 5.6×4.5 | $39 \times .31$ | 8.6×9.4 |
| 6. 49×2.5 | 4.2×1.5 | $39 \times .41$ | $6.8 \times .72$ |

Exercise 113.

What is the continued product of :—

- | | |
|----------------------|-------------------|
| 1. .4, .6, and 2.6? | .3, .6, and 2.2? |
| 2. .7, .7, and 4.1? | .9, .3, and 3.3? |
| 3. .9, .5, and 4.5? | .2, 1.3, and 3.4? |
| 4. .7, .9, and 6.7? | 1.2, .3, and 4.4? |
| 5. .5, 1.1, and 5.5? | .7, .6, and 5.8? |
| 6. .9, 1.1, and 9.1? | 6.4, .4, and 1.9? |

Exercise 114.

- Find the difference between .45 and .675.
- Find the difference between three times .56 and three times .257.
- From 5.6×2.4 take 2.4×2.6 .
- Simplify $3.8 \times 7.2 + 7.2 \times 3.4 + 2.8 \times 7.2$.
- Simplify $4.5 \times 7.6 - 6.3 \times 4.5 + 4.5 \times 8.7$.
- Simplify $3.9 \times 6.7 + 8.5 \times 3.9 + 4.8 \times 3.9$.
- I bought 4.6 lbs. tea at \$.44 and gave 4.4 lbs. sugar at \$ 16. How much is yet to be paid?

Division.**Exercise 115.**

Divide, and verify by vulgar fractions :—

1. $.4 \div 2$	1.2 $\div 2$	.32 $\div 4$	6.4 $\div 2$	4.3 $\div 2$
2. $.6 \div 2$	1.2 $\div 3$	.24 $\div 6$	6.9 $\div 3$	6.5 $\div 2$
3. $.6 \div 3$	3.2 $\div 4$	.36 $\div 9$	7.2 $\div 4$	5.5 $\div 4$
4. $.8 \div 2$	1.5 $\div 3$	.42 $\div 7$	8.5 $\div 5$	6.5 $\div 4$
5. $.8 \div 4$	2.5 $\div 5$	.81 $\div 9$	9.6 $\div 6$	7.6 $\div 5$
6. $.9 \div 3$	3.6 $\div 4$	.72 $\div 8$	8.4 $\div 7$	8.7 $\div 8$
7. $.4 \div 4$	4.8 $\div 6$	.45 $\div 9$	9.6 $\div 8$	9.9 $\div 5$

Exercise 116.

Find the price :—

1. If 2 (4, 8) lbs. lamb cost \$.64.
2. If 3 (6, 9) yds. ribbon cost \$.72.
3. If 4 (7, 12) qts. vinegar cost \$.84.
4. If 2 (4, 5) yds. cloth cost \$5.9.
5. If 4 (5, 8) tons coal cost \$24.6.
6. If 8 (9, 11) bush. wheat cost \$19.8.
7. If 6 (8, 12) cords wood cost \$48.96.

Exercise 117.

1. $.4 \div .2$	1.6 $\div .2$	56 $\div .2$	4.56 $\div .02$
2. $.6 \div .2$	2.7 $\div .3$	64 $\div .4$	5.84 $\div .03$
3. $.8 \div .2$	3.6 $\div .4$	72 $\div .3$	6.75 $\div .04$
4. $.6 \div .3$	4.8 $\div .5$	84 $\div .5$	3.07 $\div .05$
5. $.9 \div .3$	7.6 $\div .5$	75 $\div .4$	3.56 $\div .08$
6. $.8 \div .4$	9.8 $\div .8$	69 $\div .8$	4.57 $\div .04$
7. $.3 \div .3$	9.9 $\div .8$	58 $\div .5$	9.87 $\div .08$

Exercise 118.

1. Divide 1.35 hours by .45 minutes.
2. Divide 17.5 weeks by .25 days.
3. Divide .625 bushels by 2.5 gallons.
4. Divide 30.25 minutes by 5.5 seconds.
5. Divide 422.5 feet by 6.5 inches.
6. Divide .48 acres by .75 sq. rods.
7. Divide 9.021 yards by 9.3 feet.

Exercise 119.

Find, in lower denominations, the value of :—

1. .5 of a £.	.45 of a £.	£2.45.
2. .25 of a ton.	.75 of a week.	4.75 acres.
3. .75 of a bush.	.65 of an hour.	3.65 bushels.
4. .45 of a gal.	.33 $\frac{1}{3}$ of a gross.	7.54 tons.
5. .75 of a yard.	.2 $\frac{1}{4}$ of a cwt.	8.75 weeks.
6. .35 of a sq. yd.	.7 $\frac{1}{2}$ of a ream.	7.25 yds.
7. .375 of a mi.	.3 $\frac{1}{5}$ of a score.	5.35 sq. yds.

Exercise 120.

Reduce these vulgar fractions to decimals :—

1. $\frac{1}{10}$.	$\frac{1}{4}$.	$\frac{1}{25}$.	$\frac{1}{8}$.	$\frac{3}{32}$.	$\frac{1}{3}$.	$\frac{11}{11}$.	$\frac{1}{6}$.
2. $\frac{3}{10}$.	$\frac{3}{4}$.	$\frac{4}{25}$.	$\frac{3}{8}$.	$\frac{5}{32}$.	$\frac{2}{3}$.	$\frac{5}{11}$.	$\frac{5}{6}$.
3. $\frac{5}{10}$.	$\frac{1}{20}$.	$\frac{9}{25}$.	$\frac{5}{8}$.	$\frac{9}{32}$.	$\frac{1}{9}$.	$\frac{7}{11}$.	$\frac{12}{12}$.
4. $\frac{7}{10}$.	$\frac{5}{20}$.	$\frac{16}{25}$.	$\frac{7}{8}$.	$\frac{11}{32}$.	$\frac{2}{9}$.	$\frac{1}{11}$.	$\frac{5}{12}$.
5. $\frac{1}{5}$.	$\frac{9}{20}$.	$\frac{18}{25}$.	$\frac{5}{16}$.	$\frac{15}{32}$.	$\frac{4}{9}$.	$\frac{3}{7}$.	$\frac{7}{12}$.
6. $\frac{2}{5}$.	$\frac{11}{20}$.	$\frac{21}{25}$.	$\frac{7}{16}$.	$\frac{25}{32}$.	$\frac{7}{9}$.	$\frac{4}{7}$.	$\frac{11}{12}$.
7. $\frac{4}{5}$.	$\frac{19}{20}$.	$\frac{24}{25}$.	$\frac{9}{16}$.	$\frac{31}{32}$.	$\frac{8}{9}$.	$\frac{6}{7}$.	$\frac{4}{15}$.

Exercise 121.

Reduce to equivalent vulgar fractions :—

1. .1	.45	.345	.16	.06	.99	3.4
2. .3	.63	.567	.83	.13	.333	5.6
3. .5	.81	.396	.083	.26	.666	3.9
4. .6	.36	.495	.416	.46	.4545	7.4
5. .8	.99	.594	.583	.53	.1666	1.6
6. .4	.27	.954	.916	.73	.0833	5.83
7. .7	.54	.873	.0916	.86	.1818	9.16

Express as pure decimals :—

8. $2\frac{1}{2}$.	$3\frac{3}{4}$.	$4\frac{3}{4}$.	$2\frac{3}{8}$.	$6\frac{7}{16}$.	$\frac{1}{2}$.	$\frac{1}{4}$.	$\frac{4}{8}$.	$\frac{5}{8}$.	$\frac{5}{16}$.	$\frac{5}{32}$.
9. $1\frac{1}{9}$.	$3\frac{1}{3}$.	$4\frac{2}{3}$.	$3\frac{5}{8}$.	$2\frac{7}{11}$.	$\frac{1}{3}$.	$\frac{5}{9}$.	$\frac{5}{6}$.	$\frac{4}{7}$.	$\frac{4}{11}$.	$\frac{7}{12}$.

Exercise 122

1. $7.5 \times .075 \div (.15 - .075) =$
2. $8.4 + 6.4 \times 2.5 - 3.5 \times 2.4 =$
3. $8.3 \times .87 - 6.4 \times .66 + .36 \times 3.4 =$
4. $5.2 \times 2.8 \div .56 \times 2.6 - 4.5 \times 5.5 =$
5. $6.3 \div .09 \times 5.4 \div .27 + 3.5 \times 4.5 =$
6. $5.4 - 3.2 \times .25 + 4.4 \times .75 - .81 \div .162 =$
7. $.7 + 3.54 - 2.36 + .5 + 2.6 - 2.8 =$
8. $1.6 \times 1.3 + 2.6 \div 1.7 + 8(3.7 - 2.6) =$

Exercise 123.

1. 2 ft., 6 in. is what decimal of a yard?
2. 2 qts., 1 pt. is what decimal of a gallon?
3. 4 hrs., 48 min. is what decimal of a day?
4. 17s. 6d. is what decimal of £1?
5. 3 dys., 12 hours is what decimal of a week?
6. 6 sq. ft., 108 sq. in. is what decimal of a sq. yard?
7. 3 pks., 1 gal., 2 qts. is what decimal of 5 bushels?

Exercise 124.

1. 6s. is what decimal of a shilling? a crown? a sovereign? a guinea? £1, 10s. 6d?
2. Reduce 5s. (15s; 12s. 6d; 6s. 8d; 13s. 4d.) to a decimal of £1.
3. Express 3 pks. (3 gal.; 2 gal., 1 qt.; 1 pk., 1 gal., 2 qts.) as a decimal of a bushel.
4. A piece of oilcloth 9' x 6' [9" x 12"] is what decimal of a square yard?
5. What decimal of a cubic yard is a stone [1' x 6' x 3']? [18" x 72" x 12"]? [60" x 24" x 27"]?
6. What decimal of an acre is a plot [5 rds x 8 rds.]? [16 rds. x 15 rds.]? [3 ch. x 8 ch.]?
7. What decimal of 5 acres is a field [15 rds. x 24 rds.]? [8 ch. x 6 ch.]? [9 ch. x 12 ch.]?

Exercise 125.

1. A bought $.3$ ($.4$, $.6$) of a farm, and B bought $.4$ ($.5$, $.75$) of the remainder. Which bought the more? How much more?
2. I owned $.55$ ($.45$, $.75$) of a ship, and sold $.4$ ($.6$, $.25$) of my share. How much did I sell?
3. I owned $.45$ ($.64$, $.75$) of a mill, and sold $.8$ ($.25$, $.25$) of my share. How much had I left?
4. I owned $.8$ ($.6$, $.25$) of a farm, and sold $.5$ ($.75$, $.25$) of my share. Find my former share if I sold 60 acres.
5. I owned $.8$ ($.5$, $.25$) of a farm and sold $.25$ ($.5$, $.4$) of my share. How much was in the farm if I sold 16 ac.?
6. I owned $.8$ ($.45$, $.75$) of a farm, and sold $.6$ of my share. How much land was in the farm if I sold 12 acres more than I kept?
7. The sum of two numbers is $.37$ ($.493$, 8.64), and their difference is $.05$ ($.125$, 2.32). Find the numbers.

Exercise 126.

1. Find my weekly wages if I get \$2.25 (\$3.425, \$1.875) a day.
2. How much does a boy earn in a year, if he gets \$7.5 (\$9.25, \$8.625) a month?
3. A boy takes two steps in a second. How far will he walk in a minute, if each step is $1.5'$? $1.25'$? $.625$ yds.?
4. A pint of water weighs 1.25 lbs. What is the weight of 3 pints? 5 pints? 7 pints? 1 quart? 3 quarts? 1 gallon? 1 gal., 3 qts., 1 pt.?
5. If a cubic foot of water weighs 62.5 lbs., what is the weight of the water in a rectangular trough [$1' \times 2' \times 8'$]? [$2' \times 2' \times 6'$]? [$2' \times 4' \times 5'$]?
6. A does $.55$ ($.35$, $.75$) of a work. B does $.6$ of the remainder. C finishes it. How much does C do?
7. A does $.375$ of a work, B does $.4$ of the remainder, and C finishes it. How much does each do?
8. A does $.35$ of a \$20.00 job. B does $.6$ of the remainder and C does the rest. Find pay of each.

Exercise 127.

1. I had .8 of a farm, and sold .63 (.456, .325) of it. What part of the farm have I left?

2. A owns .4 (.23, .425) of a farm. B owns .3 (.35, .375) of it. C owns the rest. Find C's share.

3. A does .24 of a work. B does .356 of it, and C does .234 of it. How much of it remains undone?

4. I have 2.83 acres more than B, and together we have 33.43 acres. How much land has each of us?

5. I gave .55 of an apple to Tom, and $.3\frac{1}{3}$ of the remainder to Will. How much had I left?

6. I owned .5 of a vessel and sold .75 of my share for \$12,000. Find the value of my present share.

7. A can mow .13 of an acre in an hour, and B .25 of an acre in an hour. How long would it take the two to mow a 19-acre field?

Exercise 128.

1. Find the least number which contains $\frac{1}{2}$, $\frac{2}{3}$, .75 or 1.2 an exact number of times.

2. Find the least number to be taken from 5 (8, 12) so that the remainder be a multiple of $\frac{3}{4}$ ($3\frac{1}{4}$, .45)?

3. If .45 of a work is done in 2.25 days, how long will it take to finish the work?

4. A can make an article in .25 of an hour, and B in .35 of an hour. How many would the two make in 3.5 hours?

5. I gave .34 of my money for a clock, .22 of it for a table, and .14 of it for a chair, and had \$6 left. Find the cost of each of them.

6. It took 24 yards of carpet 1.25 yards wide to cover a floor. How many yards of carpet .75 of a yard wide would be needed?

7. I sold $.3\frac{1}{3}$ of my farm to A and .75 of the remainder to B, and the rest, $\frac{3}{6}$ acres, to C. How much did A and B get?

Exercise 129.

1. Show that decimal notation is but a continuation of the Arabic system of notation.
2. How is a decimal fraction expressed?
Distinguish a vulgar fraction from a decimal.
3. How is the value of a decimal fraction affected by moving the decimal point to the right? To the left?
4. Show that a "0" may, or may not, alter the value of a decimal fraction.
5. What caution should be observed in writing down a question in addition, or subtraction, of decimals?
6. How may a decimal be multiplied or divided by 10? 100? 1000?
7. How many figures should there be in the decimal part of the product of two decimals?
8. Give, in order, the steps to be taken to divide a decimal by a decimal.
9. Show that the quotient is not altered by multiplying or dividing both divisor and dividend by the same number.
10. Distinguish a problem from a theorem.
11. Upon what theorem does division by factors depend?
12. What vulgar fractions can be reduced to (1) terminating, (2) pure repeating, (3) mixed repeating decimals?
13. Give the rule for reducing (1) terminating decimals, (2) circulating decimals, to vulgar fractions.
Show that two of these rules are not absolutely correct.
14. Prove the rule for fixing the decimal point in the answer to a question in multiplication of decimals.
15. How would you proceed to add, subtract, multiply or divide, circulating decimals?
16. What are the co-factors of :—
.24? .36? .28? .32? .35? .49? .64? .45?
6.3? 8.8? 6.4? 3.3? 5.6? .055? .729? .625?
17. The product of two numbers is .24. One of them is .4 (.5, 4.8). Find the other.

PERCENTAGE.

Percentage is a term applied to certain exercises in arithmetic in which 100 is used as the basis of computation.

Per cent. is an abbreviation of the Latin words *per centum*, which mean, *by the hundred*.

The sign % is used for the words **per cent**.

The Base is the quantity on which the percentage is computed.

The Rate per cent. is the number which denotes how many hundredths of the base is to be taken. It denotes a part, and can be expressed as a vulgar fraction, or a decimal.

The Percentage is the number, or quantity, which is the given per cent. of the given base.

Exercise 130.

Find the loss on :—

1. 200 apples, if 6 (8, 11) in every hundred rot.
2. 300 oranges, if 7 (4, 16) in every hundred spoil.
3. 500 cattle, if 5 (9, 12) in every hundred die.
4. 800 soldiers, if 4 (15, 25) are killed in every hundred.
5. 700 peaches, if 12 (14, 18) spoil in every hundred.
6. 600 eggs, if 10 (13, 17) are broken in each hundred.
7. 1000 sheep, if 8 (12, 16) die in every hundred.

Exercise 131.

Find the loss on :—

1. 150 (250, 350) apples, if 6 in every hundred rot.
2. 250 (450, 750) cattle, if 4 in every hundred die.
3. 350 (650, 950) soldiers, if 12 in every hundred die.
4. 125 (225, 425) peaches, if 8 in every hundred spoil.
5. 325 (725, 625) sheep, if 16 in every hundred die.
6. 160 (240, 480) eggs, if 5 (15, 25) in every hundred are broken.
7. 320 (430, 560) lambs, if 10 (20, 30) in every hundred die.

Exercise 132.

Write down the fractions (1) vulgar, (2) decimal, which are equivalent to the following percentages :—

- | | | | | | | | |
|----|------|------|------|---------------------|---------------------|---------------------|--------------------|
| 1. | 10%. | 5%. | 24%. | 25%. | $33\frac{1}{3}\%$. | $11\frac{1}{5}\%$. | $\frac{1}{2}\%$. |
| 2. | 20%. | 15%. | 48%. | $12\frac{1}{2}\%$. | $66\frac{2}{3}\%$. | $22\frac{2}{5}\%$. | $\frac{1}{3}\%$. |
| 3. | 40%. | 35%. | 96%. | $37\frac{1}{2}\%$. | $16\frac{2}{3}\%$. | $55\frac{1}{5}\%$. | $\frac{1}{4}\%$. |
| 4. | 80%. | 55%. | 1%. | $62\frac{1}{2}\%$. | $8\frac{1}{3}\%$. | $88\frac{8}{9}\%$. | $\frac{1}{8}\%$. |
| 5. | 60%. | 95%. | 36%. | $87\frac{1}{2}\%$. | $41\frac{2}{3}\%$. | $14\frac{2}{7}\%$. | $\frac{1}{8}\%$. |
| 6. | 30%. | 25%. | 72%. | $6\frac{1}{2}\%$. | $83\frac{1}{3}\%$. | $28\frac{4}{7}\%$. | $\frac{1}{10}\%$. |
| 7. | 90%. | 75%. | 84%. | $3\frac{1}{8}\%$. | 100%. | $7\frac{1}{7}\%$. | $\frac{1}{2}\%$. |

Exercise 133.

- I gain 20 cents on every hundred. How much will I gain on 200 pears? 300 plums? 500 books? 600 eggs?
- I lose twenty cents per hundred plums. How much will I lose on 100 plums? 50 plums? 25 plums? 75 plums?
- I gain 20 per cent. What is my gain on 100 papers? 10 papers? 30 papers? 60 papers? 90 papers? 40 papers?
- I have 80 sheep. How many are 10% of my flock? 20%? 40%? 80%? 60%? 30%? 90%? 45%? 15%? 5%?
- What per cent. of my flock is 6 sheep out of 12? of 24? of 30? of 60? of 120? of 15? of 45? of 75? of 90?
- What % is 8 eggs out of 16? of 32? of 40? of 20? of 10? of 80? of 160? of 24? of 64? of 48? of 72? of 96?

Exercise 134.

What percentage is equivalent to :—

- $\frac{1}{2}$? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$? $\frac{1}{7}$? $\frac{1}{8}$? $\frac{1}{9}$? $\frac{1}{10}$? $\frac{1}{11}$?
- $\frac{2}{3}$? $\frac{3}{4}$? $\frac{4}{5}$? $\frac{5}{6}$? $\frac{6}{7}$? $\frac{7}{8}$? $\frac{8}{9}$? $\frac{9}{10}$? $\frac{10}{11}$?
- $\frac{1}{12}$? $\frac{1}{13}$? $\frac{1}{14}$? $\frac{1}{15}$? $\frac{1}{16}$? $\frac{1}{17}$? $\frac{1}{18}$? $\frac{1}{19}$? $\frac{1}{20}$? $\frac{1}{21}$?
- .04? .08? .06? .09? .37? .45? .63? .25? .75?
- .125? .625? .375? .875? .425? .345? .695?
- .3325? .4725? .5625? .3825? .0625? .0125? .64125?
- .3? .6? .5? .16? .09? .63? .142857? .285714?

Exercise 135.

- | | | | |
|--------------------------|------------|--------------|--------------------------|
| 1. $\frac{1}{2}$ of 8 = | .1 of 60 = | .05 of 200 = | $.33\frac{1}{3}$ of 45 = |
| 2. $\frac{2}{3}$ of 9 = | .7 of 80 = | .25 of 300 = | $.66\frac{2}{3}$ of 36 = |
| 3. $\frac{4}{5}$ of 25 = | .9 of 40 = | .15 of 400 = | $.12\frac{1}{2}$ of 48 = |
| 4. $\frac{7}{8}$ of 24 = | .6 of 45 = | .35 of 500 = | $.37\frac{1}{2}$ of 64 = |
| 5. $\frac{6}{8}$ of 30 = | .8 of 85 = | .65 of 800 = | $.11\frac{1}{8}$ of 81 = |
| 6. $\frac{7}{8}$ of 63 = | .4 of 75 = | .95 of 700 = | $.14\frac{2}{7}$ of 63 = |

Exercise 136.

What is :—

- 10% of \$50? \$80? \$7.50? \$13.60? 90 sheep?
- 20% of \$85? \$75? \$4.25? 95 girls? 65 apples?
- 25% of \$100? \$84? \$160? 360c.? 840 acres? 235 pigs?
- 50% of \$200? \$96? \$1.50? 48 sheep? 64 weeks?
- 75% of \$300? \$30? \$3.00? 60 yards? 84 miles?
- $12\frac{1}{3}$ % of \$400? \$40? \$4.00? 96 reams? 88 hrs.?
- $16\frac{2}{3}$ % of \$300? \$30? \$3.00? 36 gal.? 48 tons?

Exercise 137.

- | | | |
|----------------|---------------|---------------------------------|
| 1. 10% of 30 = | 8% of \$25 = | $33\frac{1}{3}$ % of 48 sheep = |
| 2. 20% of 80 = | 5% of \$40 = | $16\frac{2}{3}$ % of 72 eggs = |
| 3. 50% of 64 = | 6% of \$50 = | $12\frac{1}{2}$ % of 64 hens = |
| 4. 25% of 48 = | 12% of \$75 = | $37\frac{1}{2}$ % of 48 lambs = |
| 5. 75% of 84 = | 24% of \$25 = | $11\frac{1}{8}$ % of 63 geese = |
| 6. 45% of 60 = | 48% of \$75 = | $87\frac{1}{2}$ % of 80 cows = |
| 7. 15% of 40 = | 72% of \$50 = | $14\frac{2}{7}$ % of 49 acres = |

Exercise 138

What per cent. is :—

- \$5 of \$10? \$20? \$25? \$40? \$50? \$75? \$100?
- 6 of 12? 30? 48? 24? 36? 72? 100? 50? 96?
- \$8 of \$16? \$32? \$64? \$96? \$24? \$48? \$72?
- 3 quarts of 4 qts.? 6 qts.? 9 qts.? 8 qts.? 1 gal.?
- 1 gallon of 4 gal.? 8 gal.? 1 pk.? 2 pk.? 1 bush.?
- 12 hours of 6 hrs.? 4 hrs.? 16 hrs.? 20 hrs.? 1 day?

Exercise 139.

1. A man had 45 lambs, and sold 20% (40%, 60%) of them. How many did he sell? How many had he left?
2. I had 64 sheep, and 25% (50%, 75%) of them died. How many have I still?
3. A man had 360 acres, and sold 35% (45%, 85%) of his farm. Find the size of his present farm.
4. A man bought 480 bushels of potatoes, and sold 25% (30%, 35%) of them. How much had he left?
5. I had 48 bushels of apples, and sold $12\frac{1}{2}\%$ ($16\frac{2}{3}\%$, $8\frac{1}{3}\%$) of them. Find the value of the rest at \$1 a bushel.
6. A man earned \$800, and saved $12\frac{1}{2}\%$ ($37\frac{1}{2}\%$, $62\frac{1}{2}\%$). How much did he save? How much did he spend?
7. I earned \$720 a year, and saved $11\frac{1}{3}\%$ ($12\frac{1}{4}\%$, $16\frac{2}{3}\%$) of it. How much do I spend? How much less do I save?
8. A school class of 84 pupils is 25% ($33\frac{1}{3}\%$, $16\frac{2}{3}\%$) boys. How many girls are in the class?

Exercise 140.

1. A clerk who received \$7.50 a week had his wages raised 20% ($33\frac{1}{3}\%$, $16\frac{2}{3}\%$). Find his present wages.
2. A clerk received \$9 a week, and spent 50% (25%, $12\frac{1}{2}\%$) of his wages. How much did he save?
3. A clerk who received \$12 a week had his wages reduced 25% (30%, 15%). Find his present wages.
4. A person received \$75 a month. He spends 40% ($33\frac{1}{3}\%$, $83\frac{1}{3}\%$). How much does he save?
5. A man gets \$960 a year, and spends 75% ($66\frac{2}{3}\%$, $62\frac{1}{2}\%$) of it. How much does he save?
6. A man gets \$750 a year, and spends 30% (35%, 45%) of it. How much more than that does he save?
7. My house and lot cost \$2,400. The lot cost 25% (30%, $37\frac{1}{2}\%$) of the whole. Find the cost of each.
8. 32 sq. rds. is what per cent. of 40 sq. rds.? 64 sq. rds.? 80 sq. rds.? 128 sq. rds.? 1 acre? 5 acres?

Commission.

Commission is the charge made by an agent for buying or selling goods—usually a percentage on the value of the goods.

A Commission Merchant is one who buys or sells goods intrusted to him. **A Consignment** is goods sent to a commission merchant to be sold. The **Consignor** is the person who sends the goods. The **Consignee** is the person to whom the goods are sent. The **Net Proceeds** is the amount for which the goods were sold, less the commission.

Exercise 141.

How much will an agent get for selling goods for :—

1. \$800 (\$700, \$1,200), if his com. be 7% (8%, 10%)?
2. \$450 (\$750, \$1,250), if his com. be 8 (10, 20) %?
3. \$325 (\$825, \$1,275), if his com. be 8 (12, 24) %?
4. \$360 (\$480, \$720), if his com. be $12\frac{1}{2}$ ($37\frac{1}{2}$, $62\frac{1}{2}$) %?
5. \$420 (\$630, \$936), if his com. be $33\frac{1}{3}$ ($66\frac{2}{3}$, $16\frac{2}{3}$) %?
6. \$490 (\$630, \$880), if his com. be $14\frac{7}{8}$ ($11\frac{1}{8}$, $9\frac{1}{8}$) %?

Exercise 142.

1. What is the commission for selling a house for \$700 (\$800, \$1,600) at 5%? 8%? 10%?
2. How much would a man receive for collecting a note of \$450 at 2%? $2\frac{1}{2}$ %? $3\frac{1}{3}$ %?
3. How much would I receive for a house which my agent sold for \$1,500 (\$2,400, \$3,500) on a com. of 4%?
4. Find the cost of a vessel which my agent bought for \$1,250 (\$1,500, \$4,500) on 8% com.
5. Find the net proceeds from 400 bbls. flour @ \$4.50, if the commission merchant gets $2\frac{1}{2}$ ($7\frac{1}{2}$, $12\frac{1}{2}$) %.
6. What commission would I receive for selling 750 bbls. apples @ \$2 a bbl., at $\frac{1}{2}$ %? $\frac{1}{3}$ %? $1\frac{1}{3}$ %?
7. Find the com. at $1\frac{1}{4}$ ($2\frac{1}{2}$, $3\frac{3}{4}$) % I must pay an agent for buying 300 bales cotton, each 800 lbs., @ 6c. a lb.
8. Find com. at $6\frac{2}{3}$ ($6\frac{1}{4}$, $7\frac{1}{2}$) %, for selling 48 bbls. apples @ \$5 a bbl.

Exercise 143.

Goods Sold.	Rate of Com.	Com.	Net Proceeds.
1. \$800.	4 (5, 9) %.	... ..	.....
2. \$450.	6 (8, 12) %.	.....	.....
3. \$625.	8 (10, 20) %.	.....	.....
Goods Bo't.	Rate of Com.	Com.	Net Cost.
4. \$750.	10 (20, 40) %.	.....	.....
5. \$840.	25 (12½, 37½) %.	.....	.....

Exercise 144.

1. I received \$75 commission for selling a house @ 5 (10, 7½%). What was the selling price?
2. I received \$45 for selling a house on a commission of 11½ (9½, 6¼) %. How much did the owner get?
3. Find net proceeds from selling 24 kegs butter, each 26 lbs., @ 25c. a lb. : commission 2 (5, 10) %.
4. How much would I have to pay my agent for 48 bbls. apples @ \$3.50, commission 14¾%? 12½%? 16¾%?
5. How much must I remit my agent, that he may buy me a house for \$1,200 (\$750, \$1,225), and have 2% com.?
6. My agent remitted \$1,176 (\$1,440, \$1,710) when selling 300 bbls. flour @ \$4 (\$5, \$6) a bbl. Find (1) his commission ; (2) his rate of commission.
7. Bought 360 bbls. flour @ \$4 a bbl. Sold ¼ of it @ 25 (50, 20) % gain, and the remainder @ 10 (25, 20) % ain. Find the gain.

Exercise 145.

Value.	Commission.	Rate.	Net Proceeds.
1. \$600.	\$24 (\$36, \$45).	.....	.....
2. \$500.	.....	.....	\$450 (\$400, \$250).
3.	\$21 (\$56, \$75).	.....	\$679 (\$744, \$675).
4.	\$45 (\$72, \$95).	12½%.	.....
5. ....	.....	25%.	\$150 (\$480, \$750).
6. ....	.....	10 (25, 40) %.	\$900.

Trade Discount.

A **Discount** is a reduction made from the nominal price of an article. The **List Price** of an article is its usual retail price. A **Trade Discount** is a reduction from the list price, made to the retail dealer, by the wholesale merchant or the manufacturer. A **Cash Discount** is a reduction from the list price, for prompt cash payment. An **Invoice** is a statement, in detail, of goods sold by one dealer to another.

Exercise 146.

What is the discount if the invoice price is : —

1. \$300 (\$450, \$7.50) and discount 10%? 20%? 30%?
2. \$600 (\$360, \$4.80) and discount 5%? 15%? 35%?
3. \$800 (\$250, \$12.50) and discount 8%? 16%? 48%?
4. \$500 (\$350, \$4.50) and discount 6%? 12%? 24%?
5. \$900 (\$720, \$8.40) and discount $33\frac{1}{3}\%$? $16\frac{2}{3}\%$? $8\frac{1}{3}\%$?
6. \$400 (\$640, \$8.80) and discount 25%? $12\frac{1}{2}\%$? $37\frac{1}{2}\%$?

Exercise 147.

What is the cost if the marked price is :—

1. \$500 (\$750, \$6.25) and discount 4%? 8%? 12%?
2. \$400 (\$850, \$3.25) and discount 6%? 10%? 20%?
3. \$600 (\$720, \$6.40) and discount 5%? 15%? 25%?
4. \$800 (\$480, \$9.60) and discount 25%? $12\frac{1}{2}\%$? $6\frac{1}{4}\%$?
5. \$900 (\$540, \$3.24) and discount $33\frac{1}{3}\%$? $66\frac{2}{3}\%$? $16\frac{2}{3}\%$?
6. \$450 (\$729, \$6.48) and discount $11\frac{1}{9}\%$? $22\frac{2}{9}\%$? $55\frac{5}{9}\%$?

Exercise 148.

Find the net cost if the list price is :—

1. \$500, and the trade discounts 20%, 10% and 10%.
2. \$600, and the trade discounts $33\frac{1}{3}\%$, 25% and 2%.
3. \$7.50, and the trade discounts $16\frac{2}{3}\%$, 20% and 3%.
4. \$9.60, and the trade discounts $12\frac{1}{2}\%$, $14\frac{2}{7}\%$ and 5%.
5. \$640, and the trade discounts 25%, $33\frac{1}{3}\%$ and 75%.
6. \$6.25, and the trade discounts 20%, 10% and $3\frac{1}{3}\%$.

Exercise 149.

	List Price.	Rate of Disc.	Discount.	Net Cost.
1.	\$300 (\$450).	(6) %.	.....	.....
2.	\$500 (\$750)	.....	\$50 (\$150).	.....
3.	\$600 (\$720).	.....	.....	\$450 (\$480).
4.	.....	25 (20) %.	\$225 (\$84).	.....
5.	.....	10 (30) %.	.....	\$720 (\$84).
6.	.....	.....	\$90 (\$250).	\$360 (\$375).

Exercise 150.

1. I buy goods at 25 (20, 40) % discount, and sell at list prices. Find my gain %.
2. I gain 20 (25, 33 $\frac{1}{3}$) % by selling goods at list prices. Find the discount allowed me.
3. What single discount is equivalent to a discount of 25% and 33 $\frac{1}{3}$ %? 20% and 25%? 12 $\frac{1}{2}$ % and 14 $\frac{2}{3}$ %?
4. What is the difference between a discount of 20% and 25%; and a discount of 25% and 20%?
5. I am allowed 20% and 10% discount and pay \$360 (\$792, \$5.76) for goods. Find the list price.
6. Find the difference between a discount of 30% and a discount of 20% and 10% on \$500 (\$250, \$425).
7. I sent my agent \$630 (\$715, \$720) to buy goods at 5 (10, 12 $\frac{1}{2}$) % com. Find the value of the goods.
8. I sell wheat @ 3% com., and buy goods @ 2%, and get \$200. Find the value of (1) the wheat; (2) the goods.

Exercise 151.

	List Price.	Discount.	Rate.	Net Cost.
1.	\$300 (\$4.80)	.....	33 $\frac{1}{3}$ (8 $\frac{1}{3}$)%	.....
2.	\$400 (\$7.20)	\$50 (\$4.50)	.....	.....
3.	\$800 (\$9.00)	.....	.....	\$750 (\$8).
4.	.....	\$45 (\$28)	6 $\frac{2}{3}$ (2 $\frac{1}{2}$)%	.....
5.	.....	.....	$\frac{1}{2}$ ($\frac{3}{4}$)%	\$398 (\$3.97).
6.	.....	\$9 (\$09)	.....	\$591 (\$2.31).

Loss and Gain.

The **cost** is what is paid for an article.

The **selling price** is what is got for an article.

Goods sold at an advance on cost are sold at a **gain**.

Goods sold at less than cost are sold at a **loss**. The loss or gain is the difference between the **cost price** and the **selling price**. The loss or gain % is always computed on the cost.

Exercise 152.

Find the gain and the selling price if:—

1. Cost \$100 : gain 6%, 8%, 25%, $6\frac{1}{4}\%$, $7\frac{1}{2}\%$, $37\frac{1}{2}\%$.
2. Cost \$75 : gain 20%, 40%, 30%, 50%, 25%, $33\frac{1}{3}\%$.
3. Cost \$250 : loss 10%, 16%, 20%, 24%, 32%, 40%.
4. Cost \$4.80 : loss 5%, $7\frac{1}{2}\%$, $12\frac{1}{2}\%$, $16\frac{2}{3}\%$, $33\frac{1}{3}\%$, $8\frac{1}{3}\%$.
5. Cost \$6.30 : gain $11\frac{1}{3}\%$, $22\frac{2}{3}\%$, $55\frac{5}{6}\%$, $14\frac{2}{7}\%$, $28\frac{1}{4}\%$.
6. Cost \$9.60 : gain 50%, 25%, 20%, 40%, $12\frac{1}{2}\%$, $37\frac{1}{2}\%$.
7. Cost \$2.50 : loss 20%, 10%, 5%, $2\frac{1}{2}\%$, $1\frac{1}{4}\%$, $\frac{5}{8}\%$.

Exercise 153.

1. Apples cost \$2 40 a bbl. What is the selling price to gain 20%? 25%? 30%? $33\frac{1}{3}\%$? $12\frac{1}{2}\%$? $16\frac{2}{3}\%$? $6\frac{1}{4}\%$?

2. I bought flour @ \$4.80 a bbl. What was the selling price if I lost 10%? 15%? 26%? 20%? $12\frac{1}{2}\%$? $16\frac{2}{3}\%$?

3. Bought lambs at \$3.00. What was the gain %, if I sold @ \$3.30? \$3.60? \$4.20? \$4.50? \$4.00? \$5.00?

4. What is the gain % on buying land @ \$24 an acre and selling @ \$30? \$36? \$27? \$32? \$40? \$48? \$72?

5. Find the loss % on buying wheat @ 72 cents and selling @ 54c.? 36c.? 48c.? 63c.? 60c.? 66c.? 45c.?

6. What is the gain or loss % on buying cloth @ \$4 and selling @ \$5? \$6? \$7? \$3? \$2? \$3.60? \$4.80?

7. Find the cost of cloth which sold @ \$4.50, at a loss of 10%, 25%, 50%, 75%, $66\frac{2}{3}\%$, $33\frac{1}{3}\%$, $16\frac{2}{3}\%$.

8. Find the cost of flour which sold @ \$6 a bbl. at a gain of 20%, 25%, 100%, $11\frac{1}{6}\%$, $9\frac{1}{11}\%$, $33\frac{1}{3}\%$, $66\frac{2}{3}\%$, $14\frac{2}{7}\%$.

9. If $\frac{4}{5}$ of the selling price = cost, find gain %.

Exercise 154.

What is the gain or loss %, if the cost is : —

1. \$200 and selling price \$220? 230? \$250? \$275?
2. \$300 and selling price \$330? \$345? \$360? \$270?
3. \$450 and selling price \$495? \$540? \$600? \$750?
4. \$750 and selling price \$735? \$675? \$600? \$690?
5. \$625 and selling price \$750? \$875? \$500? \$612.50.
6. \$3.20 and selling price \$4.00? \$4.80? \$2.40? \$2.80?
7. \$7.20 and selling price \$8.00? \$6.40? \$9.60? \$8.40?

Exercise 155.

1. I gained 25 ($12\frac{1}{2}$, $11\frac{1}{9}$) % by selling machines for \$75 (\$63, \$8.50). Find the cost of each.
2. I lost 20 ($16\frac{2}{3}$, $14\frac{2}{7}$) % by selling cattle @ \$48 (\$75; \$9.60). How much did each cost me?
3. I gained \$5 (\$8, \$2.50) by selling some sheep for \$20 (\$20, \$15). What was the gain %?
4. I lost \$5 (\$10, \$2.50) by selling my land @ \$20 (\$15, \$17.50) an acre. What was the loss %?
5. I gained 10 ($33\frac{1}{3}$, $16\frac{2}{3}$) % by selling chairs @ \$22 (\$24, \$2.80). Find gain % by selling @ \$25 (\$20, \$3).
6. I lost $12\frac{1}{2}$ ($9\frac{1}{11}$, $37\frac{1}{2}$) % by selling for \$35 (\$40, \$6). Find my gain or loss % by selling for \$48 (\$33, \$8.40).
7. I received \$300 (\$450, \$450) for 50 (90, 100) bbls. flour—a gain of 20 (25 , $12\frac{1}{2}$) %. Find cost per bbl.

Exercise 156.

Cost.	Selling Price.	Gain.	Rate.
1. \$8 (\$10, \$12).	\$10 (\$15, \$15).	..	.....
2. \$8 (\$9, \$15).	.....	\$3	.....
3. \$6 (\$16, \$24).	.....	..	25 ($12\frac{1}{2}$, $37\frac{1}{2}$)%.
4.	\$15 (\$18, \$21).	\$6	.....
5.	\$25 (\$30, \$36).	..	25 (20 , $12\frac{1}{2}$)%.
6. ....	.....	\$5	$16\frac{2}{3}$ ($33\frac{1}{3}$, $11\frac{1}{9}$)%.

Exercise 157.

	Cost	Selling Price.	Loss.	Rate.
1.	\$2.50.	\$2 (\$1.50)	.....	.....
2.	\$4.50.	.....	\$.50 (\$1.50).	.....
3.	\$9.60.	.....	.....	12½ (6½)%.
4.	.....	\$3.60 (\$4.80).	\$.60 (\$.60).	.....
5.	.....	\$7.50 (\$5.50).	.....	14⅔ (16⅔)%.
6.	.....	.....	\$.45 (\$.75).	9⅓ (8⅓)%.

Exercise 158.

1. A man bought 450 (375, 525) bbls. apples and sold them at a gain of 20%. Find the gain.
2. I bought 350 (420, 640) bbls. flour, and sold at a loss of 15 (25, 37½)%. Find the loss.
3. A man bought 320 (440, 760) bbls. potatoes @ \$.80 (\$.96, \$.60) and sold them at a loss of 15 (25, 16⅔)%. Find total loss.
4. B had a flock of 640 sheep, and the increase this year is 25 (12½, 87½)%. Find the present flock.
5. How many gals. water must be mixed with 9 (12, 15) gals. wine that 25 (20, 16⅔)% of the mixture is water?
6. I bought cloth @ \$75 a yard and sell it to gain 15 (25, 45)% on each yard. Find gain % on 32 yds.
7. Bought cloth @ \$.50 (\$.60, \$.80) a yard. Find the marked price, so that I may give 20% (25%, 10%) discount, and still make a gain of 20% (10%, 12½)%.

Exercise 159.

What is the number which is :—

1. 480 when increased 50%? 25%? 20%? 60%? 140%?
2. 880 when increased 10%? 25%? 33⅓%? 66⅔%? 14⅔%?
3. 480 when decreased 50%? 25%? 33⅓%? 20%? 11⅓%?
4. 420 when decreased 25%? 20%? 16⅔%? 14⅔%? 12½%?
5. \$840 when increased 33⅓%? 25%? 20%? 16⅔%?
6. \$840 when decreased 16⅔%? 14⅔%? 12½%? 11⅓%?

Exercise 160.

1. What % is gained by selling 15 oz. for 1 lb.? 35 inches for 1 yd. ? 1750 lbs. for 1 ton?
2. At what % above cost must I mark goods to gain a discount of 10% and yet gain 8 (17, 26) % ?
3. My flock increased 50% in three successive years, and then I had 270 sheep. Find each year's increase.
4. The population of a city decreased 10% in each of three successive decades, and now is 7290. Find the population at each census.
5. Find my gain % by buying at a discount of 20%, and selling at an advance of 10 (20, 25) % on list prices.
6. If $\frac{5}{8}$ ($\frac{7}{8}$, $\frac{7}{10}$) of the selling price is 10 (4, 2) % less than cost, find the gain % at which the goods are sold.
7. I bought 8 (16, 20) cattle @ \$25. Four of them die, and I sell the others @ \$40. Find gain or loss %.

Exercise 161.

1. I sell 5 sheep for what 6 (7, 4) cost me. Find the gain or loss %.
2. I sell goods to A at 10% profit, who sells to B at 20% profit. Find my gain % had B bought from me.
3. I sold a horse for \$72 (\$63, \$170), losing 20 (10, 15) %. Find the price to gain 20 (10, 15) %.
4. I lost 10 (20, 25) % by selling a horse. Had I received \$30 (\$25, \$15) more I had gained 5%. Find cost.
5. I sold two lots @ \$300 (\$450, \$180), gaining 20 (16 $\frac{2}{3}$, 12 $\frac{1}{2}$) % on one and losing 20 (10, 10) % on the other. Find gain or loss.
6. By selling what cost \$90 (\$80, \$75), I gain 10 (20, 25) % of the selling price. Find the selling price.
7. By selling what cost \$90 (\$80, \$84) I lose 12 $\frac{1}{2}$ (33 $\frac{1}{3}$, 16 $\frac{2}{3}$) of the selling price. Find the selling price.
8. In two successive decades the population increased 20%, and now is 2880. Find the population 20 years ago.

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Insurance.

Insurance is a system in which one party, on receiving a certain sum from another, undertakes to pay a specified sum to the owner of a property, in case of loss by fire, water, etc., within a certain time.

The **Premium** is the amount paid to secure the insurance.

The **Policy** is the written agreement or contract.

The **Risk** is the amount promised in case of loss. It is usually less than the value of the property.

Exercise 162.

Amount of Risk.	Rate of Ins.	Premium.
1. \$500 (\$750, \$960).	$\frac{1}{8}(\frac{3}{8}, \frac{3}{4})\%$.	.....
2. \$800 (\$640, \$960).	$\frac{1}{8}(\frac{3}{8}, \frac{5}{8})\%$.	.....
3. \$600 (\$720, \$750).	.....	\$3 (\$5.40, \$6).
4. \$900 (\$450, \$480).	.....	\$6 (\$6.75, \$6).
5.	$\frac{5}{8}(\frac{2}{8}, 1\frac{3}{8})\%$.	\$4 (\$7.50, \$10).
6.	$\frac{3}{4}(\frac{5}{8}, 2\frac{1}{2})\%$.	\$9 (\$7.50, \$10).

Exercise 163.

- Find the premium to insure a property worth \$1200 (\$750, \$960) for $\frac{3}{8}$ of its value @ $\frac{3}{4}(\frac{1}{8}, 1\frac{1}{2})\%$.
- Find the value of my property if I paid \$6 (\$7.50, \$13.50) to insure it for $\frac{3}{4}$ of its value @ $\frac{1}{2}(1\frac{1}{2}, 2\frac{1}{4})\%$.
- I paid \$9 (\$6.40, \$21) to insure my property for $\frac{4}{8}$ of its value @ $\frac{3}{4}(\frac{3}{8}, 1\frac{3}{4})\%$. Find the value of my property.
- What part of the value of a property worth \$1500 is insured, if the premium @ $\frac{3}{8}(\frac{1}{8}, 1\frac{1}{4})\%$ is \$8 (\$8, \$15)?
- For how much must I insure a vessel worth \$9,500 (\$19,500, \$6,345) @ 5 (2 $\frac{1}{2}$, 10)% to get the value of ship and the premium, in case of loss.
- Find the greatest gain (loss) a company can have by insuring a house for \$750 (\$1250) @ $\frac{2}{3}(2)\%$.
- \$45 (\$75, \$50) is paid to secure a risk of \$2500 for 3 years. What is the yearly rate?

Exercise 164—Bankruptcy.

1. A man has \$3000 (\$4500, \$4800) to pay \$6000 (\$7500, \$6400). How much can he pay on the \$?
2. A bankrupt's liabilities are \$4500; his assets are \$2250 (\$1500, \$3375). Find his dividend.
3. A's assets are \$750 (\$960, \$981) and he pays 20 (25, 45) cents on the \$. Find his liabilities.
4. B's liabilities are \$6480, and he pays 25 (50, 62½) cents on the \$. Find his assets.
5. C owes me \$720 (\$492, \$976), and I get 25 (37½, 62½) cents on the \$. How much do I lose?
6. A man owes \$7500, and his creditors lose \$2500 (\$5000, \$1875). Find assets and dividend.
7. A gets \$300 (\$112.50, \$337.50) on a debt of \$450. How much will B lose on a debt of \$960?

Exercise 165—Partnership.

1. A and B have equal shares in a business. The gain is \$750 (\$4325, \$3475). Find the share of each.
2. A invests \$500 and B \$750. The gain was \$750 (\$1250, \$960). Find the gain of each.
3. A and B invest \$700 (\$924, \$6475) in business, in the ratio of 3 : 4. A's loss is \$750 (\$963, \$73.50). Find B's.
4. A and B gain \$2250 (\$1500, \$3,000) on \$4,500 invested. A received \$450 (\$600, \$720). How much did B invest in the business?
5. A invested \$500 (\$600, \$750) for 4 years; and B \$500 (\$800, \$2000) for 3 years. Find the share of each in a gain of \$4500 (\$2896, \$9675).
6. The rent of a field is \$30. A puts in 6 (2, 14) cows and B 4 (8, 16) cows. Find share each pays.
7. A and B rent a pasture for \$24 (\$35, \$40). A puts in 12 (9, 10) sheep for 4 months, and B 8 (8, 20) sheep for 6 months. Find share each should pay.
8. A and B paid \$1500 for a house, and sold it for \$1800 (\$2125). A gained \$100 (\$125). What did B pay?

Exercise 166—Taxes.

What are the taxes on a property assessed at :—

1. \$800 (\$600, \$900) @ $\frac{1}{8}\%$? $\frac{1}{4}\%$? $\frac{3}{8}\%$? $\frac{1}{2}\%$? $\frac{5}{8}\%$? $\frac{3}{4}\%$?
2. \$800 (\$1200, \$4800) @ $1\frac{1}{8}\%$? $1\frac{1}{4}\%$? $1\frac{1}{2}\%$? $1\frac{3}{4}\%$? $2\frac{1}{2}\%$?
3. \$900 (\$750, \$875) @ 2 (4, 6, 8, 10, 12) mills on the \$?
4. \$900 (\$1250, \$625) @ 3 (5, 7, 9, 11, 15) mills on the \$?
5. \$1200 (\$840, \$960) @ $1\frac{1}{4}$ ($2\frac{1}{2}$, $3\frac{1}{4}$, $4\frac{1}{2}$) mills on the \$?
6. \$1200 (\$750, \$1800) @ $1\frac{1}{3}$ ($2\frac{2}{3}$, $3\frac{1}{3}$, $6\frac{2}{3}$) mills on the \$?

Exercise 167.

1. A man whose property is assessed at \$1500 (\$2400, \$3000) pays \$12 (\$12, \$22.50) taxes. Find the rate.
2. A town assessed at \$2,500,000 raises \$10,000 (\$15,000, \$3,500) taxes. Find the rate of taxation.
3. What is the rate on an assessment of \$350,000, to build a school worth \$1400? \$2100? \$5250?
4. A pays \$6 (\$7.50, \$18) on an assessment of \$1500; how much should B pay on property assessed for \$4200?
5. On what part of my income of \$750 (\$1200, \$2000) do I pay if the tax @ 8 mills on the \$ is \$4 (\$4.80, \$14)?
6. What part of my income of \$1200 is exempt, if I pay \$4 (\$6, \$12) taxes, at 8 (12, 15) mills on the \$.
7. A collector receives 2 (3, 5)%. Find the taxes raised in a town to pay \$490 (\$970, \$3,800) for a bridge.
8. With \$700 exempt, I have \$1195 (\$2182, \$1684) after paying a tax of 10 (12, 16) mills on the \$. Find income.

Exercise 168—Income Taxes.

Find the income tax (\$700 exempted) on :—

1. \$1000 (\$850) @ 2%, 3%, $\frac{1}{2}\%$, $\frac{1}{4}\%$, $\frac{1}{8}\%$, $\frac{5}{8}\%$.
2. \$1200 (\$940) @ $1\frac{1}{4}\%$, $1\frac{1}{2}\%$, $2\frac{1}{2}\%$, $3\frac{3}{4}\%$, $4\frac{1}{2}\%$, $7\frac{1}{2}\%$.
3. \$1500 (\$1250) @ 2 (3, 4, 6, 9, 12, 15) mills on the \$.
4. \$1800 (\$1525) @ 1 (3, 5, 7, 9, 4, 8, 16) mills on the \$.
5. \$2300 (\$900) @ $1\frac{1}{2}$ ($2\frac{1}{2}$, $3\frac{1}{2}$, $2\frac{1}{4}$, $5\frac{1}{4}$, $8\frac{1}{2}$) mills on the \$.
6. \$2500 (\$1450) @ $1\frac{1}{3}$ ($2\frac{2}{3}$, $3\frac{1}{3}$, $6\frac{2}{3}$, $8\frac{1}{3}$, $16\frac{2}{3}$) mills on the \$.

Exercise 169.

Valuation.	Rate on \$.	Amount of Taxes.
1. \$900 (\$750).	5 (6) mills.	.....
2. \$700 (\$1,250).	.....	\$5.60 (\$10).
3.	6 (9) mills.	\$42 (\$8.64).
4. \$800 (\$650).	7½ (6.4) mills.	.....
5. \$1,200 (\$17.50).	.....	\$4.20 (\$9.10).
6.	6½ (8.6) mills.	\$7.50 (\$10.32).

Exercise 170—Customs and Excise.

1. Distinguish excise and customs ; direct and indirect taxation ; specific and ad valorem duty.
2. Find the duty on books valued at \$700 (\$450, \$3.75) at 5 (10, 20) % *ad valorem*.
3. Find the duty on dry goods invoiced at \$1,200 (\$750, \$2.25) at 12½ (25, 33⅓) % *ad valorem*.
4. Find the duty on 640 yds. tweed @ 75 cents, at an *ad valorem* duty of 20 (25, 37½) %.
5. Find the *specific* duty on 750 gals. wine worth \$3 a gal., if the rate be 36 (48, 64) cents a gal.
6. Find duty on 480 gals. wine @ 2.50 ; the *specific* duty is 25 (35, 75) cents a gal ; the *ad val.* duty is 25 (33⅓, 16⅔) %.
7. I paid \$40 (\$90, \$.70) customs on goods, valued at \$800 (\$750, \$3.50). Find the *ad valorem* duty.
8. Find the duty on goods invoiced at £450 12s. 6d., if the *ad val.* duty be 10 (20, 25) %.

Exercise 171.

Value of Goods.	Rate of Duty.	Amount of Duty.
1. \$600 (\$750, \$8.75).	12 (16, 20) %.	.....
2. \$500 (\$650, \$6.25).	.....	\$60 (\$130, \$1.50).
3.	15 (25, 75) %.	\$30 (\$7.50, \$3.75).
4. \$800 (\$840, \$4.80).	12½ (14⅔, 16⅔) %.	.....
5. \$900 (\$960, \$4.50).	.....	\$200 (\$320, \$375).
6.	2½ (6¼, 6⅔) %.	\$25 (\$7.50, \$.48).

Simple Interest.

Interest is the money paid for the loan of money.

The **Principal** is the money loaned.

The **Unit of Time** is one year.

The **Rate per cent.** is the interest on \$100 for 1 year.

The **Amount** is the principal + the interest.

Exercise 172.

1. I borrow \$100 for a year. How much interest must I pay at 3%? 4%? 5%? 8%? 9%? 12%? 7%?

2. Money is going at 4%. How much interest a year do I pay for \$100? \$200? \$500? \$700? \$900? \$1200?

3. What is the yearly interest on \$200 @ 5%? \$300 @ 6%? \$500 @ 7%? \$600 @ 8%? \$900 @ 9%? \$400 @ 12%?

4. What is the interest @ 6% *per annum* on \$400 for 1 year? 2 years? 3 years? 4 years? 7 years? 5 years?

5. What is the interest @ 6% *per an.* on \$800 for 1 year? $\frac{1}{2}$ yr. ? $\frac{1}{4}$ yr. ? $\frac{3}{4}$ yr. ? $\frac{1}{3}$ yr. ? $\frac{2}{3}$ yr. ? $\frac{1}{5}$ yr. ? $\frac{4}{5}$ yr. ?

6. At 8% *per an.* what is the interest on \$600 for 1 year? 6 mos. ? 3 mos. ? 9 mos. ? 4 mos. ? 8 mos. ?

7. At 6% *per an.* find the interest on \$800 for $1\frac{1}{2}$ yrs., $2\frac{1}{2}$ yrs., $1\frac{1}{4}$ yrs., $1\frac{3}{4}$ yrs., $3\frac{1}{3}$ yrs., $6\frac{2}{3}$ yrs.

8. What is the interest @ 9% on \$800 for 1 yr., 6 mos. ? 1 yr., 3 mos. ? 2 yrs., 9 mos. ? 3 yrs., 4 mos. ?

Exercise 173.

Find the simple interest on :—

1. \$100 for 1 year @ 4%, 6%, 10%, 8%, 9%, 7%.

2. \$200 for 1 year @ 5%, 8%, 7%, 10%, 6%, 9%.

3. \$200 for 2 years @ 4%, 6%, 8%, 5%, 7%, 9%.

4. \$200 for 2 years @ $\frac{1}{2}$ %, $\frac{1}{4}$ %, $\frac{3}{4}$ %, $1\frac{1}{2}$ %, $2\frac{1}{2}$ %, $4\frac{1}{2}$ %.

5. \$300 for 2 years @ $4\frac{1}{2}$ %, $5\frac{1}{2}$ %, $6\frac{1}{2}$ %, $7\frac{1}{2}$ %, $12\frac{1}{2}$ %.

6. \$400 for 2 years @ $4\frac{1}{4}$ %, $5\frac{1}{4}$ %, $6\frac{3}{4}$ %, $8\frac{3}{4}$ %, $3\frac{3}{8}$ %, $6\frac{3}{8}$ %.

7. \$800 for $\frac{1}{2}$ year @ 6%, 8%, 5%, 7%, $4\frac{1}{2}$ %, $6\frac{1}{2}$ %, $8\frac{1}{4}$ %.

8. \$600 for $1\frac{1}{2}$ years @ 6%, 8%, 5%, 9%, $3\frac{1}{3}$ %, $6\frac{2}{3}$ %.

Exercise 174.

What is (1) the interest on ; (2) the amount of : —

1. \$250 @ 6% for 1 yr. ? (2, 3, 5, 7, 6, 9) yrs. ?
2. \$350 @ 8% for $\frac{1}{2}$ yr. ? ($\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$) yrs. ?
3. \$750 @ 9% for 4 mo. ? (8, 12, 6, 3, 9) mo. ?
4. \$450 @ 5% for 73 days ? (146, 219, 292) days.
5. \$960 @ 8% for $1\frac{1}{2}$ yrs. ? ($2\frac{1}{2}$, $2\frac{1}{4}$, $3\frac{1}{4}$, $3\frac{1}{2}$) yrs. ?
6. \$480 @ 6% for 1 yr., 6 mo. ? 3 yrs., 4 mo. ?
7. \$1250 @ 10% for 1 yr. 219 da. ? 1 yr., 146 da. ?

Exercise 175.

1. In what time will a sum of money double itself at (4, 5, 6, 8, 10, 9, 7) %, simple interest ?
2. At what rate % would a sum of money double itself in 2 (4, 5, 8, 6, 3, 7, 9, 10, 20) years ?
3. At 6 %, to what fraction of itself will a sum of money amount in 3 yrs., 4 mo. ? 4 yrs., 6 mo. ?
4. In 3 yrs., 4 mo. what fraction of the principal will the interest be @ 3 (6, 9, 15, 12) % ?
5. What is the interest on £600 16s. 8d. for 1 (2, 3) year at 4% ? 5% ? 6% ? 10% ? 8% ? $7\frac{1}{2}$ % ? $12\frac{1}{2}$ % ?
6. What is the amount of £750 12s. 6d. in 1 (2, 3) year @ 8% ? 4% ? 6% ? 5% ? $12\frac{1}{2}$ % ? $6\frac{1}{4}$ % ?

Exercise 176.

Principal.	Rate.	Time.	Interest.	Amount.
1. \$100 (200)	6 (7) %	1 yr.	.....	.....
2. \$300 (600)	.....	1 yr.	\$27 (36)	.....
3. \$400 (900)	5 (6) %	....	\$60 (108)	.....
4. \$400 (700)	.....	2 (3) yrs.	.....	\$448 (784).
5.	5 (7) %	2 (3) yrs.	\$60 (84)	.....
6.	6 (5) %	....	\$144 (70).	\$774 (770).
7. \$500 (800)	4 (5) %	....	.....	\$580 (920).
8. ....	.....	$1\frac{1}{2}$ yrs.	\$72 (90)	\$672 (840).
9.	8 (6) %	$2\frac{1}{2}$ yrs.	.....	\$300 (345).

Exercise 177—Bank Discount.

Find the bank discount on a note for :—

1. \$400 (\$750, \$625) due in 1 year at 4 (6, 8) %.
2. \$600 (\$450, \$640) due in 6 mo. at 6 (8, 5) %.
3. \$500 (\$800, \$320) due in 3 mo. at 8 (6, 10) %.
4. \$800 (\$750, \$640) due in 9 mo. at 6 (8, 10) %.
5. \$700 (\$650, \$620) due in 73 da. at 10 (5, 6) %.
6. \$900 (\$550, \$325) due in 146 da. at 6 (7, 8) %.
7. \$350 (\$960, \$360) due in 292 da. at $7\frac{1}{2}$ ($12\frac{1}{2}$, $8\frac{1}{2}$) %.

Exercise 178.

1. How much will I receive for a note for \$450 (\$75, \$37.50) due in 2 (6, 4) mo. — discount 6 (8, 12) %?
2. A note for \$250, due in 3 (4, 6) mo., is discounted at 6%. How much does the bank pay for it?
3. A note for \$350 (\$750, \$360), due June 15, is discounted at 5 (6, 8) % on April 4. Find the bank's gain.
4. I lose \$2 (\$1.80, \$3) by discounting a note for \$75 (\$60, \$37.50) due in 4 (6, 8) mo. Find rate of discount.
5. On July 8, the bank discounts a note for \$50 at 6 (8, 10) %, paying \$49.40 (\$48.40, \$48). When is it due?
6. Find the discount and the proceeds of a note for £450 8s. 4d., due in 3 (8, 6) mo., at 8 ($7\frac{1}{2}$, 6) %.

Exercise 179.

Face of Note.	Time.	Rate.	Discount.	Proceeds.
1. \$300 (450).	1 year.	7 (9) %.	.....	.....
2. \$600 (750).	6 mo.	.....	\$18 (30).	.....
3. \$800 (350).	.....	5 (8) %.	\$10 (7).	.....
4. \$500 (850).	8 mo.	.....	.....	\$480 (799).
5. \$900 (750).	.....	7 (6) %.	.....	\$858 (735).
6.	73 da.	6 (8) %.	\$8.40 (12).	.....
7.	146 da.	5 (5) %.	.....	\$882 (441).
8. ....	.....	6 (9) %.	\$12 (27).	\$388 (423).
9.	3 mo.	.....	\$15 (25).	\$785 (775).

Exercise 180—True Discount.

1. Find the amount of \$400 (\$750, \$836) in 1 year at 6 (8, 10)%, simple interest.
2. What sum will amount to \$212 (\$648, \$49.50) in 1 year at 6 (8, 10)%, simple interest?
3. Find the present value of a debt of \$224 (\$290, \$72.90) due in 2 years, if money is worth 6 (8, 12½)%.
4. Find the present worth of a note for \$327 (\$330, \$36.30) due in 1½ (1¼, 1¾) years at 6 (8, 12)%.
5. Find the true discount on \$612 (\$721, \$420) due in 3 (4, 6) mo. @ 8 (9, 10)%.
6. Find difference between true and bank discount on \$510 (\$520, \$530) due in 6 (8, 9) mo. at 4 (6, 8)%.
7. The difference between the true and the bank discount on a sum of money due in 4 (6, 10) mo. at 6 (10, 6)% is \$.16 (\$1.50, \$2.). Find the sum of money.

Exercise 181.

Find (1) the true discount ; (2) the present worth, of:—

1. \$220 (\$440, \$550) due in 1 year at 10%.
2. \$336 (\$560, \$784) due in 2 years at 6%.
3. \$312 (\$364, \$468) due in 6 months at 8%.
4. \$416 (\$260, \$572) due in 146 days at 10%.

Exercise 182.

Face of Note.	Time.	Rate.	True Dis.	Pres. Worth
1. \$420 (636).	1 year.	5 (6)%.	.....	.....
2. \$545 (345).	2 yrs.	.....	\$45 (45).	.....
3. \$412 (260).	.....	6 (8)%.	\$12 (10).	.....
4. \$424 (386).	8 mo.	.....	.....	\$400 (350).
5. \$742 (675).	.....	8 (12)%.	.....	\$700 (625).
6.	73 da.	5 (10)%.	\$3 (11).	.....
7.	219 da.	10%.	.....	\$750 (450).
8. ....	.....	6 (8).	\$45 (90).	\$500 (750).
9.	2½ yrs.	.....	\$36 (60).	\$360 (400).

Exercise 183—Compound Interest.

What is the compound interest on :—

1. \$100 for 2 years @ 10%? 8%? 6%?
2. \$200 for 2 years @ 5%? 6%? 8%?
3. \$400 for 2 years @ 10%? $6\frac{1}{4}\%$? $12\frac{1}{2}\%$?
4. \$500 for 3 years @ 6%? 8%? 20%?
5. \$500 for 2 years @ 8 (6) % payable half-yearly.
6. \$800 for 1 year @ 10 (8) % payable quarterly.
7. \$750 for $1\frac{1}{2}$ years @ 8 (12) % payable half-yearly.

Exercise 184.

1. I deposit \$100 (\$200, \$500) in the bank each New Year's Day. What will stand to my credit at the end of two years, if the interest is 5%, compounded yearly?

2. Find the difference between the simple and the compound interest on \$800 (\$600, \$640) in 2 years at 5 (10, $12\frac{1}{2}$)%.

3. The difference between the simple and the compound interest on a sum of money for two years @ 5 (4, 10)% is \$.25 (\$.64, \$4). Find the sum of money.

4. The difference between the simple and the compound interest on \$125 (\$625, \$640) for two years is \$.80 (\$1.00, \$10). Find the rate %.

Exercise 185.

Principal.	Time.	Rate.	Interest.	Amount.
1. \$200 (250)	2 yrs.	5 (6)%	.....	.....
2. \$500 (750)	2 yrs.	.....	\$40.8 (124.8)	.....
3. \$400 (350)	.....	5 (4)%	\$41 (28.56)	.....
4. \$300 (450)	2 yrs.	.....	.....	\$363 (544.5).
5. \$600 (800)	.....	10 (5)%	.....	\$726 (882).
6.	2 yrs.	10%	\$105 (84)	.....
7.	2 yrs.	10%	.....	\$847 (1936).
8. ....	.....	4 $12\frac{1}{2}\%$	\$51 (170)	\$676 (810).
9.	2 yrs.	.....	\$114 (159)	\$739 (784).

Exercise 186—Partial Payments.

1. I borrow \$100 (\$200, \$300) at 4 (6, 8)%. How much is due at the end of one year? Of two years?

2. I borrow \$200 at 4 (5, 6)%. In a year, I pay \$100. How much is due at the end of the second year?

3. I borrow \$200 (\$300, \$500) at 10%. In a year, I pay \$150 (\$200, \$300). How much is due at the end of another year?

4. I borrow \$400 (\$500, \$800) at 6%. In 6 mo. I pay \$200 (\$250, \$500). How much is due at the end of the year.

5. I borrow \$300 (\$600, \$700) at 4 (6, 8)%. At the end of 6 mo. I make a payment and at the end of the year there is \$102 (\$412, \$237.12) due. Find the first payment.

6. I borrow \$200 (\$300, \$400) @ 8%. In three months I make a payment, and \$106 (\$212, \$265) is due at the end of the year. Find the payment I made.

Exercise 187—Equation of Payments.

1. I owe \$300 due in 5 (6, 7) mo., and \$600 due in 2 (3, 4) mo. When may I pay both at once?

2. I owe \$500 (\$800, \$900) due in 1 year. I pay \$200 (\$400, \$300) now. When is the balance due?

3. I pay \$300 (\$400, \$750) in one payment instead of \$50 (\$100, \$75) a month. When should I pay it?

4. I have 3 notes: \$400 due in 8 mo.; \$600 due in 3 mo.; and \$500 due in 2 mo. What single payment will discharge all?

5. What single note is equivalent to a note for \$300 (\$600, \$800) due in 10 mo., and one for \$400 (\$200, \$200) due in 3 (2, 5) mo.?

6. What single payment equals \$300 (\$400, \$250) due June 4, and \$300 (\$800, \$750) due June 28?

7. Find the equated time for \$30 due Jan. 15; \$80 due Jan. 27; \$70 due Feb. 8; and \$60 due Feb. 24.

Exercise 188—Stocks and Bonds.

1. Find the cost of 24 (50, 63) shares (\$100) stock at par ; at 10% prem. ; at 20% discount.
2. Find the cost of 24 (36, 48) shares of railroad stock at 75 (125, 175).
3. How much do I realize by selling 25 (30, 48) shares bank stock at a discount of 40 (16, 25) %.
4. How much must I pay for 16 (20, 25) shares of insurance stock quoted at 25 (30, 44) % premium.
5. How much stock going at a discount of 10 (25, 35) % must I sell to realize \$900 (\$975, \$780)?
6. I buy stock at a discount of 8 (12, 16) % and sell at a premium of 5 (11, 10) %, gaining \$130 (\$253, \$936). How much stock do I buy?
7. Find the cash value of \$800 (\$900, \$1600) stock quoted at $87\frac{1}{2}$ ($66\frac{2}{3}$, $62\frac{1}{2}$).

Exercise 189.

1. Find my income from 30 (48, 160) shares of bank stock paying a dividend of 8 (10, $12\frac{1}{2}$) %.
2. How much must I invest in 6 (7, 8) % consuls at 75 (83 , $87\frac{1}{2}$) to have an income of \$600 (\$630, \$640)?
3. What rate of interest do I receive by investing in 8 (6, 5) % consuls going at 80 (120, $62\frac{1}{2}$)?
4. I invest in stock at 20 (25, 40) % premium, and receive a half-yearly dividend of 6 (5, 7) %. What rate of interest do I receive?
5. Which is the better investment, 6 (5, 7) % stock at 75 ($62\frac{1}{2}$, $87\frac{1}{2}$), or 8% stock at par (20% prem., 20% disc.)?
6. At what price must 6 (8, 10) % stock be selling that I may get 8 (5, $12\frac{1}{2}$) % interest on my investment.
7. What do I pay for stock that I may gain 20 (25, $33\frac{1}{3}$) % by selling at 2 (5, 8) % prem.
8. Sold 40 shares of 6 (8, 5) % bonds at 90 (120, $62\frac{1}{2}$), and invest in 4% (6, 12) % bonds at 60 (80, 125).

Exercise 190—Brokerage.

1. Find the cost of stock quoted at $87\frac{1}{2}$ ($67\frac{1}{4}$, $74\frac{3}{8}$)—brokerage $\frac{1}{2}$ ($\frac{1}{4}$, $\frac{1}{8}$) %.
2. How much do I receive for stock sold at $62\frac{1}{2}$ ($83\frac{5}{8}$, $112\frac{1}{2}$)—brokerage $\frac{1}{2}$ ($\frac{1}{4}$, $\frac{3}{8}$) %?
3. Find the brokerage at $\frac{1}{8}$ ($\frac{3}{4}$, $\frac{1}{2}$) %, on selling 72 (80, 96) shares railroad stock, going at $75\frac{3}{8}$ ($112\frac{1}{4}$, $187\frac{1}{2}$).
4. Find the proceeds from selling 20 (24, 36) shares of bank stock at $62\frac{3}{4}$ ($75\frac{3}{8}$, $80\frac{1}{8}$)—brokerage $\frac{1}{4}$ ($\frac{3}{8}$, $\frac{1}{8}$) %.
5. My broker buys \$6400 stock for me at $62\frac{3}{8}$ ($87\frac{1}{8}$, $99\frac{3}{8}$)—brokerage $\frac{1}{8}$ ($\frac{3}{8}$, $\frac{5}{8}$) %. How much do I pay?
6. I receive \$2400 (\$2800, \$2000) for stock at 76 (88, $62\frac{7}{8}$)—brokerage 1 ($\frac{1}{2}$, $\frac{3}{8}$) %. How much stock was sold?
7. I pay \$2400 (\$2700, \$3000) for \$3600 stock. Find price of the stock, if the brokerage is $\frac{1}{2}$ ($\frac{1}{8}$, $\frac{1}{4}$) %.

Exercise 191.

1. Find the sales to give \$25 brokerage at $\frac{1}{4}$ ($\frac{1}{8}$, $\frac{5}{8}$) %.
2. How much stock @ $88\frac{1}{4}$ must be sold to realize \$700 (\$875, \$1750), brokerage $\frac{3}{4}$ %?
3. How many shares, \$100 each, must be sold at 37 (12, $24\frac{1}{2}$) % discount to realize \$625 (\$1050, \$1125), brokerage $\frac{1}{2}$ %.
4. A broker sells 50 (64, 96) shares stock @ $\frac{1}{2}$ % brokerage, and remits \$3125 (\$2400, \$8400). Find price of the stock.
5. A broker remits \$2322 (\$1295, \$3150) for 36 shares of stock @ $62\frac{1}{2}$ ($37\frac{1}{2}$, 90). Find brokerage and rate.
6. Find cost of \$800 in gold at $112\frac{1}{2}$ ($108\frac{1}{4}$, $105\frac{3}{8}$), brokerage $\frac{1}{2}$ ($\frac{1}{4}$, $\frac{5}{8}$) %.
7. Bought 36 shares canal stock at $87\frac{1}{2}$ and sold at $108\frac{1}{2}$. Find gain, brokerage $\frac{1}{2}$ % in each case.
8. At what price must I buy 10 (12, 15) % stock that it may yield the same income as 6% stock @ 90?

Exercise 192—Review.

1. A gallon is what % of a peck? A bushel?
2. A has \$36; B, \$24. What % has each of the others?
3. A lost $\frac{2}{4}$ ($\frac{2}{5}$, $\frac{5}{8}$) of his money. What % remains?
4. What monthly rent will allow 4 (6, $7\frac{1}{2}$)% on a house that cost \$3600?
5. What part taken from a number is equal to 25% ($.35$, $\frac{2}{5}$) of the remainder?
6. A book was sold for $\frac{4}{3}$ ($\frac{9}{11}$, $.87$) of the cost. Find the gain or loss %.
7. A earned \$800, and saved 15% (25%; $37\frac{1}{2}$ %) of it. How much did he spend?
8. Teas @ 35, 40 and 45 cents are mixed equally, and sold @ 50 (60, 65) cents a pound. Find the gain %.
9. A shed [24' x 36' x 16'] contains 27 (81, 72) cords of wood. What fraction (decimal, %) of it is empty?

Exercise 193.

1. A merchant uses a yard stick 1 inch too short. Find his gain %. On a sale of \$10.80.
2. After paying an income tax of 15 mills on the \$, I have \$788 (\$1182, \$985) left. Find taxes and income.
3. My income tax (\$400 exempt) at 8 (10, 12) mills on the \$, is \$12 (\$16, \$18). Find my income.
4. A owns \$40 less than $\frac{2}{3}$ of the stock. The gain is \$300, and B gets \$120. Find A's gain and the stock each has.
5. Bought chestnuts @ \$2 a bu. and sold @ 5c. a pint. Find the gain or loss %.
6. The difference between a 35% discount and a discount of 30% and 5%, is 60c. Find the amount of the invoice.
7. I lent A \$500 (\$700, \$800) for 3 mo., and \$500 (\$300, \$300) for 7 mo. For how long should he lend me \$1000 (\$600, \$900) to return the compliment?

Exercise 194—Theory.

1. Give the four ways of denoting per cent.
2. Give the various ways of finding the % of a number.
3. Name the applications of percentage which involve time. Name some which do not involve time.
4. What are agents, commission merchants, brokers, assessors, collectors?
5. Show the relation between the cost price, the selling price, and the gain or the loss.
6. What is a tax? An income tax? A poll tax? A property tax? An exemption from taxation?
7. Distinguish direct from indirect taxation, and give examples of each.
8. Upon what base is brokerage computed?
Upon what base is commission computed?
Upon what base is the loss or gain computed?
9. What is an invoice? For what purpose is a certified invoice required?

Exercise 195.

1. Distinguish simple interest from compound interest.
2. What is true discount? Bank discount?
Which is the greater? How much the greater?
Distinguish both from trade discount.
3. In business, how many days are considered as a month?
4. What is meant by 3 days of grace?
5. Distinguish between when a note is nominally due and legally due.
6. Define assets, liabilities, dividends.
7. Distinguish commission from brokerage.
8. Show that a fraction represents the quotient of the numerator by the denominator.
9. What is meant by quoting greenbacks at 93, or by saying gold is at a premium?

MECHANICAL MEASUREMENTS.

6 feet 4 inches is usually written **6' 4"**.

1 chain = 100 links = 4 rods = 22 yards = 66 feet.

1 mile = 320 rods = 1760 yards = 5280 feet.

1 acre = 10 sq. ch. = 160 sq. rods = 4840 sq. yds.

Lumber is sold by the **M**—1000 feet. A board **1' x 1' x 1"**, or its equivalent, is **1 foot of lumber**. If less than an inch thick it is counted as 1 inch thick. If more than an inch thick, the amount of lumber is proportional to the thickness.

Ditching is paid for by the foot, yard, or rod.

Painting is paid for by the square yard.

Bricks are usually **2" x 4" x 8"**, and are sold by the **M**.

Drain Tiles are usually **12"** long, and are sold by the **M**.

Plastering is counted by the square yard. Half the area of the doors and windows is usually deducted, and the nearest square yard counted as the area.

Lathing—deduct area of the doors and windows and estimate **1 bundle** laths for each **5 sq. yds.** of surface.

Flooring—a square = 10 feet square = 100 sq. ft.

Shingling—1000 shingles (4 bundles) cover one square = 100 sq. ft. An average shingle is 4 inches wide, and laid 4 inches to the weather.

Carpeting—Carpet is sold by the linear yard, and the commonest widths are **27"**, **30"** and **36"**. The strips are usually laid lengthwise of the room, and must be matched. If part of a strip is required, the whole strip must be taken; but any fraction of a yard may be purchased.

Wall Papering—A single roll is **24 feet** long; a double roll is **48 feet** long. The commonest width is **18 inches**, but several other widths are manufactured. The width of the doors and windows is deducted from the perimeter of the room in calculating the number of strips required for the walls of the room. The border is sold by the yard.

Excavating—**1 cubic yard** of earth is considered a load. A cord of rough stone is **128 cubic feet** = 4 loads.

Exercise 196 - Cost of Material.

What is the cost, at the given price per M, of:—

1. 500 (250, 960) ft. lumber @ \$10? \$20? \$30?
2. 900 (750, 840) ft. lumber @ \$5? \$15? \$25?
3. 700 (1250, 720) ft. lumber @ \$12? \$14? \$16?
4. 800 (1750, 528) ft. lumber @ \$12.50? \$22.50? \$32.50?
5. 1,200 (880, 672) ft. lumber @ \$7.50? \$17.50? \$27.50?
6. 1,600 (650, 1260) ft. lumber @ \$12.50? \$15.00? \$17.50?
7. 2,400 (480, 2472) ft. lumber @ \$11.25? \$21.25? \$13.75?

Exercise 197.

1. What is the value of 500 rails @ \$8 per M? \$4? \$12? \$16? \$20? \$10? \$30? \$15? \$45? \$90? \$9?
2. What will a man get for hauling 4,800 bricks @ \$2.50 per M? \$1.25? \$.50? \$1.00? \$1.50? \$.75? \$2.25?
3. What will I receive for laying 3,200 tiles @ \$1.25 per M? \$2.50? \$3.75? \$7.50? \$15? \$5? \$1.50? \$.75?
4. What will a man receive for piling 1,250 ft. lumber @ \$1.00 per M? \$.50? \$.25? \$.75? \$1.50? \$2.25?
5. At \$2.50 per M, how much will I get for making 400 bricks? (800, 200, 600, 300, 900, 450) bricks?
6. At \$12.50 per M, what do I get for splitting 800 rails? (1600, 400, 100, 500, 1500, 300, 1200, 120) rails?
7. At \$7.50 per M, how much do I get for laying 400 bricks? (40, 80, 160, 320, 640, 960, 480, 120, 840) bricks?

Exercise 198.

What is the cost, at the given price per M, of:—

1. 700 (750, 720) bricks @ \$10? \$20? \$40? \$50?
2. 600 (250, 640) bricks @ \$5? \$25? \$35? \$75?
3. 500 (1750, 960) bricks @ \$12? \$22? \$32? \$52?
4. 400 (480, 996) bricks @ \$12.50? \$22.50? \$52.50?
5. 800 (650, 990) tiles @ \$4? \$6? \$8? \$7? \$9?
6. 1,200 (1250, 1750) tiles @ \$12? \$14? \$16? \$18?
7. 2,000 (1500, 2500) tiles @ \$22? \$24? \$36? \$48?

Ho

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

- 1.
- 24' x 4
- 48' x 0
- 56' x 7
- 2.
- 27'?
- 36'?
- 54'?
- 3.
- 350 ft
- 280 y
- 20 ro

Fin

1. 45
2. 25
3. 15
4. 5
5. 5
- 6.
- 7.

Exercise 199 - Fencing.

How long a fence would enclose a field :—

1. 6 ch. x 4 ch. ? 36 yds. x 64 yds. ? 25 yds. x 45 ft. ?
2. 9 rds. x 6 rds. ? 75 yds. x 85 yds. ? 45 yds. x 60 ft. ?
3. 7 ch. x 8 ch. ? 87 rds. x 63 rds. ? 75 yds. x 60 ft. ?
4. 8 rds. x 9 rds. ? 95 rds. x 75 rds. ? 24 rds. x 24 yds. ?
5. 35 yds. square ? 16 yds., 2 ft. x 13 yds., 1 ft. ?
6. 48 yds. square ? 23 yds., 1 ft. x 26 yds., 2 ft. ?
7. 57 rds. square ? 45 yds., 1 ft. x 21 yds., 1 ft. ?
8. 65 ch. square ? 24 ch., 2 rds. x 10 ch., 2 rds. ?
9. 84 rds. square ? 36 ch., 3 rds. x 23 ch., 1 rd. ?

Exercise 200.

1. How many posts, 8' apart, to fence a field :—

- | | | |
|-------------|---------------------|---------------------|
| 24' x 40' ? | 24 yds. x 32 yds. ? | 8 rds. x 16 rds. ? |
| 48' x 64' ? | 64 yds. x 80 yds. ? | 8 rds. x 24 rds. ? |
| 56' x 72' ? | 88 yds. x 96 yds. ? | 16 rds. x 32 rds. ? |

2. How many posts, 9 feet apart, for a straight fence :—

- | | | | | | |
|-------|-----------|-----------|-----------|---------|----------|
| 27' ? | 9 yds. ? | 12 yds. ? | 18 rds. ? | 3 ch. ? | 15 ch. ? |
| 36' ? | 18 yds. ? | 24 yds. ? | 36 rds. ? | 6 ch. ? | 30 ch. ? |
| 54' ? | 45 yds. ? | 15 yds. ? | 72 rds. ? | 9 ch. ? | 45 ch. ? |

3. How much inch lumber for a close-board fence :—

- | | |
|--------------------------------|--------------------------------|
| 350 ft. long and 5 ft. high ? | 275 ft. long and 4 ft. high ? |
| 280 yds. long and 4 ft. high ? | 325 yds. long and 6 ft. high ? |
| 20 rds. long and 4 ft. high ? | 40 rds. long and 6 ft. high ? |

Exercise 201.

Find the length of a fence enclosing a field :—

1. 45' x 64' 64 yds. x 56 yds. 46 ch. x 84 ch.
2. 25 yds. x 55 ft. 20 rds. x 90 yds. 10 rds. x 35 ft.
3. 15 ch. x 20 rds. 18 ch. x 28 rds. 16 ch. x 36 rds.
4. 5 ch. x 90 yds. 8 ch. x 64 yds. 12 ch. x 136 yds.
5. 5 ch. x 70 ft. 10 ch. x 140 ft. 15 ch. x 110 ft.
6. 6 yds., 2 ft. square. 7 ch., 2 rds square.
7. 11 yds., 2 ft. square. 10 ch., 40 ft. square.

Exercise 202.

Find the cost of fencing a field :—

1. [36' x 64'] @ 5c. a ft. [16 rds. x 24 rds.] @ 2c. a yd.
2. [42' x 48'] @ 6c. a ft. [25 rds. x 35 rds.] @ 4c. a yd.
3. [35' x 45'] @ 8c. a ft. [28 rds. x 42 rds.] @ 2c. a yd.
4. [53' x 67'] @ 6c. a yd. 24 rds. square @ \$.94 a rd.
5. [36' x 54'] @ 7c. a yd. 27 rds. square @ \$1.02 a rd.
6. [75' x 75'] @ 9c. a yd. 28 rds. square @ \$1.18 a rd.
7. [12 rds., 4 yds. x 16 rds., 2 yds.] @ 2c. a yd.
8. [18 rds., 1 yd. x 16 rds., 2 yds.] @ 3c. a yd.

Exercise 203.

1. How much wire will make a 5-strand fence around a field 36 rds. x 44 rds. ? 48 rds. x 52 rds. ? 135' x 165' ?
2. Find weight of the wire for a 6-strand fence around a field 24 yds. x 36 yds., if 5 yards of wire weigh a lb.
3. Find cost of the fence for a 10-mile railway @ 50c. a rd. ; @ 20c. a yd. ; @ 10c. a ft. ; @ \$2 a ch.
4. It cost \$20 (\$150, \$28.80) to fence a square field @ 25 (75,60) cents a rod. Find the dimensions of the field.
5. Find the cost of fencing a 10 (9, 7) acre field, which is 40 rods long, @ 10 cents a foot.
6. A field is 2 (3, 4) times as long as wide. The fence cost \$15 (\$20, \$25) @ 25 cents a rod. Find dimensions.
7. A field is 48 (64, 80) rds. long and contains 12 (16, 20) acres. Find the perimeter of the field.

Exercise 204.

How much inch lumber is required to fence a field :—

1. 125' x 175' with a 4-ft. close-board fence ?
2. 120 yds. x 80 yds. with a 5-ft. close-board fence ?
3. 16 rds. x 24 rds. with a 4-ft. close-board fence ?
4. 125 feet square with a 6-ft. close-board fence ?
5. 120 yards square with a 5-ft. close-board fence ?
6. 20 rods square with a 5-ft. close-board fence ?

Exercise 205—Ditching.

1. Find the cost of digging a ditch 60 (150, 750) yards long @ \$.75 (\$1.50, \$.84) a yard.
2. How much will it cost to dig a ditch 60 (150, 400) rods long @ 20 (30, 28) cents a yard?
3. What is the cost of the ditches for a mile of road @ \$2.50 a ch.? @ 75c. a rod? @ 20c. a yard?
4. I paid \$90 (\$105, \$48.75) for digging a drain @ 25 (35, 75) cents a rod. Find length of drain.
5. Find the cost of digging a ditch 600 ft. long, 2 (3, 4) feet wide, and 2 feet deep at 6c. a cub. ft.
6. Find the cost of digging a ditch 630 feet long, 5 (6, 9) feet wide at the top, 3 (4, 5) feet wide at the bottom, and 3 feet deep, @ 10c. a cub. yd.
7. It cost \$10 (\$20, \$75) to dig a ditch 3 (6, 9) feet wide and 3 (4, 6) feet deep at 10 (25, 50) cents a cub. yd. How long was it?

Exercise 206.

1. How many tiles, 12" long, will be needed for a drain 50 (85, 165) feet long?
2. How many tiles 12" long, will be needed for a drain 60 (75, 325) yards long?
3. How many tiles, 12" long, will be needed for a drain across and along one side of a field [24 rds. x 36 rds.]? [36 rds. x 44 rds.]? [16 ch. x 24 ch.]?
4. How many tiles, 12" long, would be needed for a drain across each end of a field 25 (50, 60) rods wide?
5. At \$12.50 per M, find the cost of the tiles 12 (16, 18) inches long, needed for a drain 800 ft. (320 yds., 40 rds.) long?
6. At \$15 per M, it costs \$9.60 for the tiles for a drain. Find the length of the drain if the tiles are 12" (15", 24") long.
7. At 10 cents a yard, it costs \$33 (\$44, \$49.50) to dig a drain across and along one side of a field 24 (36, 40) rods wide. How long is it?

Exercise 207—Painting, Etc.

Find the cost @ 9 (12, 15) cents a sq. yd., of painting the floor, or the ceiling, of a room :—

- | | | | |
|---------------|------------|--------------|--------------|
| 1. 12' x 15'. | 10' x 15'. | 7'6" x 12'. | 8'4" x 12'. |
| 2. 15' x 18'. | 12' x 16'. | 10'6" x 12'. | 12'6" x 12'. |
| 3. 16' x 18'. | 15' x 16'. | 13'6" x 18'. | 13'6" x 15'. |
| 4. 18' x 21'. | 16' x 18'. | 9'6" x 12'. | 16'6" x 15'. |
| 5. 21' x 24'. | 12' x 20'. | 16'6" x 18'. | 16'6" x 21'. |
| 6. 25' x 27'. | 15' x 22'. | 22'6" x 24'. | 19'6" x 24'. |

Exercise 208.

Find the cost, @ 3 (5, 6) cents a sq. yd., of kalsomining the walls of a room :—

- | | | |
|---------------------|--------------------|----------------------|
| 1. 9' x 12' x 9'. | 10'6" x 12' x 9'. | 10'6" x 7'6" x 9'. |
| 2. 12' x 15' x 9'. | 10'6" x 15' x 9'. | 10'6" x 10'6" x 9'. |
| 3. 13' x 14' x 10'. | 13'6" x 15' x 12'. | 11'6" x 12'6" x 9'. |
| 4. 14' x 16' x 12'. | 14'6" x 10' x 12'. | 12'3" x 14'9" x 10'. |
| 5. 16' x 17' x 15'. | 16'6" x 18' x 12'. | 12'7" x 14'5" x 12'. |
| 6. 22' x 28' x 18'. | 19'6" x 24' x 15'. | 18'8" x 17'4" x 15'. |

Exercise 209.

1. A room is 15' x 12' x 9'. Find cost of tinting ceiling @ 10 (12, 15) c., and walls @ 8 (9, 12) c., a sq. yd.
2. What will it cost to paint a 2 (3, 4) foot wainscot around a room 11' 3" x 11' 3" @ 15 (20, 25) c. a sq. yd. ?
3. Find the cost, @ 20 cents a sq. yd., of painting the roof of a barn 75' long and 36' from eaves to gable.
4. I paid \$5 (\$10.50, \$8.75) for painting a floor 15 (21, 21) feet long at 25 cents a sq. yd. Find width of room.
5. At 8 (10, 15) c. a sq. yd. it cost \$9.60 (\$16, \$30) to tint the walls of a room 24' x 36'. How high is the room ?
6. Find cost, @ 9 (12, 15) c. a sq. yd., of painting one side of a 5-ft. close-board fence, 36 (48, 90) yards long.
7. Find cost of painting a 6-ft. close-board fence around a field 24 rds. x 36 rds. @ 10 (12, 15) c. a sq. yd.

Exercise 210—Plastering.

How many square yards of plastering will be counted for the ceiling of a room :—

- | | | |
|---------------------|------------------|---------------------|
| 1. 9' x 12' x 10'? | 10' x 12' x 9'? | 10' x 12' 6" x 9'? |
| 2. 9' x 15' x 10'? | 10' x 15' x 9'? | 12' x 12' 6" x 9'? |
| 3. 12' x 15' x 10'? | 12' x 16' x 9'? | 16' x 12' 6" x 9'? |
| 4. 12' x 18' x 11'? | 15' x 16' x 10'? | 16' x 15' 6" x 10'? |
| 5. 15' x 18' x 12'? | 15' x 20' x 10'? | 20' x 22' 3" x 12'? |
| 6. 18' x 24' x 16'? | 20' x 30' x 10'? | 20' x 24' 9" x 16'? |

Exercise 211.

How many yards of plastering will be counted for the walls of a room :—

- | | | |
|---------------------|------------------|------------------------|
| 1. 10' x 12' x 9'? | 10' x 12' x 10'? | 10' 6" x 14' 6" x 9'? |
| 2. 12' x 15' x 9'? | 10' x 15' x 10'? | 12' 6" x 17' 6" x 12'? |
| 3. 12' x 15' x 10'? | 14' x 16' x 12'? | 14' 3" x 15' 9" x 12'? |
| 4. 12' x 15' x 12'? | 12' x 18' x 12'? | 17' 4" x 14' 8" x 15'? |
| 5. 15' x 18' x 12'? | 15' x 15' x 16'? | 17' 3" x 20' 3" x 15'? |
| 6. 16' x 20' x 14'? | 15' x 20' x 16'? | 16' 2" x 21' 4" x 18'? |

Exercise 212.

1. How many yards of plastering will be counted for a room [12' x 15' x 9']? [15' x 18' x 12']? [12' x 18' x 9']?

2. What is the cost, @ 15c. a sq. yd., of the plastering of a room [15' x 21' x 12']? [15' x 18' x 12']?

3. How many yards of plastering in a room having a 12-inch base-board and measuring [12' x 15' x 10']?

4. How much plastering will be counted for a room having a 3' wainscot and measuring [12' x 12' x 9']? [12' x 15' x 9']? [12' x 15' x 12']? [14' x 16' x 13']?

5. Find the cost, @ 15 cents a square yard, of plastering a room 15' x 18' x 12' (18' x 24' x 12') having 4 windows 3' x 6', and 2 doors 7' 6" x 4'.

6. The cost of plastering the ceiling of a room 24 feet long @ 20c. a sq. yard was \$8 (\$9.60, \$11.20). Find the width of the room.

Exercise 213 - Lathing.

How many bundles of laths are required :—

(1) For the ceiling of a room :—

1. $9' \times 10' \times 9'$ $12' 6'' \times 10' \times 9'$ $12' 3'' \times 12' \times 10'$?
2. $9' \times 15' \times 10'$ $15' 6'' \times 20' \times 12'$ $12' 4'' \times 15' \times 12'$?
3. $12' \times 15' \times 10'$ $17' 6'' \times 20' \times 15'$ $12' 8'' \times 15' \times 12'$?

(2) For the walls of a room :—

4. $15' \times 12' \times 10'$ $9' 6'' \times 13' \times 12'$ $11' 8'' \times 15' 4'' \times 10'$?
5. $11' \times 16' \times 10'$ $15' 6'' \times 16' \times 12'$ $15' 3'' \times 20' 9'' \times 10'$?
6. $16' \times 20' \times 10'$ $16' 6'' \times 15' \times 12'$ $14' 3'' \times 17' 3'' \times 10'$?

Exercise 214.

How many bundles of laths for a room :—

1. $12' \times 15' \times 12'$ having a $12''$ base-board around room?
2. $12' \times 18' \times 13' 6''$ having a $12''$ base-board?
3. $15' \times 18' \times 12' 6''$ having a $2'$ wainscot around room?
4. $12' \times 15' \times 10'$; doors 2 [$7' \times 4'$]; windows 2 [$6' \times 3'$]?
5. $12' \times 15' \times 12'$; doors 2 [$7' 6'' \times 4'$]; windows 4 [$3' \times 5' 6''$]?
6. $15' 6'' \times 18' \times 12'$; doors 2 [$8' 6'' \times 4'$]; wind's 6 [$4' \times 7' 6''$]?

Exercise 215 - Roofing.

1. Find the surface of the roof of a barn 50 (60, 75) feet long, and 30 (40, 45) feet from eaves to ridge.

2. How many squares in the roof of a shed 36 (48, 72) feet long, and 25 feet from eaves to ridge?

3. How many bundles of shingles are needed for a roof 24 (32, 40) feet long, and 25 feet from eaves to ridge?

4. Find cost, @ \$1.25 a bundle, of shingles needed for a roof 75 (64, 80) feet long, and 36 (25, 40) feet wide.

5. How many shingles, 4" wide, and laid 4" to the weather, are needed for a roof [$32' \times 16'$]? [$36' \times 20'$]?

6. How many slates, 8" wide, and laid 8" to the weather, are needed for a roof 2 [$32' \times 25'$]? 2 [$40' \times 25'$]?

7. Find distance, from eaves to ridge, of a roof 24 (36, 64) feet long, requiring 24 (35, 128) bundles shingles.

Exercise 216—Land Areas.

How many acres in a field :—

1. 24 rds. x 40 rds. ? 12 ch. x 15 ch. ? 10 ch. x 24 rds. ?
2. 36 rds. x 40 rds. ? 15 ch. x 18 ch. ? 36 rds. x 10 ch. ?
3. 40 rds. x 28 rds. ? 16 ch. x 20 ch. ? 32 rds. x 20 ch. ?
4. 32 rds. x 80 rds. ? 18 ch. x 25 ch. ? 64 rds. x 25 ch. ?
5. 48 rds. x 80 rds. ? 15 ch. x 24 ch. ? 48 rds. x 25 ch. ?
6. 25 rds. x 32 rds. ? 25 ch. x 32 ch. ? 24 ch. x 20 rds. ?
7. 64 rds. x 25 rds. ? 64 ch. x 75 ch. ? 25 rds. x 16 ch. ?

Exercise 217.

1. From a field 12 ch. x 15 ch. I sell a field 24 rds. x 40 rds. How much land remains ?

2. A field is 40 (80, 64) rds. wide, and contains 7 (12, 14) acres. How wide is it ?

3. My farm is $\frac{1}{4}$ mile wide and contains 80 (100, 160) acres. Find the length of the fence which encloses it.

4. A square field contains 900 (1600, 3600) sq. rds. Find its dimensions and its perimeter.

5. A square field contains 10 (40, 90) acres. Find its dimensions and the length of its fence.

6. My farm, 1 mi. square, is in square 40-acre fields. How many fields have I ?

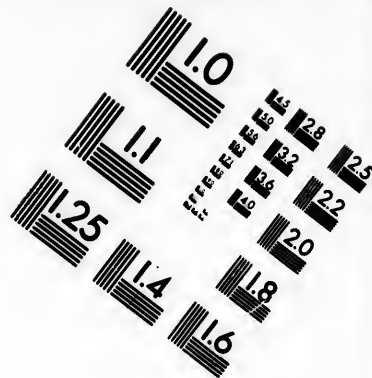
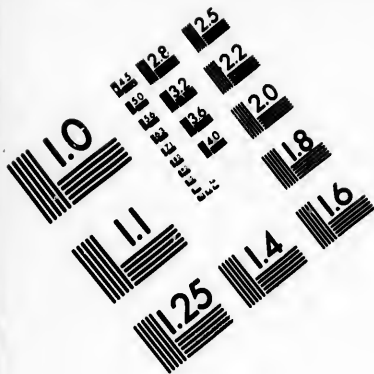
Find the length of fence which is required to enclose these fields.

Exercise 218.

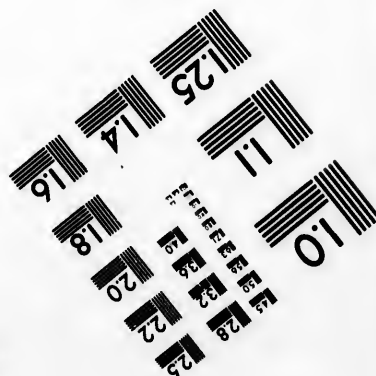
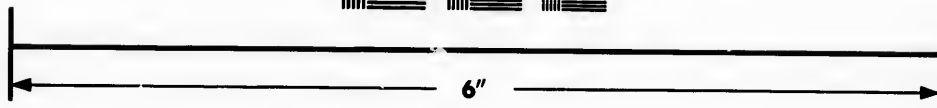
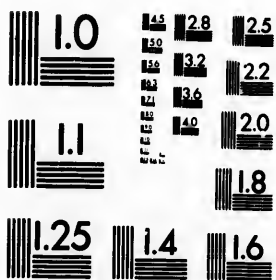
What are the dimensions of a field whose sides are to each other as :—

1. 2 : 1 and which contains 2 ac., 130 sq. rds. ? (5) ac. ?
2. 3 : 1 and which contains 7 ac., 5 sq. ch. ? $(7\frac{1}{2})$ ac. ?
3. 2 : 3 and which contains 3 ac., 120 sq. rds. ? $(3\frac{3}{4})$ ac. ?
4. 3 : 4 and which contains 7 ac., 80 sq. rds. ? $(1\frac{7}{8})$ ac. ?
5. 2 : 5 and which contains 2 ac., 40 sq. rds. ? $(6\frac{1}{2})$ ac. ?
6. 4 : 5 and which contains 3 ac., 20 sq. rds. ? $(4\frac{1}{4})$ ac. ?





**IMAGE EVALUATION
TEST TARGET (MT-3)**



**Photographic
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Corporation**

23 WEST MAIN STREET
WEBSTER, N.Y. 14590
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0
11
E5 28
E6 32
E7 36
E8 40
E9 45
18
16

11
10
E3
E2

Exercise 219.

1. How many sods $2' \times 1'$ will be required for a lawn 24 (36, 48) ft. long, and 20 (30, 40) ft. wide?
2. How many sods will be required for a lawn 36 yds \times 48 yds., if each is [$2' \times 3'$]? [$3' \times 18''$]? [$18'' \times 24''$]?
3. How much will it cost to pave a court 12 (24, 36) yards square with flags [$2' \times 3'$] at 75c. each?
4. How many flags 2 (3, 4) feet square will be required for a court yard 64 (75, 80) yards square?
5. It required 300 sods, each $2' \times 3'$ ($24'' \times 36''$) to sod a lawn 60 (90) feet long. How wide was it?
6. A lawn is twice as long as it is wide. The fence around it is 600 (450, 750) feet long. Find the cost of sodding the lawn @ 9 cents a sq. yd.
7. The dimensions of a lawn are as 2 : 3. The fence around it is 100 (150, 250) yds. long. Find the cost of sodding it @ 2 cents a sq. ft.

Exercise 220.

1. How many sods $1' 6'' \times 2' 6''$ will be required for a lawn [$36' \times 60'$]? [$48' \times 75'$]? [$75' \times 100'$]?
2. How many flags $1' 4'' \times 1' 8''$ will be needed for a court [$16' \times 20'$]? [$32' \times 40'$]? [32 yds. \times 40 yds.]?
3. How many bricks, laid on edge, will be required for a walk 32 (48, 80) feet long, and 6 feet wide?
4. How many bricks, laid on edge, will be needed for a road 400 yards long and 4 (6, 8) feet wide?
5. How many paving stones each $4'' \times 9''$ will be needed for a road 600 yards long and $6'$ ($5' 3''$, $6' 9''$) wide?
6. How long a swath $4'$ wide will cut 100 sq. yards? 40 sq. rods? 1 acre?
7. A man turns a furrow $9''$ ($12''$, $16''$) wide. How far will he walk in plowing 4 sq. rods? 40 sq. rods? 1 acre?
8. A man is plowing a square 10-acre field. If he turns a $12''$ furrow how far will he have walked when the work is done?

Exercise 221—Lumber.

How much lumber in a board :—

1. 1' x 1' x 1". 12' x 12" x 1". 12' x 1' x 2". 12' x 1' x $\frac{1}{2}$ ".
2. 3' x 1' x 1". 12' x 6" x 1". 16' x 1' x 2". 12' x 2' x $\frac{1}{2}$ ".
3. 6' x 1' x 1". 16' x 6" x 1". 15' x 1' x 3". 12' x 2' x $1\frac{1}{2}$ ".
4. 10' x 1' x 1". 16' x 3" x 1". 12' x 8" x 3". 16' x 2' x $2\frac{1}{2}$ ".
5. 10' x 2' x 1". 16' x 9" x 1". 16' x 6" x 3". 18' x 2' x $2\frac{1}{4}$ ".
6. 12' x 2' x 1". 18' x 4" x 1". 16' x 9" x 3". 16' x 2' x $2\frac{1}{4}$ ".
7. 15' x 2' x 1". 18' x 8" x 1". 15' x 8" x 3". 20' x 3' x $3\frac{1}{4}$ ".

Exercise 222.

1. How many feet of lumber in 3 (5, 8) inch-boards, each 12' (16', 18') long and 1' (15", 16") wide?

2. How much lumber in 8 (12, 20) scantlings 12' (15', 24') long, 4" wide, and 2 (3, $2\frac{1}{2}$) inches thick?

3. How much lumber in 10 (15, 20) planks, 12' (16', 20') long, 12" (15", 18") wide, and $2\frac{1}{2}$ inches thick?

4. How much lumber in a close-board fence 4' (5', 6') high and 30 ft. (60 yds., 20 rds.) long?

5. How much lumber in a 4 (6, 8) foot walk, 60 ft. (50 yds., 40 rds.) long—the planks 2" (3", $2\frac{1}{2}$ ") thick?

6. How many boards 12' x 6" x 1" would make a pile of lumber 4 (5, 8) ft. broad and 2 ft. high?

7. How many planks 8" (12", 16") wide, and 2" (3", $3\frac{1}{2}$ ") thick, would make a load 4 ft. wide and 3' 6" high?

Exercise 223.

How much lumber is needed for a floor :—

1. 8' x 12'. 22' x 28'. 12' 6" x 16'. 9' 3" x 9' 9".
2. 10' x 15'. 23' x 27'. 13' 6" x 16'. 10' 4" x 10' 8".
3. 12' x 15'. 25' x 25'. 15' 6" x 20'. 14' 5" x 14' 7".
4. 15' x 18'. 24' x 26'. 17' 6" x 20'. 19' 2" x 19' 10".
5. 18' x 25'. 21' x 29'. 22' 3" x 16'. 19' 6" x 19' 6".
6. 20' x 28'. 31' x 39'. 22' 8" x 15'. 24' 4" x 24' 8".
7. 25' x 32'. 32' x 38'. 27' 9" x 20'. 29' 6" x 29' 6".

Exercise 224—Flooring, etc.

1. How much inch-lumber is in a floor [16' x 25']? [36' x 40']? [32' x 45']? [35' x 48']? [25' x 64']?
2. How much lumber is in a close-board fence 6 feet high and 36 (45, 64, 75, 175) feet long?
3. How much inch-lumber is in a 5 (4, 6)-foot close-board fence around a lot [30' x 64']? [148' x 252']?
4. How much lumber in a 4 (5, 6)-foot walk made of 2" (3", 4") planks, and 25 (36, 72) yds. long?
5. How much lumber is in an 8-foot walk made of $2\frac{1}{2}$ ($2\frac{1}{4}$, $2\frac{3}{4}$)-inch planks, and 20 rods long?
6. Find the thickness of the lumber, if I used 600 (900, 750) feet, in making a floor [24' x 25']?
7. I used 1800 (2250, 2025) feet of lumber in making 150 feet of 6' sidewalk. Find thickness of planks used.

Exercise 225.

1. Find cost, @ \$12.50 per M, of the inch-lumber used to make a floor [25' x 32']; [25' x 48']; [30' x 40'].
2. Find the cost of the $2\frac{1}{2}$ -inch planks in a 5' walk 320 (480, 640) feet long, @ \$15 per M.
3. I use boards 4" wide to make a floor 16 (24, 36) feet wide. How many boards do I use?
4. How many boards 4" wide, having a half-inch tongue and groove, will be used for a floor 14 (21, 28) feet wide?
5. How much lumber will be required for a floor [24' x 25'], made of boards 3 (4, 6) inches wide, and having a half-inch tongue and groove?
6. I used 1440 (1800, 1620) feet of inch lumber for a close-board fence 120 yds. long. How high is it?
7. At \$15 per M, I paid \$7.50 (\$12, \$30) for the lumber in a 5' close-board fence. Find length of the fence.
8. I used 1000 (1080, 1200) feet of inch-lumber for a 4-foot close-board fence around a lot 25 yards long. How many feet wide was it?

Exercise 226—Carpeting.

How many strips of 3-foot carpet, running lengthwise of the room, are required for a room :—

- | | | | |
|---------------|------------|------------|------------|
| 1. 9' x 12'? | 10' x 15'? | 9' x 14'? | 11' x 20'? |
| 2. 12' x 15'? | 14' x 18'? | 12' x 16'? | 16' x 25'? |
| 3. 15' x 18'? | 16' x 21'? | 18' x 25'? | 20' x 28'? |
| 4. 18' x 24'? | 20' x 24'? | 24' x 32'? | 25' x 32'? |
| 5. 30' x 36'? | 32' x 36'? | 27' x 40'? | 28' x 40'? |

How many yards of carpet are required for each ?

Exercise 227.

How many strips of 27-inch carpet, running lengthwise of the room, are required for a room :—

- | | | | |
|---------------|------------|---------------|---------------|
| 1. 9' x 12'? | 11' x 15'? | 6' 9" x 12'? | 7' 6" x 10'? |
| 2. 18' x 24'? | 15' x 18'? | 11' 3" x 15'? | 12' 3" x 15'? |
| 3. 27' x 36'? | 20' x 24'? | 13' 6" x 15'? | 15' 6" x 18'? |
| 4. 36' x 45'? | 28' x 33'? | 15' 9" x 18'? | 21' 9" x 24'? |
| 5. 45' x 48'? | 30' x 36'? | 20' 3" x 24'? | 22' 3" x 27'? |

How many yards of carpet are required for each ?

Exercise 228.

- Find the width of a room which requires 3 (4, 7, 9, 8, 6, 5) strips of 3-foot carpet.
- Find the width of a room which requires 4 (8, 6, 10, 5, 9, 7) strips of 27-inch carpet.
- A room 12-feet wide requires 20 (24, 33 $\frac{1}{2}$) yds. of 3-foot carpet. How long is the room?
- A room 13' 6" wide requires 25 (35, 28 $\frac{1}{2}$) yds. of 27-inch carpet. Find the length of the room.
- Find width of a room 15 (18, 20) feet long, which requires 25 (30, 40) yds. of 3' (27", 30") carpet.
- A room is 15 feet square. How many yards of 3' (27", 30") carpet would it require.
- Which is the cheaper way to run a 3' (27", 30") carpet in a room 20' x 24' ? Find the saving @ \$1 a yd.

Exercise 229.

If the strips run lengthwise of the room, how many 3' (2', 18") patterns must be taken for rooms:—

1. 10' x 12' ? 10' x 15' ? 12' 6" x 12' ? 20' x 18' 6" ?
2. 12' x 18' ? 12' x 16' ? 13' 6" x 12' ? 15' x 14' 6" ?
3. 15' x 18' ? 15' x 21' ? 16' 6" x 15' ? 20' x 28' 6" ?
4. 20' x 24' ? 18' x 25' ? 25' 6" x 18' ? 30' x 15' 6" ?

Find the length of each strip.

How much will be lost on each strip in matching?

Exercise 230.

1. How many yards carpet are needed for 16 (18, 24) steps each 8" high and 10" (12", 14") broad?
2. What length of border carpet is needed for a room 12' x 15' ? 14' x 16' ? 11' 6" x 15' 6" ? 17' 2" x 20' 4" ?
3. Find cost of 27" carpet for a room 15' x 20' ; strips to run lengthwise of room, and 1' is lost in matching each.
4. Find difference in cost between carpeting a room 15' square with 27" carpet @ \$1, and 3' carpet @ \$1.25.
5. Find the width of the 75-cent carpet used for a room 18' x 24', if the cost is \$36 + \$48?
6. It cost \$15 (\$17.50, \$47.25) to carpet a room with carpet 3' (30", 27") wide @ 50 (50, 75) cents. Had the room been 6' (6', 4' 6") wider, it would have cost \$21 (\$24.50, \$60.75). Find the size of the room.

Exercise 231.

Find the cost of carpeting a room:—

1. 9' x 12' with 3' (30", 27") carpet @ \$.50 a yard.
2. 15' x 18' with 3' (30", 18") carpet @ \$1.25 a yard.
3. 18' x 24' with 3' (27", 18") carpet @ \$.75 a yard.
4. 11' 3" x 18' with 3' (27", 30") carpet @ \$1.50 a yard.
5. 20' 3" x 24' with 3' (30", 27") carpet @ \$1.25 a yard.
6. 13' 6" x 17' 6" with 3' (27", 18") carpet @ \$.90 a yard.
7. 15' 9" x 22' 6" with 3' (27", 30") carpet @ \$1.20 a yard.

Exercise 232—Wall-Papering.

1. How many strips of 2-foot wall-paper are needed for a ceiling which is 8 (12, 18, 15, 25) feet wide?
2. How many strips of 18-inch wall-paper are needed for a ceiling which is 9 (12, 15, 10, 14, 16) feet wide?
3. How many strips of 18-inch wall-paper are needed for a ceiling [7' 6" x 9']? [10' 6" x 12']? [13' 6" x 15']?
4. How many strips of 18-inch wall-paper are needed for the walls of a room [9' x 12']? [12' x 15']? [15' x 18']?
5. How many strips of wall-paper can be made of a double roll, for a ceiling [9' x 12']? [12' x 16']? [18' x 24']?
6. How many double rolls of 18" wall-paper are needed for a ceiling [9' x 12']? [12' x 16']? [12' x 15']? [12' x 20']?
7. How many double rolls of 18" wall-paper are needed for the walls of a room [9' x 12' x 8']? [12' x 15' x 12']?

Exercise 233.

How many double rolls of 18" wall paper are required for the ceiling of a room :—

- | | | | |
|---------------|---------------|------------|---------------|
| 1. 9' x 12'? | 7' 6" x 8'? | 10' x 12'? | 10' x 15' 6"? |
| 2. 12' x 12'? | 7' 6" x 12'? | 10' x 16'? | 12' x 14' 6"? |
| 3. 12' x 16'? | 10' 6" x 12'? | 14' x 16'? | 14' x 15' 9"? |
| 4. 15' x 16'? | 10' 6" x 16'? | 16' x 24'? | 16' x 11' 4"? |
| 5. 18' x 24'? | 13' 6" x 16'? | 20' x 24'? | 20' x 22' 7"? |

How much border paper is needed for each room?

Exercise 234.

How many double rolls of 18" wall-paper will be required for the walls of a room :—

1. 9' x 12' x 8'? 10' 6" x 12' x 8'? 7' 6" x 10' 6" x 8'?
2. 9' x 12' x 9'? 10' 6" x 15' x 9'? 10' 6" x 13' 6" x 9'?
3. 12' x 12' x 9'? 13' 6" x 15' x 10'? 10' 6" x 16' 6" x 10'?
4. 12' x 15' x 12'? 13' 6" x 18' x 11'? 10' 3" x 16' 9" x 10'?
5. 12' x 18' x 12'? 16' 6" x 21' x 12'? 13' 4" x 16' 8" x 12'?
6. 15' x 18' x 16'? 16' 6" x 24' x 15'? 16' 5" x 19' 7" x 12'?

Exercise 235.

1. Find cost, @ 15 cents a yard, of the border for the walls of a room $15' \times 18'$? $16' 4'' \times 19' 8''$? $17' 6''$ square ?

2. Find the length the strips of wall-paper will be for a room 10 feet high, if the pattern is $2'$ ($30''$; $1' 6''$, 1 yd.) long.

3. How many rolls of 18-inch wall-paper will be needed for the walls of a room [$15' \times 18' \times 11'$], if the paper used has a pattern $2'$ ($3'$, $2' 6''$, $1' 6''$) long ?

4. How many rolls of 18-inch wall-paper will be needed for the ceiling of a room [$12' \times 15' \times 12'$], if the paper used has a $2'$ ($3'$, $2' 6''$, $1' 6''$) pattern ?

5. Find the number of double rolls of 18-inch wall-paper required for the ceiling and walls of a room [$15' \times 24' \times 10'$], having a 12-inch base-board.

6. Find the number of double rolls of 18-inch wall-paper needed for the ceiling and walls of a room [$12' \times 18' \times 10' 6''$], if the pattern on the paper is $3'$ long.

Exercise 236.

1. Find the cost, @ 20 cents a roll, of the 18-inch wall-paper required for the ceiling of a room [$13' 6'' \times 15' \times 10'$] ? [$13' 6'' \times 16' \times 12'$] ? [$17' 6'' \times 24' \times 16'$] ? [$20' \times 22' 9'' \times 16'$] ?

2. Find the cost, @ 20 cents a roll, of the 18" paper needed for the walls of a room [$15' \times 18' \times 12'$], having 2 doors $4'$ wide, and 4 windows $3' 6''$ wide.

3. What is the cost, @ 12 cents a yard, of the border paper required for a room [$15' \times 18'$] ? [$16' \times 14'$] ? [$15' 6'' \times 17' 6''$] ?

4. How many double rolls of wall-paper will be required for the walls and ceiling of a room [$12' 6'' \times 15' 6'' \times 9'$] if there is a door $4'$ wide, 3 windows $3'$ wide, and a $12''$ base-board around the room ?

5. The border paper, @ 15 cents a yard, for a room 9 high, and whose sides are as 2 : 3, cost \$3. How many double rolls of 18" wall-paper will be required for the walls and ceiling of the room, if the width of the doors and windows is 20 feet ?

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Exercise 237 - Excavating, etc.

1. How many cubic yards of earth must be removed to make a cellar [12' x 15' x 6']? [15' x 18' x 8']?
2. How many loads of earth will be taken out to make a cellar [12' x 18' x 7']? [15' x 18' x 9']? [12' x 18' x 10']?
3. Find the cost of drawing away the earth to form a cellar 12' square and 6 (7, 8) feet deep, @ 75c. a load.
4. Find the cost of filling a cellar 15 feet square and 6 (8, 9) feet deep, @ 45 cents a load.
5. At 25 cents a yard, I paid \$15 (\$12.50, \$17.50) for digging a cellar 15' long and 9' deep. How wide was it?
6. A cellar 12' (15', 18') long is as deep as it is wide. Find the width, if 36 (45, 96) loads of earth were removed in forming it.

Exercise 238—Road-Making.

1. How many loads of gravel can be taken from a bank 24' long, 12' wide at the bottom and 6' wide at the top?
2. How many loads of gravel will put a 12" (6", 9") layer on a road 90 yds. long and 15 feet wide?
3. Find the cost of putting a 12" (4", 8") layer of gravel on a road 150 yards long and 18 feet wide, @ 75c. a load.
4. At 75 cents a load, it cost \$30 (\$75, \$37½) to put a 6" layer of gravel on a road 18' wide. How long was it?
5. It takes 10 (40, 50) loads more, to put a 12" layer of gravel on a road 18' wide, than if it were 15' wider. Find the length of the road.
6. At 75 cents a load, it cost \$270 (\$180, \$135) to gravel a road 18' wide and 180 yards long. How deep was the layer of gravel?
7. Find the cost, per running foot, of a road 27 feet wide @ 75 cents a square yard.
8. What length of road, 18 feet wide, will require 25 (75, 250) loads, for a 9-inch layer of gravel?

Exercise 239—Review.

1. How many cent pieces, placed side by side, would reach 5 feet? 8 feet? 12 feet? 25 yards? 10 rods?
2. How many cent pieces, laid side by side, would cover a surface $6'' \times 8''$? $2' \times 3'$? $4' \times 5'$? $6' \times 10'$? 2 yds. \times 4 yds.? 6 feet square? 4 yds. square?
3. How many 2'' cubes would form a 6'' cube? An 8'' cube? A 12'' cube? A cubic foot? A cubic yard? A cube 2 yards long?
4. Find the height of a room $12' \times 15'$ that contains 80 (100, 150) cubic yards of air.
5. What is the height of a room [$16' \times 20'$] if the area of the walls is 72 sq. yds.? 80 sq. yds.? 96 sq. yds.?
6. It cost 48 cents to cut a log into 3 pieces. How much will it cost to cut it into 2 (4, 7) pieces?
7. The sides of a field containing 8 (6, 7) acres are as 4 : 5 (3 : 5; 7 : 10). Find the length of the fence surrounding it.

Exercise 240.

1. How much land, @ $\$ \frac{2}{3}$ a square rod, can be bought for \$36? 48? \$75? \$73.80? \$100 $\frac{1}{2}$?
2. What is the area of the surface of a brick [$2'' \times 4'' \times 8''$]? Of a six-inch cube? Of a box [$6' \times 4' \times 2'$]?
3. How many rotations will a wheel 11 feet in circumference make, in going 1 mile? 80 rods? 240 rods?
4. How many acres in a farm 1 mile square? 2 mi. square? 3 mi. square? 1 mi. \times 2 mi.? 2 mi. \times 3 mi.?
5. At \$.75 a sq. ft., what is the cost of dressing the top, front and ends of a stone [$4' \times 2' \times 1'$]? [$6' \times 3' \times 2'$]? [$8' \times 4' \times 2'$]?
6. What is the cost, @ 12 cents a sq. yd., of painting the outside of a box [$3' \times 2' \times 2'$]? [$4' \times 3' \times 2'$]? 4 feet each side?
7. Find the dimensions of a field containing 600 sq. yds., and whose sides are as 3 : 2? As 6 : 1? As $\frac{1}{2}$: $\frac{3}{4}$?

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Exercise 241—Review.

1. How much land will be rolled by a 9-foot roller in going 150 feet? 240 yards? 40 rods?

2. How much land will be rolled in going around a field 36 rods x 24 rods, with a roller 6 (8, 11) feet wide?

3. How many 3-inch pickets, placed 3 inches apart, will be needed for a fence around a lot 125 ft. x 175 ft.?

4. How many sods, 12" x 18", will be needed to make a 6-foot border around a flower-bed 24' x 36'? 30' x 45'?

5. How many panes of glass, 6" x 9", can be cut from a sheet of glass 2' x 3'? 3' x 4'? 7' 6" x 6' 9"?

6. Find the cost of a foot of lumber @ \$10 (\$12, \$12.50, \$15, \$25, \$30, \$37.50) per M.

7. How many yards of satin, 2 (3, 1½) feet wide, will cover a box [3' x 4' x 2']?

8. If 16 (24, 19½) bundles of laths were used in lathing the walls of a room 16' x 20', how high is the room?

Exercise 242.

1. It took 45 (75, 50) flags 2' x 3' to cover a courtyard. How many flags 15" x 18" would be required?

2. It cost \$30 to carpet a room 15' x 18'. How much would it cost to carpet a room 15 (18, 27) feet square with the same carpet?

3. It cost \$40 to fence a square field @ 25 (50, 33⅓) cents a rod. Find its value at \$75 (\$50, \$32) an acre.

4. A square field contains 10 (3⅓, 8⅒) acres. Find the cost of fencing it @ \$.50 (\$1.25, \$.75) a rod.

5. Find the cost of making a gravel walk, 3 (4, 5) feet wide, around a bed 40' x 75', @ 25 cents a square foot.

6. A mat 15 feet square is placed in the middle of a floor 20' x 24'. What part of the floor is covered? What part is uncovered?

7. The cost of plastering the walls of a room 15 feet long and 12 feet high, @ 10c. a yard, was \$6.40 (\$7.20, \$8). Find its width.

Exercise 243—Review.

1. Find the perimeter of a field .625 mi. x .375 mi.
2. The sides of a rectangular field are as 2 : 3. Find the dimensions if the area is 150 (384, 600) sq. rds.
3. Find the length of the fence around a field containing 3 (12, 27) acres, if the sides are as 5 : 6.
4. Find the cost of fencing a square field containing 10 ($2\frac{1}{2}$, $5\frac{1}{2}$) acres @ 75 cents a rod.
5. A fence 36 yards long cost \$18 (\$15, \$16) less than if it were 48 yards long. Find its cost.
6. It cost \$15 (\$22.50, \$30) to carpet a room 15 (18, 24) feet long. If it had been 3 feet wider it would have cost \$16.50 (\$27, \$36). Find its dimensions.
7. How many acres in a tract of land $1\frac{1}{4}$ miles square?
8. Find the solid contents of a cube whose edge measures 3 yds., 1 ft. Find its surface.
9. Find the value of a bin of wheat [$5' \times 8' \times 12'$] @ 75 cents a bushel. Find its weight if filled with barley.

Exercise 244.

1. What is the area of a square field whose perimeter is 50 rods? 62 rods? 82 yds.?
2. How many 10-acre fields in a farm 160 rds. square?
3. Find the cost of digging the post-holes, 8 feet apart, around a square farm of 160 acres, @ 10 cents each.
4. How many rods of fencing will be required to enclose a square 160-acre farm and divide it into 10 (20, 40) acre fields?
5. How many acres in a field 15 ch. x 40 rods?
6. Find the cost of sodding a plot 150 yds. x 75 @ 9 cents a square yard.
7. How long a pile of 16" (24", 30") wood will make a cord, if piled 4 feet high?
8. If a bushel of wheat equals $1\frac{1}{4}$ cubic feet, how deep must a bin $5' \times 8'$ be to contain 300 bush.? 400 bush.?

1. $23 \times$
2. $34 \times$
3. $35 \times$
4. $32 \times$
5. $39 \times$

1. $2\frac{1}{4} \times$
2. $3\frac{1}{4} \times$
3. $4\frac{3}{8} \times$
4. $5\frac{3}{8} \times$
5. $6\frac{1}{8} \times$

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TYPE QUESTIONS.

Exercise 245—Short Methods.

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| 1. $23 \times 27 =$ | 19 \times 21 = | 25 \times 45 = |
| 2. $34 \times 36 =$ | 28 \times 32 = | 35 \times 55 = |
| 3. $35 \times 35 =$ | 37 \times 43 = | 35 \times 75 = |
| 4. $32 \times 38 =$ | 65 \times 75 = | 45 \times 85 = |
| 5. $39 \times 31 =$ | 56 \times 64 = | 75 \times 95 = |

Exercise 246.

- | | | |
|---|---------------------------------------|---------------------------------------|
| 1. $2\frac{1}{2} \times 2\frac{1}{2} =$ | 1 $\frac{1}{2} \times 2\frac{1}{2} =$ | 1 $\frac{1}{2} \times 3\frac{1}{2} =$ |
| 2. $3\frac{1}{2} \times 3\frac{1}{2} =$ | $3\frac{1}{2} \times 2\frac{1}{2} =$ | $2\frac{1}{2} \times 6\frac{1}{2} =$ |
| 3. $4\frac{2}{3} \times 4\frac{1}{3} =$ | $6\frac{1}{3} \times 5\frac{2}{3} =$ | $4\frac{1}{2} \times 6\frac{1}{2} =$ |
| 4. $5\frac{3}{8} \times 5\frac{5}{8} =$ | $8\frac{3}{8} \times 7\frac{7}{8} =$ | $3\frac{1}{2} \times 7\frac{1}{2} =$ |
| 5. $6\frac{5}{8} \times 6\frac{3}{8} =$ | $9\frac{5}{8} \times 8\frac{1}{8} =$ | $9\frac{1}{2} \times 3\frac{1}{2} =$ |

Exercise 247.

- | | | |
|-------------------------|----------------------|--------------------|
| 1. $2.5 \times 2.5 =$ | 1.75 \times 2.25 = | 2.5 \times 4.5 = |
| 2. $3.25 \times 3.75 =$ | 2.95 \times 3.05 = | 3.5 \times 5.5 = |
| 3. $4.36 \times 4.64 =$ | 3.85 \times 4.15 = | 4.5 \times 6.5 = |
| 4. $6.45 \times 6.55 =$ | 6.55 \times 7.45 = | 5.5 \times 7.5 = |
| 5. $7.27 \times 7.73 =$ | 5.64 \times 6.36 = | 8.5 \times 6.5 = |

Exercise 248.

1. Find $73 \times 770 - 53 \times 570$; $860 \times 84 - 760 \times 74$.
2. Find $9\frac{3}{4} \times 9\frac{1}{4} + 19\frac{3}{8} \times 19\frac{3}{8} + 29\frac{3}{8} \times 29\frac{3}{8}$.
3. From 9.48 times 9.52 take 4.49 times 4.51.
4. Add $9\frac{1}{2} \times 9\frac{1}{2}$, 9.6×9.4 and 19.25×19.75 .
5. Find the difference between the cost of 25 cows @ \$25 and 22 cows @ \$28; 36 cows @ \$34 and 26 cows @ \$24.
6. How much money must I give with 35 sheep @ \$7.50 to pay for 45 sheep @ \$8.50? 65 sheep @ \$6.50? 45 lambs at \$7.50?

Exercise 249 - Aggregates.

Find the aggregate of:—

- 26, 34, 45, 28, 70, 92, 28, 77, 39 and 35.
308, 547, 659, 783, 206, 865, 474 and 792.
- 28 men, 36 men, 47 men, 65 men, 94 men and 53 men.
64 cents, 85 cents, 92 cents, 37 cents and 78 cents.
- \$7.26, \$4.35, \$5.48, \$8.54, \$3.62 and \$6.79.
\$5, \$2.86, \$3.07, \$4.50, \$9, \$.74 and \$3.25.
- 6' 4", 3' 9", 5' 6", 8' 2", 7' 5", 4' 7" and 9' 9".
3 yds., 2 ft. ; 5 yds., 6 in. ; 6 ft., 4 in. ; 8 yds., 2 ft., 7 in.
- £20 16s., £24 12s., £36 14s., £75 8s, and £64 10s.
£10 16s. 6d., £15 10s. 10d., £36 12s. 8d.
- 4 gal., 3 qts. ; 5 gal., 2 qts. ; 6 qts., 1 pt. ; 3 gal., 1 pt.
4 bu., 3 pks. ; 9 bu., 3 pks. ; 6 pks., 1 gal. ; 4 bu., 1 gal.
- 30%, 40%, 75%, 86%, 93%, 87%, 75% and 65%.
45%, 38%, 59%, 76%, 64%, 27%, 93% and 82%.

Exercise 250.

Find the aggregate of:—

- $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ and $\frac{1}{5}$.
 $\frac{2}{3}, \frac{3}{4}, \frac{4}{5}$ and $1\frac{1}{2}$.
- $1\frac{1}{2}, 1\frac{1}{3}, 1\frac{1}{4}$ and $1\frac{1}{5}$.
 $2\frac{2}{3}, 3\frac{1}{2}, 4\frac{1}{4}$ and $31\frac{5}{2}$.
- .47, .38, .64, .73, .96, .85 and 59.
.324, .545, .768, .836, .687, .493 and .952.
- .47, .386, .658, .56, .807, .74 and .925.
6.8, 4.93, 6.55, 6.8, .37, .42 and 5.08.
- .3, .2, .9, .06, .5, .7, .88 and .44.
.45, .36, .27, .63, .81, .72, .63 and .18.
- 4.3, 8.4, 9.27, 6.36, 7.09, 3.6 and 4.5.
.323, .040, .434, .545, 6.282, 5.727 and .494.
- .625, .375, .875, .25, .75, .125, .5 and .625.
 $87\frac{1}{2}\%$, .75, $62\frac{1}{2}\%$, $\frac{3}{4}$, 50%, .375, .25, $12\frac{1}{2}\%$.

Find

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Find

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.6.
- 36
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- 62
16
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Exercise 251 - Averages.

Find the average of :—

- 6, 8, 9, 4, 3, 8, 7, 6, 5 and 4.
35, 28, 67, 49, 52, 73, 96, 84 and 56.
- 45c., 86c., 29c.; 64c., 53c., 78c., 97c. and 68c.
\$23, \$24, \$25, \$26, \$27, \$28, \$29, \$30 and \$31.
- \$2.45, \$3.26, \$4.84, \$5.63, \$6.78, \$7.39 and \$4.65.
\$3.25, \$3.27, \$3.29, \$3.31, \$3.33, \$3.35 and \$3.37.
- 3' 6", 3' 9", 4', 4' 3", 4' 6", 4' 9", 5', 5' 3" and 5' 6".
3 yds., 2 ft., 7 in.; 4 yds., 2 ft., 8 in.; 3 yds., 9 in.
- £24 10s. 6d.; £36 15s. 9d.; and £31 13s. 9d.
£48 10s. 4d.; £50 14s. 7d.; and £52 18s. 10d.
- 4 wks., 2 d., 9 hrs.; 5 wks., 4 d., 8 hrs.; 2 wks., 7 hrs.
8 lbs., 13 oz.; 5 lbs., 12 oz.; 3 lbs., 7 oz.; and 18 lbs.
- 48 bu., 36 lbs.; 56 bu., 40 lbs.; and 64 bu., 44 lbs.
16 bu., 17 lbs.; 32 bu., 29 lbs.; and 48 bu., 41 lbs.

Exercise 252.

Find the average of :—

- $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{5}$. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$ and $\frac{7}{12}$.
 $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{12}$. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$ and $\frac{1}{12}$.
- $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{4}{10}$, $\frac{1}{8}$ and $\frac{2}{3}$.
0, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{8}$, $1\frac{3}{8}$, $1\frac{1}{4}$, and $1\frac{1}{2}$.
- $1\frac{1}{8}$, $2\frac{1}{4}$, $3\frac{3}{8}$, $4\frac{1}{2}$, $5\frac{5}{8}$, $6\frac{3}{4}$, $7\frac{7}{8}$, 9, $10\frac{1}{8}$, $11\frac{1}{4}$ and $12\frac{3}{8}$.
 $1\frac{3}{8}$, $2\frac{5}{8}$, 4, $5\frac{1}{8}$, $6\frac{3}{8}$, $7\frac{1}{2}$, $8\frac{3}{8}$, $9\frac{5}{8}$ and 11.
- .44, 1.58, 2.72, 3.86, 5, 6.14, 7.28, 8.42 and 9.56.
1.45, 1.53, 1.61, 1.69, 1.77, 1.85, 1.93, 2.01 and 2.09.
- 1.23, 2.27, 3.31, 7.47, 8.51, 9.55, 6.43, 5.39 and 4.35.
.64, .67, .7, .73, .625, .655, .685, .715 and .745.
- 36%, 40%, 44%, 52%, 56%, 48%, 32%, 60% and 64%.
15%, 25%, 35%, 45%, 55%, 65%, 75%, 85% and 95%.
- $62\frac{1}{2}\%$, $87\frac{1}{2}\%$, $37\frac{1}{2}\%$, $12\frac{1}{2}\%$, 50%, 75% and 25%.
 $16\frac{2}{3}\%$, $33\frac{1}{3}\%$, 50%, $83\frac{1}{3}\%$, $66\frac{2}{3}\%$, 100% and $116\frac{2}{3}\%$.
 $11\frac{1}{3}\%$, $33\frac{1}{3}\%$, $66\frac{2}{3}\%$, $22\frac{2}{3}\%$, $44\frac{4}{3}\%$, $55\frac{5}{3}\%$ and $77\frac{7}{3}\%$.

Exercise 253—Alligation.

1. I mix 2 (3, 4) lbs. sugar @ 6 (9, 7) cents, with 4 (5, 6) lbs. @ 9 (7, 12) cents. Find average price per lb.
2. I mix 50 (25, 60) lbs. wool @ 13 (11, 21) cents with 75 lbs. @ 8 (7, 12) cents. Find the average price per lb.
3. How many lbs. coffee @ 20 (35, 40) cents, must be mixed with 4 (8, 9) lbs. @ 30 (20, 20) cents, to produce a blend worth 25 (30, 35) cents a pound?
4. How many lbs. tea @ 75 cents, must be mixed with 25 (30, 20) lbs. @ 45 (40, 35) cents, to produce a blend worth 50 cents a pound?
5. A man mixed 4 (1, 8) gallons water with 8 (9, 12) gallons wine @ \$3 (\$2.50, \$2.50). What is the mixture worth a gallon?
6. How many gallons of water must be mixed with 6 (8, 10) gal. wine @ \$3 (\$2.50, \$4.50) to produce a mixture worth \$1.50 (\$2, \$2.50) a gallon?

Exercise 254.

1. I buy sheep @ \$3 and @ \$4. Find the relative number at each price, if the average cost was \$3.25 (\$3.20, \$3.30).
2. I paid \$600 (\$540, \$625) for 100 sheep, some @ \$4 and some @ \$9 (\$6, \$7). How many did I buy at each price?
3. I sold 20 sheep for \$85 (\$76, \$116), some @ \$5 and the others @ \$4 (\$3, \$7). How many did I sell at each price?
4. I sold 10 (20, 30) lbs. tea and coffee for \$6.50 (\$11, \$18). If the tea sold @ \$.75 (\$.65, \$.75) and the coffee @ 50 (45, 50) cents a lb., how many lbs. of each did I sell?
5. I buy $3\frac{1}{2}$ (7, $3\frac{1}{2}$) lbs. tea and coffee for \$2 (\$2.05, \$3.65). How many lbs. of each do I buy if the tea costs 60 (40, 50) cents, and the coffee 40 (20, 40) cents a lb.?
6. If $3\frac{1}{2}$ lbs. tea and $6\frac{1}{2}$ lbs. coffee cost \$5.25 (\$5, \$5.50), and $6\frac{1}{2}$ lbs. tea and $3\frac{1}{2}$ lbs. coffee cost \$4.75 (\$5, \$6.50), find the price of each per lb.

Exercise 255 - Equations.

1. If 3 geese and 4 turkeys cost \$4.50 (\$3.60, \$7.25), and 3 geese and 7 turkeys cost \$6.75 (\$5.40, \$11.00), find the price of geese and turkeys.

2. If 3 men and 2 boys earn \$5.25 (\$5.70, \$8.35), and 5 men and 2 boys earn \$7.75 (\$8.70, \$12.85), find the wages of each.

3. If 3 ducks and 4 hens cost \$3.10 (\$3.80, \$4.25) and 2 ducks and 3 hens cost \$2.20 (\$2.70, \$3.00) find the price of ducks and hens.

4. If 5 men and 3 boys earn \$10.50 (\$12.25, \$6.50), and 3 men and 4 boys earn \$8.50 (\$9.00, \$5.00), find the wages of each.

5. If 3 men and 2 boys earn \$6.00 (\$7.50, \$11) a day, and 5 men and 4 boys earn \$10.50 (\$13, \$19) a day, find the daily wages of 3 men and 8 boys.

Exercise 256.

1. If 5 sheep and 4 pigs cost \$39 (\$53, \$71), and 4 sheep and 9 pigs cost \$66 (\$83, \$109), find the cost of 3 sheep and 5 pigs.

2. If 4 boys and 5 girls work 43 (85, 57) questions, and 2 boys and 3 girls work 23 (47, 31) questions, how many questions do a boy and a girl work?

3. If 3 men and 4 women earn \$10 (\$17, \$13.50) a day, and 7 men and 2 women earn \$16 (\$25, \$20.50) a day, find the weekly wages of 6 men and 6 women.

4. To make 3 button holes and sew on 4 buttons takes 13 minutes; to make 4 button holes and sew on 5 buttons takes 17 minutes. How long will it take to make a dozen button holes and sew on the buttons?

5. If 3 boys and 5 girls eat 29 (30, 55) apples, and 5 boys and 6 girls eat 46 (54, 73) apples, how many apples will 10 boys and 10 girls eat?

6. If 3 lbs. tea and 4 lbs. coffee cost \$3.10 (\$4.25, \$3.05), and 4 lbs. tea and 3 lbs. coffee are worth \$3.20 (\$4.50, \$3.25), find the cost of 7 lbs. of each.

Exercise 257 Mixtures.

1. If 5 oz. green tea is mixed with 7 oz. black tea, how many pounds of each will be in 72 (96, 27) lbs. of the blend?

2. I blend 24 (48, 36) lbs. tea, @ 25 cents, with 16 (12, 44) lbs. @ 20 (30, 36) cents, and sell @ 30 (40, 33) cents. Find my gain or loss?

3. I bought 10 (8, 9) lbs. tea and 12 lbs. coffee for \$8.40 (\$12, \$11.70). Find the price of each, if the tea cost 40 (25, 25) cents more, a pound, than the coffee.

4. If 24 lbs. of tea @ 50 cents, and coffee @ 30 cents, are worth \$9.60 (\$10, \$10.40), find the number of pounds of each.

5. If 5 lbs. tea @ 40 (60, 80) cents be mixed with 7 (3, 3) lbs. @ 50 (80, 50) cents, and the blend sold @ 55 (75, 55) cents, find the gain or loss %.

Exercise 258.

1. If 2 hens and 3 ducks are worth \$2.30 (\$1.85, \$2.05) and 3 hens and 5 ducks are worth \$3.70 (\$3, \$3.30), find the difference between the price of hens and ducks.

Find the cost of 1 hen and 2 ducks.

Find the cost of 5 hens and 8 ducks.

Find the cost of 8 hens and 12 ducks.

Find the cost of 7 ducks and 11 hens.

2. In a mixture of 60 gal., 20% (25%, 33 $\frac{1}{3}$ %) is water. How many gallons must be added so that 25% (40%, 66 $\frac{2}{3}$ %) may be water?

3. In a mixture of 50 gal., 50% is water. What must be added so that 25% (16 $\frac{2}{3}$ %, 12 $\frac{1}{2}$ %) of the mixture may be wine?

4. I mix 20 gallons of water and 40 gallons of wine. What must be added so that $\frac{1}{2}$ (.75, 87 $\frac{1}{2}$ %) may be wine?

5. How much water must be added to a mixture of 12 (7, 9) gal. wine and 3 (4, 2) gal. water, so that $\frac{2}{3}$ (.35, 75%) of the mixture may be wine?

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Exercise 259—Election Questions.

1. At an election, A got 3450 votes out of 7329 (4345, 8067) votes cast. How many did B get?
2. A got 4325 votes, and B got 3864 (5729, 6500) votes. Which was elected, and what was his majority?
3. A got 1487 votes out of 3524 (3700, 3164) votes cast. Find B's majority.
4. A and B, the candidates in an election, received 4250 and 3200 (3427 and 4000; 4256 and 3789) votes respectively. Which was elected, and what was his majority?
5. A and B were the candidates for mayor. A got 4352 (6478, 5369) and B got 5783, votes. Which was successful, and what was his majority?
6. In an election, A got a majority of 63 (85, 127) out of 725 votes cast. How many votes did B get?
7. In an election, 2568 ballots were cast. A's majority over B was 28 (74, 132). How many votes did each get?

Exercise 260.

1. In an election, A got $\frac{2}{3}$ (.55, 60%) of the votes, and B received 540 (2160, 9360) votes. How many did A get?
2. A received $\frac{1}{3}$ (.45, 37½%) of the votes and B's majority was 75 (96, 72). Find the vote for each.
3. In an election, A got $\frac{2}{3}$ (.75, 62½%) of the votes and the majority was 640. How many votes did each get?
4. In an election, the votes for A and B were as 2 : 3, (as 3 : 4, as 4 : 7) respectively, and the majority was 360. Find the vote for each.
5. In an election, the number of ballots cast for A and B were as 3 : 5 respectively, and B's majority was 96 (144, 720). Find the vote for each.
6. In an election, 8470 votes were polled for A and B in the ratio of 3 : 4 (4 : 7, 6 : 5) respectively. Find the result of the election.

Exercise 261—Remainders.

1. A man spent $\frac{1}{2}$ ($\frac{3}{4}, \frac{1}{4}$) of his money, and had \$750 left. How much had he at first?
2. I paid $\frac{1}{3}$ ($\frac{1}{2}, \frac{1}{3}$) of my money for a cow, and $\frac{1}{2}$ ($\frac{1}{3}, \frac{2}{3}$) of the remainder for a stove, and had \$24 left. How much had I at first?
3. A man spent $\frac{3}{4}$ ($\frac{3}{4}, \frac{5}{8}$) of his money, and lost $\frac{1}{4}$ ($\frac{3}{8}, \frac{1}{2}$) of the remainder, and had \$25 (\$35, \$45) left. How much had he at first?
4. I gave \$5 more than $\frac{1}{2}$ ($\frac{1}{3}, \frac{2}{4}$) of my money for a book, and had \$7 left. How much had I at first?
5. I gave \$20 more than $\frac{2}{3}$ ($\frac{2}{3}, \frac{4}{3}$) of my money for a horse, and had \$16 left. Find the cost of the horse.
6. I gave $\frac{2}{3}$ ($\frac{1}{2}, \frac{7}{3}$) of my money for a horse, $\frac{1}{2}$ ($\frac{1}{2}, \frac{1}{2}$) of the remainder for a buggy, and $\frac{1}{3}$ ($\frac{1}{3}, \frac{1}{3}$) of what then remained for a harness, and had \$40 left. How much had I at first?

Exercise 262.

1. B spent \$4 (\$5, \$8) more than $\frac{2}{3}$ (.6, 75%) of his money and had \$8 (\$3, \$2) more than $\frac{1}{3}$ ($\frac{1}{3}, 20\%$) of it left. How much had he at first?
2. I sold $\frac{2}{3}$ (.7, 35%) of my flock and had 15 (36, 39) sheep left. How many had I at first? How many did I sell?
3. I sold 12 (9, 25) acres more than $\frac{2}{3}$ (.5, 25%) of my farm and have 7 (4, 30) acres less than $\frac{1}{4}$ (.45, 80%) of it left. Find size of the farm and how much I sold.
4. I spent $\frac{1}{6}$ ($\frac{1}{10}, \frac{1}{5}$) of my money and \$5 (\$4, \$2) for a hat, then \$3 (\$4, \$2) less $\frac{2}{3}$ ($\frac{2}{4}, \frac{7}{11}$) of the remainder for a coat and have \$8 (\$12, \$10) left. Find the cost of each.
5. I gave \$17 (\$10, \$4) more than $\frac{2}{3}$ ($\frac{3}{4}, \frac{5}{3}$) of my money for a horse, and \$5 more than $\frac{2}{3}$ ($\frac{1}{4}, \frac{2}{3}$) of the remainder for a harness, and had \$10 (\$10, \$15) left. Find cost of each.

Exercise 263—Work Questions.

1. A can do $\frac{1}{4}$ ($\frac{1}{2}, \frac{1}{4}$) of a work in a day. B can do $\frac{1}{2}$ ($\frac{1}{4}, \frac{1}{2}$) of the work in a day. How long would it take A and B to do the work?

2. A can do a work in 2 (3, 5) days, and B in 3 (3, 6) days. How much will the two do in one day?

3. A can do a work in 2 (3, 4) days. B can do it in 3 (4, 5) days. How long would it take the two to do it together?

4. A can do a work in 2 (3, 4) days; B in 3 (4, 3) days; C in 4 (5, 2) days. In what time would the work be done by A and B? B and C? A and C? A, B and C?

5. A can do a work in $2\frac{1}{2}$ ($1\frac{1}{2}, 1\frac{3}{2}$) days; B can do it in $3\frac{1}{2}$ ($1\frac{1}{2}, 1\frac{1}{2}$) days; C can do it in $4\frac{1}{2}$ ($1\frac{1}{2}, 3\frac{1}{2}$) days. In what time could any two do the work? How long would it take the three to do it?

Exercise 264.

1. A can do a work in $\frac{1}{2}$ ($\frac{2}{3}, \frac{2}{3}$) of a day; B can do it in $\frac{1}{3}$ ($\frac{2}{3}, \frac{2}{3}$) of a day. How long would it take the two to do it?

2. A can do a work in 5 (6, 8) days; B can do it in $3\frac{1}{2}$ ($4\frac{1}{2}, 6\frac{1}{2}$) days. How long will it take A to finish the work after B has worked 2 days? How long will it take B to finish, after A has worked 3 days?

3. A, B and C can do a work in $1\frac{2}{3}$ ($\frac{6}{11}, 1\frac{1}{11}$) hrs.; A and B in $1\frac{1}{5}$ ($\frac{2}{3}, 1\frac{1}{3}$) hrs.; A and C in $1\frac{1}{3}$ ($\frac{2}{3}, 1\frac{1}{2}$) hrs. How long would it take each?

4. A and B can do $\frac{5}{8}$ ($\frac{7}{12}, \frac{7}{12}$) of a work in a day. A and C can do $\frac{3}{4}$ ($\frac{1}{2}, \frac{3}{5}$) of it in a day; B and C, $\frac{7}{12}$ ($\frac{5}{12}, \frac{9}{20}$) of it in a day. How long would it take all to do it? How long would it take each to do it?

5. A and B can do a work in $1\frac{1}{5}$ ($1\frac{1}{5}, 1\frac{4}{5}$) da.; A and C in $1\frac{1}{3}$ ($1\frac{1}{3}, 1\frac{2}{3}$) da.; B and C in $1\frac{1}{2}$ ($2\frac{2}{3}, 2\frac{2}{3}$) da. How long would it take all? How long would each take to do it alone?

Exercise 265 Miscellaneous.

1. A boy was to get \$100 and a suit of clothes for a year's work. At the end of 7 (8, 9) months he left and received \$50 (\$48, \$33) and the clothes. Find their value.

2. I have 75 (88, 78) books, pens and pencils. There are 55 (65, 55) pens and pencils, and 50 (60, 51) books and pencils. How many of each have I?

3. A grocer sold 3 (4, 6) dozen eggs @ 3 cents each, agreeing to get nothing and forfeit 5 cents for each bad egg. How many were bad, if he got \$.60 (\$1.12, \$2)?

4. For a ten-acre field, B offered to give \$1 for the first acre and to double the price for each successive acre. Find price offered for the field.

5. B, who can row 8 (9, 12) miles an hour in still water, takes 4 (4, 5) hours to row up a stream which runs 3 miles an hour. How long will he be returning?

Exercise 266.

1. I bought 80 lbs. tea @ 34 cents. I sold 45 (25, 30) lbs. @ 40 cents, 25 (25, 40) lbs. @ 35 cents, and the rest @ 30 cents. Find my gain or loss.

2. I bought 38 (45, 39) chickens @ 32 (45, 31) cents. I kept 2 (3, 4) of them for myself and sold the others @ 34 (48, 35) cents. Find my gain or loss.

3. I bought a number of chickens for \$10 (\$18.75, \$22.50). I gained \$3.50 (\$4.50, \$2.50) by selling some of them for \$8.75 (\$15.75, \$17.50) @ 35 cents. How many did I buy?

4. The fore wheel of a carriage is 8 (9, 10) feet in circumference, and the hind wheel is 11 (12, 12) feet. How far do they go if one revolves 90 (66, 264) times more than the other?

5. How many trees 66 feet apart will enclose a square 160-acre farm which is divided into square 10-acre fields?

6. If 2 horses are worth 3 oxen, and 4 oxen are worth 6 cows, and 8 cows are worth \$256, find the value of 5 horses.

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Exercise 267—Train Questions.

1. Find how far a train travelling 15 (30, 30) miles an hour will go in 30 (15, 45) seconds.
2. Find the rate of a train, if it travels 440 (220, 330) yards in 15 (20, 40) seconds.
3. A train, 220 (440, 440) yards long, passes a point in 50 (30, 45) seconds. Find the rate of the train per hour.
4. A train travelling at the rate of 20 (30, 45) miles an hour, passes a point in 45 (30, 10) seconds. Find the length of the train.
5. Find the length of a train which passes a point in 9 (18, 9) seconds while going at a rate of 20 (25, 35) miles an hour.
6. How long will it take a train 160 (140, 280) yards long, and going at the rate of 30 (45, 15) miles an hour, to cross a bridge 60 (80, 160) yards in length?

Exercise 268.

1. A train 220 yards long crosses a bridge in 45 (30, 45) seconds, while going at the rate of 20 (30, 40) miles an hour. Find the length of the bridge.
2. An express train, 160 yards long, passes a freight train in a siding, in 30 (15, 45) seconds. Find the length of the freight, if the rate of the express be 30 miles an hour.
3. Two trains of equal length, travelling in opposite directions, at the rates of 20 and 30 miles an hour, meet and pass in 45 (20, 30) seconds. Find the length of the trains.
4. Two trains, each 110 (220, 220) yards long, going at the same rate, in opposite directions, pass each other in 10 (20, 30) seconds. Find the rate of each.
5. How long will two trains, 110 and 220 yards long, respectively, moving in the same direction at the rate of 15 and 30 miles an hour, be in passing? How far will each travel?

Exercise 269—Stream Questions, etc.

1. I ride at the rate of 8 (6, 9) mi. an hour, and walk back at the rate of 4 (3, 6) mi. an hour. How far can I go and return in 3 (4, 2½) hours?

2. A walks to the city at the rate of 4 (5, 6) mi. an hour, and returns at the rate of 3 (4, 4) mi. an hour. Find the distance if he takes 2 (3, ¾) hours less to go than to return.

3. A boat makes a round trip in 7 (9, ¾) hours, going at the rate of 8 (10, 10) mi. an hour, and returning at the rate of 6 (8, 6) mi. an hour. Find the distance between the two points.

4. B rows 10 (9, 8) mi. an hour in still water. How long should he be rowing 4 (8, 6) mi. down a stream and returning, if the stream runs 2 (3, 4) mi. an hour?

5. A boatman rows a distance down a stream running 2 (3, 4) mi. an hour in 20 (12, 10) min., and returns in 60 (30, 30) minutes. How far down stream does he go?

Exercise 270—Racing.

1. A can run 7 (8, 9) rods while B runs 10 rds. How far behind will A be in a race of 100 yds. ? 200 rds. ? 440 yds. ?

2. A can run 100 yards in 10 (12, 20) seconds. B can run it in 12 (15, 25) seconds. What start should B have to finish with A in a race of 100 (250, 440) yds. ?

3. A can run a mile in 5 (6, 8) minutes, and B can run it in 6 (8, 10) minutes. Find A's handicap to make their chances equal.

4. A and B run a mile race. A gains 2 (3, 5) yds. in 20 rods (176 yds., 1056 ft.) How far behind will B come in the race?

5. A hare takes 5 (7, 9) leaps, each 3 (4, 5) feet, while the hound takes 1 (2, 4) leap, 1 rod (5½ yds., 12 ft.) long. How far will the hound go before he catches a hare having a start of 50 (100, 220) yards ?

Exercise 271—Clock Questions.

1. At what time after 11 (1, 3) o'clock will the hands of a clock be together for the first time?
2. When will the hands of a clock be together between 2 and 3 o'clock? 3 and 4 o'clock? 7 and 8 o'clock?
3. When will the hands of a clock be opposite between 8 and 9 o'clock? 10 and 11 o'clock? 7 and 8 o'clock?
4. When will the hands of a clock be opposite between 1 and 2 o'clock? 3 and 4 o'clock? 4 and 5 o'clock?
5. When will the hands of a clock be at right angles to each other between 5 and 6 o'clock? 6 and 7 o'clock?
6. When will the hands of a clock be at right angles to each other between 2 and 3 o'clock? 1 and 2 o'clock?
7. When will the hands of a clock be at right angles to each other between 10 and 11 o'clock? 11 and 12 o'clock?

Exercise 272.

1. At what times are the hands of a clock 14 (3, 15) minute-spaces apart between 5 and 6 o'clock?
2. At what times are the hands of a clock 20 minute-spaces apart between 4 and 5 o'clock? 1 and 2 o'clock?
3. At what times after 2 (5, 7) o'clock will the hands of the clock make an angle of 90° ?
4. At what time after 4 o'clock will the hands of the clock make an angle of 60° ? 120° ? 180° ? 270° ?
5. At what time after 3 (5, 8) o'clock will the hands of a clock be equidistant from the figure 3 (5, 8)?
6. At what time past 4 (6, 9) o'clock will the minute hand be twice as far from the figure 4 (6, 9) as the hour hand is past it?
7. At what time after 2 (3, 4) o'clock will the hour hand be midway between the minute hand and the figure 2 (3, 4)?
8. At what times between midnight and noon are the hands of a clock together?

Exercise 273 - Age Questions.

1. In 8 (11, 25) years, I will be 36 years old. How old will I be in 12 (15, 28) years?
2. Three years ago, I was 17 (20, 30) years old. How old will I be in 12 (19, 34) years?
3. If $\frac{3}{4}$ ($\frac{3}{4}$, $\frac{3}{4}$) of A's age is his age 4 (7, 9) years ago, how old will he be in 5 years hence?
4. If $\frac{1}{2}$ ($\frac{2}{3}$, $\frac{2}{3}$) of Mary's age is $\frac{5}{8}$ ($\frac{7}{8}$, $\frac{5}{8}$) of her age 8 (5, 4) years ago, find her age.
5. Find my age, if $\frac{1}{2}$ ($\frac{3}{4}$, $\frac{1}{2}$) of it is 4 (5, 7) years more than $\frac{3}{4}$ ($\frac{5}{6}$, $\frac{5}{6}$) of it.
6. If $\frac{1}{3}$ ($\frac{2}{3}$, $\frac{2}{3}$) of my age is $\frac{2}{3}$ (2, $1\frac{1}{3}$) times what it was 6 (10, 10) years ago, how old am I?
7. A's age and B's is 36 years. Four years ago A's age was $\frac{3}{4}$ ($\frac{2}{3}$, $\frac{1}{2}$) of B's. Find age of each.
8. A mother's age is 6 (5, 4) times her son's. In 6 (5, 4) years she will be 3 times as old. Find age of each.

Exercise 274 - Time Questions.

1. What time is it when the time past three o'clock is $\frac{1}{3}$ ($\frac{1}{2}$, $\frac{2}{3}$) of the time past 2 o'clock?
2. What time is it, when the time past 4 o'clock is $\frac{1}{2}$ ($\frac{1}{3}$, $\frac{2}{3}$) of the time to 5 o'clock?
3. Find the hour, if the time past noon is $\frac{1}{2}$ ($\frac{2}{3}$, $\frac{1}{2}$) of the time to midnight.
4. Find the time, if $\frac{2}{3}$ ($\frac{2}{3}$, $\frac{2}{3}$) of the time past noon is $\frac{2}{3}$ ($\frac{2}{3}$, $\frac{2}{3}$) of the time to midnight.
5. Find the time, if $\frac{1}{3}$ ($\frac{2}{3}$, $\frac{1}{2}$) of the time past midnight is equal to $\frac{2}{3}$ ($\frac{2}{3}$, $\frac{2}{3}$) of the time to midnight.
6. How long does a person sleep, if $\frac{2}{3}$ ($\frac{2}{3}$, $\frac{1}{2}$) of the time he sleeps is $\frac{2}{3}$ ($\frac{2}{3}$, $1\frac{1}{2}$) of the time he is awake?
7. Find the time a person sleeps, if $\frac{1}{2}$ of the time he sleeps is 36 (45, 45) minutes less than $\frac{1}{2}$ ($\frac{1}{2}$, $\frac{1}{2}$) of the time he is awake?
8. How long does a person sleep if the time he is awake is to the time he is asleep as 3 : 9? 4 : 8? 3 : 8?

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Exercise 275 - Wages.

1. A man getting \$10 a week has his wages increased \$2 (\$3, \$5). What % was the increase?
2. A man who got \$8 a week now gets \$10 (\$12, \$13). What per cent. was his increase in wages?
3. B got \$2.50 a day, and his wages were increased 10% (20%, 25%). Find his weekly wages now.
4. A boy receiving \$8 $\frac{1}{2}$, (\$12 $\frac{1}{2}$, \$16 $\frac{3}{4}$) a month has his wages increased 25% (16 $\frac{3}{4}$ %, 37 $\frac{1}{2}$ %). Find his yearly wages now.
5. After having my salary increased 20% (33 $\frac{1}{3}$ %, 87 $\frac{1}{2}$ %), I get \$900 (\$840, \$2250). Find my former monthly salary.
6. I get \$400 a year and am advanced 10% (20%, 25%) a year. How much do I receive for 3 years?
7. B spends 75% (66 $\frac{2}{3}$ %, 87 $\frac{1}{2}$ %) of his wages and saves \$372 a year. How much does he earn a month?

Exercise 276—Sums and Differences.

1. The sum of two numbers is 60 (11 $\frac{1}{2}$, 14.6). Their difference is 12 (3 $\frac{3}{4}$, 1.8). Find the numbers.
2. The sum of two numbers is 62 (8 $\frac{1}{2}$, 9). Half their difference is 6 (1 $\frac{1}{2}$, 1.25). Find the numbers.
3. Find the width of a field 48 (37 $\frac{1}{2}$, 62 $\frac{1}{2}$) yards long, if the perimeter is 168 (135, 200) yards.
4. Find the length of a table 3 (2 $\frac{1}{2}$, 2 $\frac{1}{2}$) feet wide, if a cord 54 (39, 60) feet long will reach 3 times around it.
5. The sum of two fractions is $\frac{7}{12}$ (1 $\frac{1}{10}$, 1 $\frac{7}{12}$). Five times their difference is $1\frac{5}{12}$ ($\frac{1}{4}$, $\frac{5}{12}$). Find the numbers.
6. The sum of two numbers is 5 $\frac{3}{4}$ (5 $\frac{7}{10}$, 11 $\frac{1}{4}$). Four times their difference is 3 (5 $\frac{1}{3}$, 15). Find the numbers.
7. One number is $\frac{3}{4}$ (4 $\frac{1}{2}$, 6.75) of another. Their difference is 12 (35, 23). Find the numbers.
8. One number is $\frac{4}{5}$ (2 $\frac{1}{4}$, 3.5) of another. Their sum is 36 (26, 22.5). Find the numbers.

Exercise 277 - Populations.

1. Ten years ago a town had 5643 (2875, 3984) inhabitants. Now it has 7000. Find the increase.
2. Ten years ago a town had 4758 inhabitants. The increase has been 2864 (3549, 7682). Find its population.
3. The population of a town was 2200 (2432, 3245). The increase has been $\frac{1}{10}$ (.25, 20%). Find population.
4. The population of A was 2500 (2250, 4820). The decrease has been $\frac{1}{4}$ (.12, 25%). Find population now.
5. What population increased by $\frac{1}{4}$ (.3, 12½%) amounts to 2500 (3965, 6390)?
6. Ten years ago the population was 2500 (2800, 3600). Now it is 3000 (3500, 4800). Find the increase %.
7. Ten years ago the population was 3000 (3200, 7500). Now it is 2500 (2400, 5000). Find the decrease %.
8. Ten years ago a town had 6400 inhabitants. Now it has 8000 (5600, 4800). Find increase or decrease %.

Exercise 278—Longitude and Time.

1. What is longitude? The greatest longitude possible?
2. When is it noon at any place north of the equator? South of the equator? On the equator?
3. It is noon at one place 1 (2, 3) hour before it is noon at another in the same latitude. How far apart are they?
4. Find the difference between Greenwich time and that of a point 15° (30°, 60°) to the (1) east, (2) to the west.
5. At noon, Greenwich, what time is it at a place whose longitude is 75° W.? 120° W.? 20° W.? 35° W.? 50° W.? 85° W.? 100° W.? 1° W.? 2° W.?
6. At noon, Greenwich, what time is it at a place whose longitude is 90° E.? 105° E.? 50° E.? 7° 30' E.? 22° 30' E.? 32° 30' E.? 17° 30' E.? 2° 30' E.?
7. Find the longitude of a place whose time, at noon in Greenwich, is:—
1 p.m.? 2 p.m.? 4 p.m.? 1.20 p.m.? 2.30 p.m.
11 a.m.? 9 a.m.? 7 a.m.? 10.20 a.m.? 9.40 a.m.?

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Exercise 279 - Ratio.

1. What is ratio? How is it expressed? Distinguish the antecedent from the consequent.
2. Express these ratios in their lowest terms :—
6 : 8, 12 : 9, 15 : 25, 16 : 32, 25 : 75.
3. Find the ratio, in the lowest terms, of :—
2 gal., 3 qts. : 3 gal., 1 qt. 3 yds., 1 ft. : 5 yds.
4. Divide \$25 (\$75, \$9.60) between two men whose shares shall be in the ratio of 2 : 3 (4 : 1, 6 : 12).
5. Find the number which bears the same ratio to 15 (\$35, £2 10s) that 5 bears to 7.
6. Divide 45 (\$37.80, £3 12s) into three parts, which shall be to one another as 1, 3 and 5.
7. A sum of money is divided into three parts in the ratio of 2, 3 and 7. The smallest share is \$16. Find the sum.

Exercise 280 - Proportion.

1. What is a proportion? How is it expressed? What are the means? The extremes? Show the relation of the means to the extremes.
2. Find the other term of the proportion :—

6 : 8 :: 9 :	\$6 :: \$30 :	\$24 :	$\frac{3}{4} :$	$\frac{2}{3} :: \frac{3}{4} :$	$\frac{5}{8} :$
5 : 15 :: 7 :	\$9 :: £21 :	£27 :	$2\frac{1}{2} :$	$3\frac{3}{4} :: 7\frac{1}{2} :$	$1\frac{1}{4} :$
4 : 9 :: 36 :	35 :: \$10 :	\$12 :	$.75 :$	$.6\frac{1}{4} :: .1\frac{1}{4} :$	$4.5 :: 7.5 :$
8 : 12 :: 27 :	\$5 :: 15 :	24 :	$4.5 :: 7.5 :: 9 :$		
3. What number bears the same relation to $3\frac{1}{2}$ that 7 bears to 8 (9, 12)?
4. If 14 (16, 21) men earn \$35 (\$24, \$35) in a day, how much will 20 (40, 15) men earn in a day?
5. If 24 (15, 16) men can do a work in 20 (16, 25) days, how long would it take 16 (24, 40) men to do it?
6. A owns $\frac{4}{8}$ ($\frac{5}{8}$, $\frac{7}{8}$) of a farm, and B owns the remainder. Find the ratio of A's share to B's.
7. If $\frac{2}{3}$ ($\frac{3}{4}$, $2\frac{1}{2}$) of A's farm equals $\frac{3}{4}$ ($\frac{5}{8}$, $3\frac{3}{4}$) of B's, find the ratio of B's farm to A's.

Exercise 281—Cancellation.

1. How many lambs @ \$6 ($\$7\frac{1}{2}$, $\$3\frac{3}{4}$) are worth as much as 33 (36, 24) sheep @ \$8 ($\5, $\$7\frac{1}{2}$)?
2. How many yards of print @ 9 ($5\frac{1}{2}$, $6\frac{1}{4}$) cents, can be bought for 24 (22, $8\frac{1}{3}$) dozen eggs @ 12 (15, 15) cents?
3. How many pounds of butter @ 21 ($12\frac{1}{2}$, $17\frac{1}{2}$) cents, must be given for 15 (16, 35) yds. cashmere @ 35 ($37\frac{1}{2}$, 45) cents?
4. How many dresses each 8 ($7\frac{1}{2}$, $6\frac{3}{4}$) yards can be made of 12 (25, 18) pieces cloth, each 36 (45, 15) yards long?
5. How many bushels of wheat will weigh as much as 45 ($12\frac{1}{2}$, $18\frac{3}{4}$) bushels of barley?
6. If 36 ($12\frac{1}{2}$, 75) pounds of butter are given for 45 (35, $37\frac{1}{2}$) yards cloth @ 24 (20, 48) cents, find the price of the butter.
7. If 36 (48, 7) bushels of wheat weigh as much as 51 (60, $7\frac{1}{2}$) bushels of another grain, what is the other grain?

Exercise 282.

Find the cost of:—

1. 4 tons, 15 cwt. hay @ \$10 ($\15, $\$12$) a ton.
6 tons, 5 cwt. bran @ 40 (60, 75) cents a cental.
2. 5 lbs., 8 oz. butter @ 10 (12, 14) cents a pound.
4 cwt., 75 lbs. beef @ \$8 ($\6, $\$4.80$) a cwt.
3. 9 tons, 5 cwt. coal @ \$6 ($\5, $\$6.40$) a ton.
8 cwt., 25 lbs. flour @ \$3 ($\3.20, $\$4.80$) a cwt.
4. 12 bu., 36 lbs. wheat @ 60 (75, 90) cents a bu.
15 bu., 36 lbs. barley @ 60 (72, 96) cents a bu.
5. 45 lbs., 12 oz. lard @ 8 (12, 16) cents a pound.
36 lbs., 14 oz. butter @ 24 (32, 40) cents a pound.
6. 42 doz. and 8 eggs @ 9 (12, 15) cents a dozen.
12 gr., 4 doz. eggs @ 12 (15, 18) cents a dozen.
7. 25 bu., 48 lbs. pease @ 75 (60, 95) cents a bushel.
12 stone, 7 lbs. oatmeal @ 20 (24, 36) cents a stone.

Exercise 283—Square Root.

1. Find the square root of:—

36, 81, 64, 100, 225, 3025, 400, 121, 196, 256.

.49, .25, 6.25, 20.25, 5.76, .0441, .1225, .0169.

$\frac{4}{25}$, $\frac{81}{144}$, $\frac{81}{121}$, $\frac{25}{81}$, $\frac{144}{100}$, $\frac{121}{100}$, $\frac{100}{225}$, $\frac{400}{576}$, $\frac{441}{625}$, $\frac{576}{500}$.

$2\frac{1}{2}$, $6\frac{1}{2}$, $12\frac{1}{2}$, $5\frac{1}{3}$, $30\frac{1}{4}$, $2\frac{1}{5}$, $7\frac{1}{5}$, $11\frac{1}{3}$, $31\frac{1}{8}$.

2. What is the side of a square field whose area is 225 sq. rds. ? 400 sq. rds. ? 576 sq. rds. ? 3 ac, 145 sq. rds. ?

3. How many times is 6 (8, 9) cubic inches contained in a 6 (8, 9) inch cube ?

4. Find the dimensions of a cube whose surface is 150 sq. in. ? 216 sq. in. ? 864 sq. in. ? 486 sq. in. ?

5. Divide a field 48 rds. x 64 rds. into square lots, the largest possible. A field 36 rds. x 44 rds. A field 88 rds. x 99 rds.

6. How many square lots, the largest possible, can be made of a field 72 rds. x 88 rods ? 50 rds. x 65 rds. ?

Exercise 284—Measures and Multiples.

1. Find the least distance which can be measured by a 6' pole, an 8' pole, or a 9' pole.

2. Find the least distance which can be measured by a pole 2' 6" long, 7' 6" long, or 12' 6" long.

3. Find the least quantity of milk which can be put into cans holding 4 gal., 2 qts., or 6 gal., 3 qts.

4. Find the G.C.M. of \$24, £36, and 42 cents.

5. A man and his daughter walk together. He steps 3' (3' 30"), and she steps 1' (2', 20"). How often will they step together ?

6. Two boys walk together, taking steps of 18" and 24" (24" and 30", 30" and 36") respectively. How often will they step together in 15 (30, 150) yards ?

7. The bells of a chime strike every second, two seconds, three seconds, four seconds, five seconds, and six seconds, respectively. How often will they strike together ? How often will they strike together in five minutes ?

Exercise 285—Aliquot Parts.

1. Give four aliquot parts of 20 (24, 36) which are whole numbers.
2. Give the largest five aliquot parts of 100 (150, 240) which can be expressed in whole numbers.
3. Give the greatest twelve aliquot parts of \$1.
4. Give, in descending order of magnitude, the ten aliquot parts of £1 which can be expressed in whole numbers.
5. Write down the principal aliquot parts of 1 sq. yd. which can be expressed in whole numbers.
6. Write down the principal aliquot parts of 1 bushel which can be expressed in whole numbers.
7. Write down the principal aliquot parts of a bushel of wheat. Of barley. Of potatoes.
8. What part of £1 is 6s. 8d.? 3s. 4d.? 13s. 4d.? 2s. 6d.? 7s. 6d.? 17s. 6d.? 33s. 4d.?

Exercise 286—Practice.

Find, by practice, the value of:—

1. 1 bu., 2 pks. @ 80 (72, 96) cents a bushel.
1 gal., 3 qts. @ 10 (12, 16) cents a gallon.
2. 3 gal., 3 qts., 1 pt. milk @ 8 (16, 20) cents a gallon.
5 bu., 3 pks., 1 gal. grain @ 64 (60, 75) cents a bushel.
3. 4 yds., 2 ft., 6 in. ribbon @ 12 (18, 20) cents a yard.
5 yds., 1 ft., 9 in. ribbon @ 12 (24, 30) cents a yard.
4. 3 lbs., 10 oz., 15 dwt. @ 48 (96, 72) cents a lb.
9 lbs., 11 oz., 10 dwt. @ 72 (48, 36) cents a lb.
5. 2 sq. yds., 4 sq. ft., 72 sq. in. @ 12 (40, 72) c. a sq. yd.
3 sq. yds., 6 sq. ft., 108 sq. in. @ 16 (24, 48) c. a sq. yd.
6. 4 gal., 3 qts., 1 pt. milk @ 20 (24, 15) cents a gal.
5 gal., 1 qt., 1 pt. milk @ 16 (20, 25) cents a gal.
7. 4 tons, 17 cwt., 2 qrs. hay @ \$8 (\$12, \$20) a ton.
5 tons, 1275 lbs. coal @ \$6 (\$5.50, \$7.50) a ton.
8. 6 tons, 12 cwt., 2 qrs. @ £2 10s. 6d. a ton.
4 tons, 7 cwt., 2 qrs. @ £6 7s. 6d. a ton.

Exercise 287 - General Review.

1. Find sum of the seven smallest composite numbers.
2. I sold 20 (16, 48) cattle, averaging 725 lbs., @ 8 cents a pound. How much did I get for them?
3. How many days in 4 (8, 16) years of next century?
4. If 3 men or 5 boys do a work in 6 days, in what time would 3 men and 5 boys do the work? 5 men and 3 boys? 3 men and 3 boys?
5. How many plants, placed 9" (6", 15") apart, will make a border for a bed [15' x 45']?
6. Find the number whose $\frac{1}{3}$ (.75, 47%) is 10 greater than its $\frac{1}{4}$ (.5, 27%).
7. Find the cost of 2 (5, 8) five-acre fields @ $\$2\frac{1}{4}$ ($\$2\frac{1}{2}$, $\$3\frac{1}{4}$) an acre.
8. The marked price is 25% ($33\frac{1}{3}\%$, 50%) above cost and the discount is 10 ($12\frac{1}{2}$, 10)%. Find the gain %.

Exercise 288.

1. Find the sum of all the numbers ending in 48 (50, 67) between 8000 and 9000.
2. What is the difference between the squares of 6 and 7? 14 and 15? 24 and 25? 36 and 37? 84 and 83?
3. Arrange the digits in three columns, so that each line added horizontally or vertically will be 15.
4. What fraction multiplied by 6 will give $\frac{3}{8}$? $\frac{4}{9}$? $\frac{5}{4}$ gal.? $\frac{6}{8}$ mi.? $\frac{7}{8}$ ac.? $\frac{8}{9}$?
5. How far will a train run in 3 hrs., 45 min., 30 sec., at the rate of 36 miles an hour?
6. A pole is $\frac{1}{3}$ (.25, 35%) in the ground, $\frac{1}{4}$ (.35, 35%) in the water, and 15 (36, 48) feet in the air. Find its length.
7. Divide 108 into two parts so that $\frac{8}{11}$ (.25, 25%) of the first is $\frac{1}{2}$ (.4, 20%) of the second.
8. I gained 25% ($16\frac{2}{3}\%$, $12\frac{1}{2}\%$) by selling cloth @ \$.75 (\$.84, \$.90). Find the gain on a sale of \$5 (\$14, \$45)?

Exercise 289—General Review.

1. I lost 35 (24, 63) cents, by selling for $\frac{1}{3}$ (.75, 87½%) of cost. Find the selling price to gain $\frac{1}{3}$ (.2, 20%).
2. What number increased by $\frac{3}{4}$ (.625, 45%) of itself amounts to 665 (\$390, £870)?
3. What number decreased by $\frac{2}{5}$ (.375, 14¾%) of itself leaves a remainder of 735 (\$955, 636 sheep)?
4. After spending $\frac{2}{3}$ (.4, 25%) of my money, I found that $\frac{1}{4}$ (.5, 20%) of the remainder was \$5 (\$3.75, \$7.50). How much money had I at first?
5. Find the cost of $1\frac{2}{3}$ ($\frac{4}{3}$, $4\frac{2}{3}$) acres of land, if $\frac{3}{4}$ ($2\frac{1}{2}$, $3\frac{3}{4}$) acres of land cost \$45 (\$75, \$135).
6. A had 4 (5, 7) times as much money as B. He gave B \$12 (\$12, \$15) and then he had twice as much as B. How much had each at first?

Exercise 290.

1. How often does a watch tick in a second? A minute? An hour? A day? A week? A fortnight?
2. I buy 487 sheep @ \$4.75 and sell them @ \$5.25 (\$4.25, \$5). Find the total gain or loss.
3. I get \$600 (\$750, \$1000) a year, and spend as much in 4 (5, 6) mo. as I earn in 3 (4, 4) mo. Find yearly savings.
4. How many lambs @ 12/6 are worth £25? £45?
5. Three hams averaged 12 lbs., 8 oz. Two of them averaged 11 lbs., 10 oz. Find the weight of the third.
6. Two trains, going at the same rate, meet and pass in 20 (30, 50) seconds. The first train is 180 yards long, and the second is 260 yards long. Find the rate of each train.
7. In an election, A received $\frac{1}{3}$ (.28, 54%) of the votes. B received $\frac{2}{5}$ (.55, 25%) of the votes, and C received 770 (1020, 1680) votes. Which was successful, and what was his plurality?

Exercise 291—General Review.

1. What number is as much above 425 (325, 48.3) as it is less than 811 (983, 67.8)?
2. Find the gain or loss on buying a gross of oranges @ 25 cents a doz. and selling them @ 3 (4, 6) for 10 cents.
3. A 36-rod fence cost \$9 more than a fence 42 (45, 48) rods long. Find the cost of a 75-rod fence.
4. If the divisor were $\frac{1}{3}$ ($\frac{1}{4}$, $\frac{2}{3}$) of what it is, the quotient would be 273 (428, 640). Find the quotient.
5. If 5 men do a work in 5 hrs., 45 min., how long would it take 1 man? 3 men? 15 men?
6. How far can I walk in $2\frac{1}{2}$ ($2\frac{3}{4}$, $2\frac{1}{4}$) hours at the rate of $3\frac{1}{2}$ ($4\frac{1}{2}$, $2\frac{3}{4}$) miles an hour?
7. Find the length of a pole if $\frac{1}{4}$ (.35, 40%) of it is in the ground, $\frac{1}{2}$ (.4, 25%) of it is in water, and 15 (39, 90) feet in the air.
8. A can do $\frac{3}{4}$ ($\frac{4}{5}$, $\frac{4}{5}$) of a work in a day. In what part of the next day should he finish it?

Exercise 292.

1. Find the product of 6, 8, 3 and 0.
2. What is the gain or loss on buying a gross of pens @ 3 for 4 cents, and selling them @ 4 for 5 cents?
3. Find the cost of 33 (35, 42) sheep if 22 (14, 33) sheep cost \$30 (\$35, \$44).
4. A and B have \$75.90 in the proportion of 7 : 8. How much has one more than the other?
5. I mix 50 (25, 60) lbs. wool @ 13 (11, 21) cents, with 75 lbs. @ 8 (7, 12) cents. Find average price per pound.
6. A milkman has 42 gal., 3 qts., 1 pt. of milk, and fills an equal number of pint, quart and half-gallon bottles. How many bottles does he fill?
7. By what must $\frac{4}{5}$ ($\frac{3}{8}$, $\frac{9}{10}$) be divided to give $\frac{2}{3}$ ($\frac{5}{6}$, $\frac{2}{3}$) as the quotient?
8. A sum of money in 12 years at 5% amounts to \$560. In how many years will it amount to \$595?

Exercise 293 - General Review.

1. Divide 756 successively by 3, 4 and 7.
2. How many sheep divided between A and B in the proportion of 2 : 3 will give A 16 (24, 36) sheep?
3. A carpet 8 feet long and 6 feet wide cost \$16. Find cost of a carpet 8' x 9' ; 10' x 12' ; 12' x 15'.
4. In the fraction .45, divide the 4 by the 5.
5. I paid \$64 for tea supposed to be done up in pound packages ; but there were only 15 ($15\frac{1}{2}$, $15\frac{1}{4}$) oz. to the pound. How much should I pay for the tea?
6. Two brakemen approach each other, each running at the rate of 6 miles an hour, on the top of a train running 15 (24, 30) miles an hour. Find the rate at which each moves.
7. Find the duty at 20% (25%, $33\frac{1}{3}\%$) on 360 boxes raisins, each 30 lbs., @ 5 cents a pound.
8. Goods are marked at an advance of 25%. Find the discount so as to gain 10%.

Exercise 294.

1. What two consecutive numbers give a quotient of 132? 210? 420? 600? 870? 2450?
2. What sum of money, divided between A and B in the ratio of 3 : 4, will give B \$25 (\$36, \$45) more than A?
3. If 35 yds. of cloth cost \$4.90 (\$4.20, \$6.30), what will 45 (55, 25) yds. cost?
4. How many lengths, each .005 feet, can be cut from a stick one yard long?
5. A owned .6 (.8, .75) of a farm and sold $\frac{3}{4}$ (.25, 40%) of his share to B. What part does each now own?
6. Find cost of 3 (4, 5) gal. milk @ $1\frac{1}{2}$ ($2\frac{1}{2}$, $1\frac{3}{8}$) c. a pint.
7. Find value of a bin of wheat [$5' \times 8' \times 12'$] @ 75 cents a bush. Find weight of barley to fill it.
8. A sum of money, in 8 years at 6 %, amounts to \$370 (\$518, \$666). in how many years will it amount to \$550 (\$560, \$747)?

Exercise 295—General Review.

1. Find the difference between the largest and the smallest number that can be expressed by the nine digits.
2. Write the prime numbers from 100 to 200.
Write the largest prime numbers of four figures.
Find the smallest multiple, of 3 figures, of 3 and 7.
3. What is the reciprocal of a number?
4. Show the difference between long division and short division.
5. What are the dimensions of a line? A surface? A solid?
6. What is the difference between the length of a No. 3 shoe and a No. 4 shoe?
7. Find the height of a horse 15 ($15\frac{1}{2}$, $16\frac{1}{2}$) hands high.
8. Find the cost of a firkin of butter @ 25 (22, 28) cents a pound (56 lbs. = 1 firkin).

Exercise 296.

1. Compare $\frac{3}{5}$, $\frac{3 \times 2}{5 \times 2}$, $\frac{3+2}{5+2}$ and $\frac{3-2}{5-2}$.
2. Find the third proportional to 4 : 6.
Between what quantities can a ratio exist?
Account for the name "Rule of Three."
3. If $\frac{3}{4}$ of a foot were 12 inches, what would $\frac{3}{8}$ of a yard be?
4. If there were 10 inches in a foot, and 4 feet in a yard, how many inches would be in 5 yds., 3 ft., 4 in.?
Multiply 6 yds., 2 ft., 7 in. by 5.
5. If 9 units made a ten, and 9 tens made a hundred, and 9 hundreds made a thousand, find the sum of 864 and 257, and the difference between 753 and 287.
6. When should I pay the year's rent in one payment instead of on the first (last) of each month?
7. How many figures will be in the decimal part when reducing a vulgar fraction to a decimal? How many remainders can there be?

INDEX.

The Figures in Italics refer to Part I.

	PAGE.		PAGE.
Addition, Simple.....	11-26	Division, Simple.....	67-86
—, Compound.....	88-102	—, Compound.....	87-110
—, Fractions.....	25, 26	—, Fractions.....	32, 33, 34, 35
—, Decimals.....	44	—, Decimals.....	49
—, Table.....	13, 15	Dry Measure.....	92
Ages.....	35, 40, 41, 43, 81, 114	Earnings.....	110, 115
Aggregates.....	44, 102	Elections.....	107
Aliquot Parts.....	120	Equations.....	105
Alligation.....	104	Equation of Payments.....	76
Analysis.....	75-78, 106, 22, 27, 29, 34	Excavating.....	97
Apothecaries' Weigh.....	96	Factors.....	56, 6, 7, 54
Arabic Notation.....	5-7, 10	Fencing.....	11, 83
Areas.....	90, 100, 47, 100	Finding Cost.....	49, 53, 61, 62, 105, 106
Averages.....	82, 103	30-34, 47, 83, 118	
Avoirdupois Weigh.....	95	Finding Price.....	75, 49
Bank Discount.....	73	Flooring.....	92
Bankruptcy.....	68	Fractions, Vulgar.....	19-38
Brokerage.....	78	Numeration.....	19
Cancellation.....	10, 118	Notation.....	20
Capacity.....	91, 92	Reduction.....	20, 21, 23, 24
Carpeting.....	93, 94	Comparison.....	24, 38
Change.....	24, 42, 62	Addition.....	25, 26
Clocks.....	113	Subtraction.....	27-29
Commission.....	59, 60	Multiplication.....	30-31
Comparisons.....	84, 24, 38, 43	Division.....	32, 34
Compound Interest.....	75, 76	Complex Frs.....	33
Cubes.....	9	G.C.M.....	36
Cubic Measure.....	101, 102	L.C.M.....	36
Customs and Excise.....	70	Simplifying.....	25, 26, 27, 30
Days of the Week.....	39-43	32, 33, 36	
Decimals.....	39-54	Theory.....	37, 38
Numeration.....	39, 40	G.C.M.....	7, 8, 9, 10-18, 36
Notation.....	41, 42, 43	Grain.....	103, 104
Addition.....	44, 46	Insurance.....	67
Subtraction.....	45, 46	Interest, Simple.....	71, 72
Multiplication.....	47, 48	—, Compound.....	75, 76
Division.....	49	Income Taxes.....	69
Denominate.....	50, 51	Land.....	89, 90
Reduction.....	50, 51	Lathing.....	88
Circulating Dec.....	50	L.C.M.....	12, 13, 14-18, 36
Theory.....	54	Linear Measure.....	97, 98
Discount, Bank.....	73	Liquid Measure.....	91
—, True.....	74		
Ditching.....	85		

INDEX—Continued.

PAGE.	PAGE
	Longitude and Time 116
	Loss and Gain 63-66, 110
	Lumber 82, 83, 84, 91, 92
	Making Change 28, 42, 62
	Materials 82
	Measures 5-11, 14-18, 119
	Mixtures 11, 104, 106
	Money, Canadian 88
	—, English 90
	—, United States 89
	Multiples 12, 13, 14-18, 119
	Multiplication, Simple 47-66
	—, Compound 87-110
	—, Fractions 30, 31
	—, Decimals 47, 48
	—, Table 51
	Notation, Arabic 5, 6, 7, 10
	—, Roman 8, 9, 10
	—, Fractions 19, 20
	—, Decimals 39-43
	Numeration 5-10, 19, 20, 39-42
	Painting 86
	Papering 95, 96
	Partial Payments 76
	Partnership 68
	Percentage 55-58, 79
	Plastering 87, 88
	Populating 116
	Posts 83
	Powers 59
	Practice 120
	Products 56, 57, 61, 62, 63
	16, 30, 48
	Proportion 117
	Percentage 55-80
	Commission 59, 60
	Trade Discount 61, 62
	Loss and Gain 63, 64, 65, 66
	Insurance 67
	Bankruptcy 68
	Partnership 68
	Taxes 69
	Customs and Excise 70
	Simple Interest 71, 72
	Bank Discount 73
	True Discount 74
	Compound Interest 75
	Partial Payments 76
	Equation of Payments 76
	Stocks and Bonds 77
	Brokerage 78

PAGE.	PAGE
	Review 79
	Theory 80
	Racing 17, 112
	Ratio 117
	Reduction 87-110
	—, Fractions 20, 21, 22, 23, 24
	—, Decimals 43
	—, Percentage 56, 57
	Remainders 27, 28, 45, 108
	Roadmaking 97
	Roofing 88
	Roman Notation 8, 9, 10
	Savings 29, 31
	Sharing 79, 80, 107, 34
	Short Methods 61, 62, 63, 101
	Simple Interest 71-73
	Simplifying 63, 81, 82, 83, 84
	33, 34, 36, 46, 48, 101
	Sodding 90
	Solid Measure 101, 102
	Spending 29, 31, 108
	Squares 9, 10
	Square Measure 99, 100
	Square Root 10, 37, 119
	Stocks and Bonds 77, 78
	Streams 35, 64, 112
	Subtraction, Simple 27-46
	—, Compound 88-102
	—, Fractions 27, 28, 29
	—, Decimals 45, 46
	—, Table 29
	Sum and Difference 35, 28, 34
	46, 115
	Surface Measure 99, 100, 99
	Table, Addition 13, 15
	—, Subtraction 29
	—, Multiplication 51
	Theory 10, 45, 46, 66, 86, 110
	18, 37, 38, 54, 80, 125
	Taxes 69, 70
	Time 93, 94, 114
	Trade Discount 61, 62
	Trains 111
	Troy Weight 96
	True Discount 74
	Wages 115
	Wall Papering 95, 96
	Weights and Measures 87-110
	Working 29, 100
	Wheels 17

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