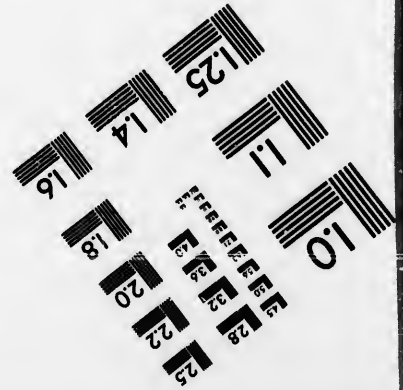
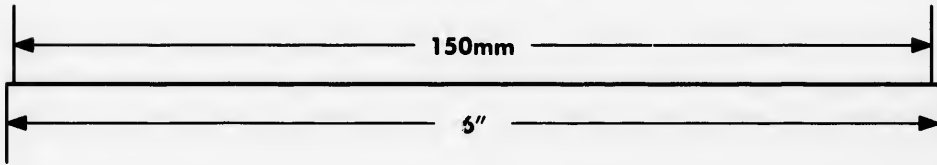
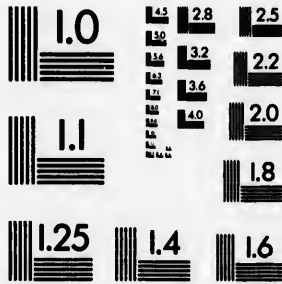
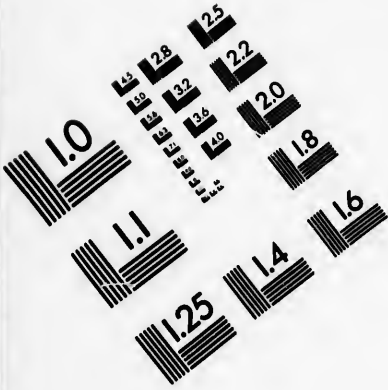


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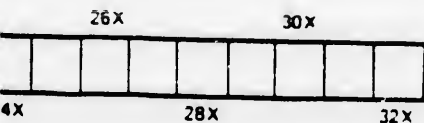
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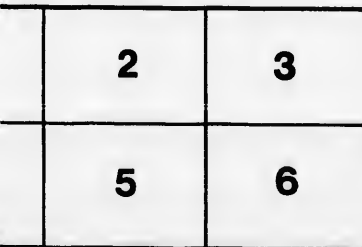
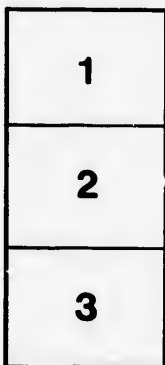
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TEACHERS' MANUAL

WITH ANSWERS

BY

E. W. ARTHY,

SUPERINTENDENT OF CITY SCHOOLS,  
MONTREAL

MONTREAL:

F. E. GRAFTON & SONS, PUBLISHERS.

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**I. D.** Multiply the numerator or divide the denominator by the integer. Notice that the denominator may be divided by the integer or the integer by the denominator, as is most convenient, *e.g.*,  $\frac{3}{8} \times 10 = 3 \times 2 = 6$ .

**I. E.** Divide the numerator or multiply the denominator by the integer. Reduce mixed numbers to improper fractions.

**I. F.** Multiply the integer and fraction separately and add the results.

**I. G.** Divide the integer and fraction separately and add the results, *e.g.*,  $22\frac{1}{4} \div 5 = 4$  with  $2\frac{1}{4}$  over.  $2\frac{1}{4} \div 5 = \frac{9}{20}$  by Ex. E. Combined result,  $4\frac{9}{20}$ .

**II. Complex Fractions.**—Treat the numerator as a dividend and the denominator as a divisor and divide one by the other, according to the rule for division of fractions.

$$1. \frac{\frac{3}{8}}{\frac{5}{8}} = \frac{3}{8} \div \frac{5}{8} = \frac{3}{8} \times \frac{8}{5} = \frac{3}{5} \text{ Ans.}$$

Another very simple method is to reduce to similar fractions,  $\frac{3}{8} \div \frac{5}{8}$ , giving  $\frac{3}{8}$  at once, as the C.D. may be disregarded. This is useful for sight work.

$$2. \frac{7\frac{1}{4} \div 3\frac{3}{8}}{4\frac{2}{3} \div 10\frac{1}{8}} = \frac{\frac{59}{4} \times \frac{8}{27}}{\frac{26}{3} \times \frac{8}{81}} = \frac{59^0 \times 2^8 \times 3^1}{2^7 \times 3^6 \times 8^1} = 5 \text{ Ans.}$$

**NOTE 1.**—Fractions forming part of the denominator must be inverted.

**NOTE 2.**—Fractions in the denominator preceded by  $\div$  must be inverted twice, and therefore remain unchanged.

**NOTE 3.**—Complex fractions when reduced to simple fractions are added, subtracted, multiplied and divided like other fractions.

**III. A.** (a) What part of 12 is 4? *Ans.*  $\frac{1}{3}$  or  $\frac{4}{12}$ .

(b) What part of  $\frac{2}{3}$  is  $\frac{3}{4}$ ? *Ans.*  $\frac{9}{8}$ .

**NOTE 1.**—Reduce to similar fractions, when the denominators may be disregarded.  $\frac{2}{3} = \frac{8}{12}$ ;  $\frac{3}{4} = \frac{9}{12}$ .

**NOTE 2.**—The number which follows "of" is always the denominator, and the other number the numerator of the required fraction.

(c) Express 3 pints as the fraction of 12 gallons.

Ans.  $\frac{3}{4}$  =  $\frac{1}{4}$ . (12 gal. = 96 pints.)

NOTE.—Reduce compound quantities to the same denomination.

(d) Express  $\frac{2}{3}$  acre as the fraction of a sq. rod.

$$\frac{\frac{2}{3} \text{ acre}}{1 \text{ sq. rod}} = \frac{\frac{2}{3} \times 160}{1} = \frac{400}{3}.$$

III. C. First find the answer as a common fraction and reduce this common fraction to a decimal.

NOTE.—When the decimal quotient does not terminate, it will be sufficiently accurate for all practical purposes to find the answer to five decimal places.

IV. See Teachers' Manual, Book II., p. 29.

The following case is new:—

3·125 of 10 yds. 2 ft. = 3·125 of 32 ft. = 100 feet.

4·045 of 1 cwt. 82 lbs. = 4·045 of 1·82 cwt. = 7 cwt. 36·19 lbs.

NOTE.—In compound quantities the lower denominations should be reduced to a decimal of the highest; or the whole quantity to the lowest denomination mentioned. Then apply the rule.

V. **Practice** is a convenient method of solving certain examples in multiplication of Compound Quantities by means of *aliquot parts*.

An *aliquot part* of a quantity is a part expressed by a fraction whose numerator is 1.

33 $\frac{1}{3}$  cents (which is  $\frac{1}{3}$  of \$1) is an *aliquot part* of \$1.

The method of practice is as follows:—

Find the cost of 1233 articles at 33 $\frac{1}{3}$  cents each.

We notice that 33 $\frac{1}{3}$  cents is  $\frac{1}{3}$  of \$1. Therefore the value of a number of articles at 33 $\frac{1}{3}$  cents each is  $\frac{1}{3}$  of their value at \$1 each. Hence the cost of 1233 articles at 33 $\frac{1}{3}$  cents each is  $\frac{1}{3}$  of \$1233 (the cost at \$1 each) or \$411.

(a) Value of 127 articles at  $\$1.87\frac{1}{2}$  each?

$$50¢ = \$\frac{1}{2}$$

$$25¢ = \frac{1}{2} \text{ of } 50¢$$

$$12\frac{1}{2}¢ = \frac{1}{2} \text{ of } 25¢$$

$$\$127.00 = \text{cost at } \$1.00 \text{ each.}$$

$$63.50 = \text{cost at } .50 \text{ each.}$$

$$31.75 = \text{cost at } .25 \text{ each.}$$

$$15.87\frac{1}{2} = \text{cost at } .12\frac{1}{2} \text{ each.}$$

$$\underline{\underline{\$238.12\frac{1}{2} = \text{cost at } \$1.87\frac{1}{2} \text{ each.}}}$$

(b) Cost of 21 cu. feet of mahogany at  $\$90$  a cu. yard?

$$9 \text{ cu. ft.} = \frac{1}{3} \text{ yard}$$

$$9 \text{ cu. ft.} = \frac{1}{3} \text{ yard}$$

$$3 \text{ cu. ft.} = \frac{1}{3} \text{ of } 9 \text{ cu. ft.}$$

$$\$90.00 = \text{cost of } 1 \text{ cu. yard.}$$

$$30.00 = \text{cost of } 9 \text{ cu. feet.}$$

$$30.00 = \text{cost of } 9 \text{ cu. feet.}$$

$$10.00 = \text{cost of } 3 \text{ cu. feet.}$$

$$\underline{\underline{\$70.00 = \text{cost of } 21 \text{ cu. ft.}}}$$

(c) Cost of 26 sacks wool, each 560 lbs., at  $\$26.50$  ton.

$$560 \text{ lbs.} \times 26 = 14,560 \text{ lbs.} = 7 \text{ tons } 560 \text{ lbs.}$$

$$\$26.50 = \text{cost of } 1 \text{ ton.}$$

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$$185.50 = \text{cost of } 7 \text{ tons.}$$

$$6.625 = \text{cost of } 500 \text{ lbs.}$$

$$.6625 = \text{cost of } 50 \text{ lbs.}$$

$$.1325 = \text{cost of } 10 \text{ lbs.}$$

$$\underline{\underline{\$192.92 = \text{cost of } 7 \text{ tons } 560 \text{ lbs.}}}$$

**VI. Cancellation.**—In examples 13, 14, 15, where decimals occur, adopt the following plan:—Count the total number of decimal places in the numerator and in the denominator. If the number of decimal places is the same in both, the decimal points may be erased and the numbers cancelled like integers. (Why?) If they are not the same, find their difference; and in erasing the decimal points multiply that term of the fraction which

has fewest by 10 for each decimal place it is short, *e.g.*, in ex. 15 the numerator has four and the denominator six decimal places. Therefore, in erasing the decimals, the numerator must be multiplied by 100.

$$\frac{.5 \times 8.1 \times 7.7}{.11 \times 5.5 \times 6.3} = \frac{5 \times 81 \times 77 \times 10}{11 \times 55 \times 63} = \frac{90}{11}$$

**VII. Proportion.**—Read and review the work in Manual, Book II., p. 7, **XIV.**, **XV.**

The problems in this exercise are to be solved both by analysis and by proportion. As soon as pupils can solve examples readily by analysis or method of unity, show how the intermediate step can be dropped by establishing at once a proportion. Begin with simple mental examples, *e.g.*, if 4 oranges cost 12 cents, what will 1 orange cost? 3 oranges? 5 oranges? 7 oranges? Pupils must answer giving a proportion only, as  $\frac{1}{4}$  of 12 cents,  $\frac{3}{4}$  of 12 cents,  $\frac{5}{4}$  of 12 cents,  $\frac{7}{4}$  of 12 cents. From simple examples of this kind derive the following principles:—

- That in a simple proportion three numbers or quantities are given to find a fourth.
- That we first select that quantity which is of the same kind as the answer required.
- That we arrange the two other numbers as a fraction.
- That if, from the nature of the question, the answer will be greater than the like quantity given, the fraction will be improper; if less, the fraction will be proper.

1. If  $1\frac{3}{4}$  bushels of potatoes last a family 2 weeks, how long will  $5\frac{1}{2}$  bushels last?

*By Analysis.*

$1\frac{3}{4}$  bushels last 2 weeks.

1 bushel lasts  $\frac{2}{1\frac{3}{4}}$  weeks.

$5\frac{1}{2}$  bushels last  $\frac{2 \times 5\frac{1}{2}}{1\frac{3}{4}}$  weeks.

*By Proportion.*

$1\frac{3}{4}$  bushels last 2 weeks.  
 $5\frac{1}{2}$  bushels last  $\frac{5\frac{1}{2}}{1\frac{3}{4}}$  of 2 weeks.

*Mental Operation.*

(1) The answer is to be weeks.  
 (2) The answer will be more than 2 weeks; therefore, the fraction representing the proportion will be improper.

2. If a field of 16 acres produces 440 bushels of wheat, how much will be grown on 22 sq. yds. ?

*By Analysis.*

16 acres =  $(16 \times 4840)$  sq. yds.  
 $(16 \times 4840)$  sq. yds. produce 440 bushels.  
 1 sq. yd. produces  $\frac{440}{16 \times 4840}$  bushels.  
 22 sq. yds. produce  $\frac{440 \times 22}{16 \times 4840}$  bushels.

*By Proportion.*

16 acres produce 440 bushels.  
 22 sq. yards produce  $\frac{22 \text{ sq. yds.}}{16 \text{ acres}}$   
 of 440 bushels.

*Mental Operation.*

(1) The answer is to be bushels.  
 (2) The answer will be less than 440 bushels; therefore, the fraction will be proper.

NOTE 1.—Before comparing 22 sq. yds. and 16 acres we must reduce them to the same denomination.

NOTE 2.—We do not multiply 440 bushels by 22 sq. yds. and divide by 16 acres. This has no meaning. We find the proportion which these two quantities bear to one another, and multiply 440 bushels by the fraction which represents that proportion.

**VIII. Metric System.**—This system was introduced in France about a century ago. The fundamental unit, the metre, is supposed to measure exactly the ten-millionth part of the distance between the Equator and the North Pole. Standard metres have been made with the utmost precision and are deposited in nearly all the civilised countries of the world. They are made of platinum, which is a very durable metal, not easily affected by exposure to the air, and are carefully preserved. From the standard metre all other weights and measures are derived.



The metric system, from its great simplicity, has been adopted in most civilised countries. Great Britain and her colonies, the United States and Russia are the only countries of importance in which this system has not been adopted.

Teachers should be supplied with a *metre stick*, a *litre* and a *cubic centimetre*.

1. When quantities are expressed in the metric system they are added, subtracted, multiplied and divided as integers and decimal fractions. This section will therefore give an excellent review of decimals. All quantities must of course be expressed in the same denominations.

2. The Greek and Roman prefixes are the key to the whole system. They should be thoroughly committed to memory, after which pupils may be asked to make the tables for themselves, the principal unit being given.

3. **Writing.**—Metric numbers are almost invariably written in one denomination, denominations lower than the one employed being written as a decimal fraction; thus, 5 m. 6 dm. is written 5·6 m.; 7 m. 6 cm. is written 7·05 m.; 6 m. 5 dm. 8 cm. 9 mm. is written 6·589 m.

4. **Reading.**—Metric numbers are generally read in one denomination only; thus, 21·45 metres is read 21 and 45 hundredths metres. If more than one denomination is required, it will be sufficient to use two, reading the integer in terms of the denomination given and the fraction in terms of one other denomination; thus, 21·45 m. may be read 21 m. 45 cm. It would be unusual to read it 21 m. 4 dm. 5 cm.; and still more unusual to read it 2 Dm. 1 m. 4 dm. 5 cm.

5. Quantities are changed from one denomination to another by simply moving the decimal point. This should be done by a mental calculation in two steps:—

(A) *First change the point so as to convert the given quantity into terms of the principal unit.*

(B) *Then change the point so as to convert the principal unit into the required unit, e.g.,*

1. Change 85.76 Km. to metres. Observing that 1000 m. = 1 Km., we move the decimal point three places to the right. *Ans.* 85760 m.

2. Change 8432165 cm. to Km. (100 cm. = 1 m. and 1000 m. = 1 Km.) Centimetres are changed to metres by moving the point two places to the left, and metres to kilometres by moving the point three places further to the left, making five places in all. *Ans.* 84.32165 Km.

**VIII. F.** To change from the English to the Metric System and *vice versa*.

1. Change 3.75 metres to yards, feet, inches.

1 metre = 39.37 inches.

3.75 metres =  $(3.75 \times 39.37)$  inches = 147.6375 inches = 4 yds. 0 ft. 3.63 in.

*This result is approximate only. Two places of decimals will generally give an answer sufficiently accurate.*

2. Change 2 ac. 140 sq. rods to Ha.

1 Ha. = 2.471 ac. 2 ac. 140 sq. rods =  $2\frac{140}{160}$  ac. = 2.875 ac.  $2.875 \text{ ac.} \div 2.471 = 1.1635 \text{ Ha. (nearly)}$ .

**IX. Mensuration.**—In reviewing the mensuration of rectangular surfaces, keep clearly before the pupils' mind the fact that 9 square feet are not 3 linear feet  $\times$  3 linear feet, but 3 times 3 square feet: 3 rows with 3 square feet in each row. *The multiplier is an abstract number.* (See Book II, p. 79, and Manual II, p. 31.)

In teaching solidity (length  $\times$  breadth  $\times$  thickness) the same method must be followed. If 27 inch cubes are built together in one block, the principle may be illustrated objectively. The rows, layers and number of

layers should be observed by the pupils. The number of cubic inches (27) in the block is then found by multiplying the number of cubic inches in a row (3 cu. inches) by the number of rows (3), and this product by the number of layers (3).

**X. Mensuration.**—Before proceeding to these exercises teach *angles*. The teacher places on the blackboard pairs of lines extending from the same point in different directions, and shows that the angles are of different sizes, and that the size of an angle depends upon the extent of opening and not upon the length of the lines. Pupils are thus led to describe an angle as the *opening between two straight lines meeting at the same point*. Proceeding, the teacher draws two lines crossing each other thus +, and says that when two lines cross each other so as to make *four equal square openings*, the angles are called right angles. Pupils are led by questioning to say that an obtuse angle (blunt corner) is an angle greater than a right angle, and an acute angle (sharp corner) is an angle less than a right angle.

The terms *horizontal* and *vertical* as applied to lines should be explained. Comparison with the surface of still water and with a plumb line will lead to a good description of horizontal and vertical lines.

**X. A. Parallelograms.**—Before parallelogram is taught, *parallel lines* are drawn and described as lines which are as far apart in one place as in another, or *equally distant from each other at every point*. Then a figure is drawn whose opposite sides are parallel, and the figure, as it is drawn, is described as a parallelogram.

The *altitude* or *perpendicular height* is taught and pupils are led to draw and point out the perpendicular height of several parallelograms. Parallelograms with right angles

and those that are not so formed should be drawn, and pupils must observe that parallelograms with right angles or square corners are *rectangles*. They should be led to see that all figures whose square or cubic contents they have thus far found are *rectangles*. They are now ready for the work designated on p. 27, by means of which they should discover for themselves that the area of any parallelogram can be found by *multiplying the length by the perpendicular height*.

**Definitions.**—In teaching a definition the object to be defined should be presented to the class, and by questions pupils should be led to observe those features of the object which must be named in the definition. For example, in teaching the definition of a square, a square surface (preferably of a cube) is presented. The pupils are led to see that (1) *it has four sides*, (2) *that the sides are equal*, (3) *that its angles are right angles*. From these facts the following statement may be drawn from pupils: "*A square is a four-sided figure, having all its sides equal and its angles right angles.*" Whenever the language of a pupil's definition is faulty, lead him to see the fault by questioning or by comparison with a correct form. Definitions of *rectangle*, *rhombus* and *rhomboid*, p. 27, and all definitions that follow, must be developed in this way.

**X. B. Triangles.**—(1) Develop clear ideas and definitions of triangles. (2) As pupils proceed to find the relative size of a parallelogram and triangle of the same base and height, give as little assistance as possible. Ask the necessary questions, giving only such directions for finding the answers as are found to be indispensable.

**X. C. Circles.**—(1) Develop clear ideas and definitions of *circle*, *circumference*, *diameter*, *radius*. (2) Establish the following formulæ:—

$$\text{Circumference} = \text{diameter} \times 3.1416.$$

$$\text{Diameter} = \text{circumference} \div 3.1416.$$

$$\text{Area} = \text{circumference} \times \frac{1}{2} \text{ radius.}$$

$$\text{Radius} = \frac{1}{2} \text{ diameter.}$$

NOTE.—To find the area multiply the circumference by the diameter and divide by 4 will often be found a convenient working formula and may easily be derived from the above.

**X. D. Solids.**—A teaching lesson from the *cube* should precede this exercise. The following facts should be observed and stated by the pupils:—(1) *The cube is a solid, i.e., it has length, breadth and thickness.* (2) *It is bounded by six faces.* (3) *The faces are equal to each other.* (4) *Each face is in the form of a square.* These facts are then gathered into one statement forming the definition p. 31.

**Right Prisms** only are dealt with in this book. The points of resemblance in all prisms are:—(1) *The ends or bases are parallel.* (2) *The upright sides are parallelograms.* Square and triangular prisms must be presented to the class.

A **Cylinder** is a round solid having circular ends or bases. The curved surface that bounds it is called the *convex* surface, and the round ends are called the *bases*.

**XI. Circular Measure** is used in measuring angles, latitude and longitude. In teaching circular measure use the globe.

A degree is equal to  $69\frac{1}{2}$  miles nearly.

**XI. A. Latitude** is distance north or south of the Equator.

When two places are on opposite sides of the Equator, their difference of latitude is found by adding their latitudes.

**XI. B. Longitude** is distance, reckoned on the Equator, east or west of a standard meridian.

The standard meridian divides the earth into Eastern and Western Hemispheres. Places on the Eastern Hemisphere are in East Longitude; on the Western Hemisphere, in West Longitude.

The English standard meridian is Greenwich. The longitude of Greenwich is  $0^\circ$ .

When two places are on opposite sides of the standard meridian, the difference of longitude is found by *adding* their longitudes.

The earth turns on its axis (*i.e.*, describes a circumference of  $360^\circ$ ) once in 24 hours. Hence, *longitude* can be expressed in *time*.

$$24 \text{ hours} = 360^\circ, 1 \text{ hour} = \frac{1}{24} \text{ of } 360^\circ = 15^\circ.$$

From this derive the rules given on p. 35.

Since the sun *appears*, to move from east to west, sunrise will occur earlier at all points east and later at all points west of a given place. Hence, clock-time will be later in all places east and earlier in all places west of the standard meridian.

NOTE.—For the sake of convenience, railroads and large cities have agreed to adopt *standard time*. *Standard time* is the clock-time of some meridian agreed upon for the purpose. Eastern standard time, which we use, is the clock-time of the meridian  $75^\circ$  west of Greenwich, *i.e.*, it is exactly 5 hours slow of Greenwich time.

**XII. Percentage.**—Teachers should bear in mind that in teaching business arithmetic it is especially important to combine neatness and clearness with reasonable rapidity. *The shortest methods consistent with clearness are to be preferred.* Mental exercises corresponding to the written should form a part of all work.

In teaching percentage and its applications many skilful teachers like to use formulas. To this course there is no objection, provided that the usual analysis is not neglected. A thorough analysis, mental and written, must precede and introduce all formulas.

**XII. A.** These preliminary exercises are of great importance. Pay special attention to the following:—

1. The reading of decimal fractions as rates per cent. Since hundredths occupy two decimal places, the first two decimal figures are read as per cent., the others as a fraction of one per cent., *e.g.*,  $\cdot 605$  is read  $60\frac{1}{2}\%$ ;  $\cdot 002$  is read  $\frac{2}{100}$  of one per cent.

2. The changing of common fractions and decimals to rates per cent. and *vice versa*. The common business fractions (halves, thirds, etc.) should be reduced to per cent., and pupils should be made thoroughly familiar with them. In working examples in percentage they should be able to use common fractions or decimals with equal facility.

In deciding whether to use common fractions or decimals in working examples in percentage, a knowledge of the table on p. 36 is necessary. This table gives the rates per cent. that can be expressed in little fractions. They are the rates which most frequently occur in business transactions.

3. Exercises should be given in pointing out the *base*, the *percentage* and the *rate* until these factors are readily recognised. Preliminary work of this kind will pay by saving time later on.

**XII. B. Fundamental Case.**—To find the *percentage* when the *base* and *rate* are given. This problem is an old friend in a new dress. It is to *take a fractional part of a given number*. Direct attention to the following:—

$$\frac{3}{4} \text{ of } 20 = 15. \quad \cdot 75 \text{ of } 20 = 15. \quad 75\% \text{ of } 20 = 15.$$

Sight examples will generally be worked best by changing the rate per cent. to a common fraction, *e.g.*,  $12\frac{1}{2}\%$  of  $64 = \frac{1}{8}$  of  $64 = 8$ .

**XII. C.** Written examples will generally be worked best by decimals, *e.g.*,  $22\frac{1}{2}\%$  of 865 acres =  $\cdot 225$  Rate  
 $\cdot 225$  of 865 acres = 194.625 acres. 194.625 Percentage.

The rule  $Percentage = Base \times Rate$  is thus easily derived.

**XII. D.** The **amount** is found by adding the percentage to the base. (See examples 8, 16, etc.)

The **difference** is found by subtracting the percentage from the base. (See examples 6, 7, 15, etc.)

**XIII. A and B. Derived Case.**—To find the *rate* when the *percentage* and *base* are given. This case is the same as to *find what fraction one number is of another*. Compare.

6 is what fraction of 9? 6 is what decimal of 9? 6 is what per cent. of 9?

Pupils must first find the common fractional part and reduce this fraction to a decimal of two places, *i.e.*, to hundredths or per cent. Care must be taken to lead pupils to recognise the base, or the number of which another number forms a part. (For method and hints see this Manual III., A., p. 2.)

**XIII. C.** The rule  $Rate = Percentage \div Base$  may now be derived, *e.g.*,

If the rent of a house is reduced from \$375 to \$350, how much is the reduction per cent. ?

The reduction is \$25 on \$375, or  $\frac{25}{375}$ .

$\frac{25}{375} = \frac{1}{15} = \cdot 06\bar{6} = 6\bar{6}\%$ .

Base = \$375.

Percentage = \$25.

**XIV. Derived Case.**—To find the *base* when the *percentage* and *rate* are given. This case is the same as to *find the number of which another number is a given fraction, or given a part, to find the whole*. (See Manual, Book II., p. 19.)



12 is  $\frac{3}{8}$  of what number? 12 is .375 of what number?  
 12 is  $37\frac{1}{2}\%$  of what number?

These examples are generally best analysed by common fractions under the unitary method; but pupils should exercise their judgment as to the methods they employ.

Compare the following:—

Find the number of which

$$59 \text{ is } 66\frac{2}{3}\%$$

$$\frac{2}{3} = 59$$

$$\frac{1}{3} = \frac{59}{2}$$

$$\frac{2}{3} = \frac{59 \times 2}{3}$$

$$59 \text{ is } 8\%$$

$$\frac{8}{100} = 59$$

$$\frac{1}{100} = \frac{59}{8}$$

$$\frac{100}{8} = \frac{59 \times 100}{8}$$

$$34 \text{ is } 17\%$$

$$17\% = 34$$

$$1\% = 2$$

$$100\% = 200$$

**XV. Derived Case.**—To find the *base* when the *amount* (or the *difference*) and *rate* are given.

$$\text{Amount} = \text{Base} + \text{Percentage.}$$

$$\text{Difference} = \text{Base} - \text{Percentage.}$$

The *base* is represented by 1, or by 100%, or by  $\frac{100}{100}$ .

The analysis here demands an additional step, *i.e.*, to find the *rate per cent.* represented by the given number. If there has been an increase or gain this will be found by adding the per cent. of increase to 100%. If there has been a decrease or loss, this will be found by subtracting the per cent. of decrease from 100%.

When the rate per cent. representing the amount or difference has been found, solve the problem as in **XIV**.

1. 36 is  $12\frac{1}{2}\%$  more than what number?

$$\text{Base} = 1$$

$$\text{Increase} = \frac{1}{8}$$

$$\text{Amount} = \frac{1\frac{1}{8}}{\frac{89}{80}}$$

36 is  $\frac{3}{8}$  of what number?

2. My flock of sheep increased 8%. I then had 324. How many had I at first?

Amount =  $100\% + 8\% = 108\%$ . 324 sheep is  $\frac{108}{100}$  of what number?

3. I lost 8% of my sheep and had 276 remaining. How many had I at first?

Difference =  $100\% - 8\% = 92\%$ . 276 sheep is  $\frac{92}{100}$  of what number?

**XVI. Profit and Loss.**—The *cost* is the *base*; the *per cent.* of gain or loss, the *rate*; the *gain* or *loss*, the *percentage*; the *selling price*, the *amount* or *difference*.

The analyses and formulæ previously given hold good.

Note the following modification:—

If I lose 8% by selling a machine for \$23, at what must I sell it so as to gain 15%?

(a)  $\frac{92}{100}$  of cost price is \$23. Cost price = \$25.

(b) 15% of \$25 = 15 of \$25 = \$3.75.

Selling price to gain 15% = \$25 + \$3.75 = \$28.75.

*Reason through the base or cost price.*

Examples like the above may be neatly solved by *proportion* as follows:—

If by selling 8% below cost I receive \$23 for a machine, what shall I receive by selling 15% above cost?

8% below cost is 92%.  $92\% = \$23$

15% above cost is 115%.  $1\% = \$\frac{23}{92}$

$115\% = \$\frac{23 \times 115}{92} = \$28.75.$

**XVII. Interest.**—Explain interest. A sufficient knowledge of the business transactions involved and of the terms employed in the applications of percentage should always be imparted to pupils before they are required to solve problems. Failure arises more frequently from a want of this knowledge than from a deficiency in arithmetical attainment.

Interest differs from the preceding applications of percentage in that it depends upon the *time* for which a sum

of money is lent, as well as on the *rate per cent.* charged.  
*Time is a new element.*

The *principal* is the *base*; the *per cent. per annum* is the *rate*; the *interest* is the *percentage*.

**XVII. Fundamental Case. A (Sight).**—If 100 be the principal, the rate will represent the *interest for one year*; the product of the rate by the number of years will give *the whole interest*.

Interest on \$450 for 2 years at  $3\frac{1}{2}\%$ ?

Int. on \$100 =  $(\$3\frac{1}{2} \times 2) = \$7$ .

Int. on  $4\frac{1}{2}$  times 100 =  $\$7 \times 4\frac{1}{2} = \$31.50$ .

**XVII. B.** As soon as the formula is derived, examples will best be worked by expressing the rate as a decimal and the time in years.

1. Interest on \$144 at  $1\frac{1}{3}\%$  for  $1\frac{3}{8}$  years.

$1\frac{1}{3}\% = .012$ .

\$144

$1\frac{3}{8}$  years = 1.375 years.

.012

1.728 interest for one year.

1.375

\$2.376000 interest for  $1\frac{3}{8}$  years.

2. Interest of \$670 at  $5\%$  for 146 days.

$5\% = .05$ .

\$670

146 days =  $\frac{146}{365}$  yr. =  $\frac{2}{3}$  yr. = .4 yr.

.02

$.05 \times .4 = .02$ .

\$13.40 Ans.

NOTE.—The only factors of 365 are  $5 \times 73$ .

3. Interest of \$4380 at  $3\frac{1}{2}\%$  from December 3, 1885, to March 21, 1887.

$3\frac{1}{2}\%$ = '035.	\$43.80	\$153.30
Time = 1 year 108 days.	'035	45.36
December, 28 days.	153.30	Int. for 1 year.
January, 31 "	108	<u>\$198 66</u> Ans.
February, 28 "	365 ) 16556'40	
March, 21 "	<u>\$45.36</u>	Int. for 108 days.
<u>108</u>		

NOTE.—Interest found to the nearest cent is sufficiently accurate.

In teaching the derived cases of simple interest begin with an easy example in the fundamental case. From that derive the others, being particularly careful to teach that, being derived, they all require *division*, as in the following:—

**XVII. C.** *To find the rate the given interest must be divided by the interest at 1%.*

Find the rate when the interest on \$375 for 4 years is \$56.25.

Int. on \$375 for 4 yrs. at 1% = \$15.

$\$56.25 \div \$15 = 3\frac{1}{2}$ .  $3\frac{1}{2}\%$  Ans.

**XVII. D.** *To find the time the given interest must be divided by the interest for one year.*

In how many years will the interest on \$840 at  $2\frac{3}{4}\%$  be \$161.70?

Int. on \$840 at  $2\frac{3}{4}\%$  for 1 year = \$23.10.

$\$161.70 \div \$23.10 = 7$ . 7 years Ans.

**XVII. E.** *To find the principal.*

(a) *The given interest must be divided by the interest on \$1.*

Find the principal that will produce \$70.31 $\frac{1}{4}$  in 3 years at 6 per cent.

Int. on \$1 for 3 yrs. at 6% = \$0.18.

$\$70.31\frac{1}{4} \div \$0.18 = 390.62\frac{1}{2}$ . \$390.62 $\frac{1}{2}$  Ans.

(b) *The given amount must be divided by the amount of \$1.*

\$153.30  
45.36  
\$198 66 *Ans.*

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What principal will amount to  $\$364.68\frac{3}{4}$  in 5 years 9 months at  $3\frac{3}{4}\%$ ?

Int. on \$1 for  $5\frac{3}{4}$  yrs. at  $3\frac{3}{4}\%$ . =  $\$1 \times 5.75 \times .0375 = \$0.215625$ .

Amount of \$1 for  $5\frac{3}{4}$  yrs. at  $3\frac{3}{4}\%$ . = \$1.215625.

$\$364.6875 \div \$1.215625 = 300$ .  $\$300$  *Ans.*

**XVIII. A. Bank Discount.**—A little familiar talk about banks and banking should precede these exercises. Banks are institutions organized under Government for the purpose of furnishing a safe place of deposit for money, exchanging money, borrowing and lending money, issuing bills for circulation, etc. The method of borrowing money at a bank should be shown by a familiar and practical example. John Martin (see p. 56) buys goods on credit from Gault Bros. amounting to \$900, and gives them a note promising to pay the money in forty days. Gault Bros. keep the note from the time they receive it (25 Jan.) till Feb. 4, when they take it to the bank to borrow money upon it. They first endorse the note, that is, write their name on the back of it. By this endorsement they guarantee the payment of the note. The bank calculates the interest on the amount, \$900, from 4 Feb. to the day when the note will mature, and adds 3 days, called days of grace. This interest the bank deducts from the face of the note (\$900) and gives Gault Bros. the amount less the discount. Within 3 days after the note matures John Martin must pay \$900 to the bank. If he does not do this, a notice called a *protest* is sent to him by the bank; and if he does not then pay, Gault Bros., who endorsed the note, become responsible to the bank for its payment, but they can hold John Martin responsible for repayment to them afterwards.

Definitions of *proceeds* of a note, *face*, *maturity*, *bank discount*, *maker*, *payee*, *endorser* and *days of grace* may now be evolved.

**XVIII. B. Trade Discount** is a deduction from the face of a bill, or from the list-price of goods.

Merchants, when they sell goods on credit, must charge more than when they sell for cash. They will take off a discount from the marked price if a customer will pay cash.

Price lists are issued by manufacturers and dealers specifying the articles manufactured with their prices. These prices are subject to many and various discounts. The manufacturer of a piano, for example, will allow a much larger discount to the trade than to an individual; or to his own agent than to one not acting as his agent. The *net price* of goods is the sum received for them, after all discounts have been taken off.

**XIX.** When a debt which becomes due after a certain time is paid before it is due, and discount is allowed for such payment, then if the discount is calculated so that a given rate of interest is allowed on the money paid, the discount is called **true discount**. The money paid is called the **present worth**. The *present worth* and the *interest on the present worth* make up amount of the debt.

The operation of finding the present worth of a sum of money at a given rate of interest is the same as the operation of finding the *principal* when the *amount*, *time* and *rate per cent.* are given. (See Manual, **XVII. E.** p. 18.)

(a) Find the present worth of \$420 due 3 years hence at 4 per cent.

(b) What principal will amount to \$420 in 3 years at 4 per cent. ?

Int. on \$1 for 3 yrs. at 4% =  $(3 \times 4)$  cts. = 12 cts.

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Amount of \$1 for 3 yrs. at  $4\%$  = \$1.12.

Present worth is  $\$420 \div \$1.12 = \$375$ .

True discount is  $\$420 - \$375 = \$45$ .

**XX. Compound Interest.**—When money is lent for a number of years the interest is usually paid by the borrower at regular intervals, yearly, or half-yearly or quarterly, as the case may be. Suppose, however, that it is agreed between the lender and the borrower that, instead of the interest being actually paid as it falls due, the interest due is *lent* in addition to the principal. In such a case the principal would be increased at the end of each year by that year's interest. *Hence, compound interest is the interest of the principal and of the unpaid interest after it becomes due.*

In questions of compound interest, the interest is understood to become due annually, unless otherwise stated.

Find the compound interest of \$800 for 2 yrs. at  $7\%$ .

\$800	
.07	
\$ 56	Interest for 1st year.
800	
856	Second Principal or Amount for 1 year.
.07	
59.92	Second Interest.
856.00	
915.92	Amount for 2 years.
800.00	
\$115.92	Compound Interest for 2 years.

**XXI. Rapid Arithmetic.**—An exercise in rapid arithmetic should be given once a week.

**XXI. A.**  $68 + 27 = 75 + 20 = 95$ .

Add first the *units* of the second number, then the *tens*.

$74 - 38$ : 38 requires 6 to make 44, and 30 more to make 74. *Ans.* 36.

$\$73.80 + \$19.57 = \$92.80 + \$0.57 = \$93.37$ .

Add to the first the dollars, then the cents, of the second.

$\$75.57 - \$19.80$ :  $\$19.80$  requires  $20\text{¢}$  to make  $\$20$ , and  $\$55.57$  more to make  $\$75.57$ . *Ans.*  $\$55.77$ .

**XXI. B.**  $86 \times 9 = 720 + 54 = 774$ .

Multiply first the *tens*, then the *units*. Add the two.

86 articles at  $8\frac{1}{2}\text{¢} = \$86 \div 12 = \$7\frac{2}{3} = \$7.16\frac{2}{3}$ .

$58 \times 25 = 58 \text{ hundred} \div 4 = 14\frac{1}{2} \text{ hundred} = 1450$ .

**XXI. C.** See suggestions given in this manual under percentage, interest, etc.

### ANSWERS.

#### I. C. PAGE 2.

- |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. $38\frac{7}{8}$ .  | 2. $53\frac{1}{2}$ .  | 3. $74\frac{7}{8}$ .  | 4. $83\frac{1}{4}$ .  | 5. $101\frac{3}{4}$ . |
| 6. $74\frac{3}{8}$ .  | 7. $70\frac{3}{8}$ .  | 8. $56\frac{3}{8}$ .  | 9. $42\frac{3}{8}$ .  | 10. $37\frac{1}{8}$ . |
| 11. $13\frac{1}{2}$ . | 12. $34\frac{1}{2}$ . | 13. $9\frac{7}{8}$ .  | 14. $35\frac{1}{8}$ . | 15. $11\frac{1}{2}$ . |
| 16. $11\frac{1}{4}$ . | 17. $30\frac{3}{8}$ . | 18. $55\frac{1}{8}$ . | 19. $30\frac{1}{4}$ . | 20. $13\frac{1}{2}$ . |
| 21. $2\frac{1}{2}$ .  | 22. $\frac{5}{8}$ .   | 23. $51\frac{1}{2}$ . | 24. $3\frac{1}{2}$ .  | 25. $\frac{1}{2}$ .   |
| 26. $4\frac{1}{2}$ .  | 27. $4\frac{1}{4}$ .  | 28. $11\frac{1}{2}$ . | 29. $4\frac{1}{4}$ .  | 30. $13\frac{1}{2}$ . |

#### I. F. PAGE 3.

- |                        |                         |                         |                        |                         |
|------------------------|-------------------------|-------------------------|------------------------|-------------------------|
| 1. $26\frac{1}{2}$ .   | 2. $70\frac{1}{2}$ .    | 3. $53\frac{1}{2}$ .    | 4. $66\frac{1}{2}$ .   | 5. $40\frac{1}{2}$ .    |
| 6. $2\frac{1}{2}$ .    | 7. $73$ .               | 8. $52$ .               | 9. $33$ .              | 10. $22$ .              |
| 11. $9\frac{1}{2}$ .   | 12. $10$ .              | 13. $16$ .              | 14. $15\frac{1}{2}$ .  | 15. $44\frac{1}{2}$ .   |
| 16. $52$ .             | 17. $31\frac{1}{2}$ .   | 18. $14\frac{1}{2}$ .   | 19. $21\frac{1}{2}$ .  | 20. $36$ .              |
| 21. $252\frac{1}{2}$ . | 22. $1216\frac{3}{8}$ . | 23. $1062\frac{7}{8}$ . | 24. $403\frac{1}{2}$ . | 25. $3056\frac{1}{2}$ . |
| 26. $971\frac{1}{2}$ . | 27. $373\frac{1}{2}$ .  | 28. $675$ .             | 29. $568\frac{1}{2}$ . | 30. $304$ .             |

#### I. G. PAGE 3.

- |                        |                       |                        |                        |                        |
|------------------------|-----------------------|------------------------|------------------------|------------------------|
| 1. $6\frac{1}{2}$ .    | 2. $4\frac{1}{2}$ .   | 3. $2\frac{1}{4}$ .    | 4. $2\frac{1}{4}$ .    | 5. $3\frac{1}{4}$ .    |
| 6. $3\frac{1}{4}$ .    | 7. $1\frac{1}{4}$ .   | 8. $4\frac{1}{8}$ .    | 9. $7\frac{1}{4}$ .    | 10. $23\frac{1}{4}$ .  |
| 11. $157\frac{3}{8}$ . | 12. $71\frac{1}{8}$ . | 13. $107\frac{1}{8}$ . | 14. $124\frac{3}{8}$ . | 15. $38\frac{1}{4}$ .  |
| 16. $40\frac{1}{2}$ .  | 17. $11\frac{1}{4}$ . | 18. $30\frac{1}{4}$ .  | 19. $40\frac{7}{8}$ .  | 20. $102\frac{1}{2}$ . |
|                        |                       |                        | 21. $42\frac{1}{4}$ .  |                        |



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## II. PAGES 3-4.

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|----------------------|-----------------------|----------------------|------------------------|----------------------|------------------------|
| 1. $\frac{1}{2}$ .   | 2. $\frac{1}{3}$ .    | 3. 8.                | 4. $4\frac{1}{2}$ .    | 5. $\frac{1}{10}$ .  | 6. $3\frac{3}{4}$ .    |
| 7. $\frac{2}{3}$ .   | 8. $6\frac{1}{2}$ .   | 9. $\frac{1}{3}$ .   | 10. $3\frac{1}{2}$ .   | 11. $1\frac{1}{2}$ . | 12. 14.                |
| 13. $\frac{1}{10}$ . | 14. $7\frac{1}{2}$ .  | 15. $3\frac{1}{2}$ . | 16. 16.                | 17. 2.               | 18. $313\frac{3}{4}$ . |
| 19. $8\frac{1}{2}$ . | 20. $12\frac{3}{4}$ . | 21. $\frac{1}{10}$ . | 22. $8\frac{1}{2}$ .   | 23. $3\frac{1}{2}$ . | 24. $1\frac{1}{2}$ .   |
| 25. $1\frac{1}{2}$ . | 26. $\frac{1}{2}$ .   | 27. 15.              | 28. $10\frac{1}{10}$ . | 29. $1\frac{1}{2}$ . | 30. 2.                 |
| 31. $3\frac{1}{2}$ . | 32. $8\frac{1}{2}$ .  | 33. $4\frac{1}{2}$ . | 34. $3\frac{1}{2}$ .   | 35. 2.               | 36. 1.                 |
| 37. $\frac{1}{10}$ . | 38. $1\frac{1}{2}$ .  | 39. 5.               | 40. 6.                 |                      |                        |

## III. B. PAGE 5.

- |                      |                      |                      |                      |                      |                      |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| 1. $\frac{1}{10}$ .  | 2. $\frac{1}{10}$ .  | 3. $\frac{1}{10}$ .  | 4. $\frac{1}{2}$ .   | 5. $\frac{1}{10}$ .  | 6. $1\frac{1}{10}$ . |
| 7. $1\frac{1}{10}$ . | 8. $3\frac{1}{2}$ .  | 9. $\frac{1}{10}$ .  | 10. $1\frac{1}{2}$ . | 11. $\frac{1}{2}$ .  | 12. $1\frac{1}{2}$ . |
| 13. $1\frac{1}{2}$ . | 14. $\frac{1}{2}$ .  | 15. $4\frac{1}{2}$ . | 16. $\frac{1}{2}$ .  | 17. $9\frac{1}{2}$ . | 18. $\frac{1}{2}$ .  |
| 19. $1\frac{1}{2}$ . | 20. $1\frac{1}{2}$ . | 21. $\frac{1}{2}$ .  | 22. $1\frac{1}{2}$ . |                      |                      |

## III. C. PAGE 6.

14. .025. 15. .1375. 16. .265625. 17. .417. 18. .00826 +  
19. .665625. 20. .63. 21. .10795 + 22. .03409 + 23. .3541 +

## IV. PAGE 7.

- |                        |                                     |  |                              |                               |
|------------------------|-------------------------------------|--|------------------------------|-------------------------------|
| 5. $101\frac{1}{10}$ . | 1. $5\frac{1}{10}$ in.              | 2. $7\frac{1}{2}$ in.                              | 3. 144 sq. rods.             | 4. 5 dys. 7 hrs. 54 m. 6 sec. |
| 10. $37\frac{1}{10}$ . | 5. £4. 11s. 8d.                     | 6. 9 cu. ft. 360 cu. in.                           | 7. 4 wks. 2 dys. 13 hrs.     |                               |
| 15. $11\frac{1}{2}$ .  | 34 min. 19 2 sec.                   | 8. 12 ac. 67 sq. rds. 22 sq. yds. 8 ft. 131 04 in. |                              |                               |
| 20. $13\frac{1}{2}$ .  | 9. 590 pks. 2 qts. 1 712 pts.       | 10. 2 mi. 1276 yds.                                | 11. $5\frac{1}{4}$ d.        |                               |
| 25. $\frac{1}{2}$ .    | 12. 39 gal. 0 24 qt.                | 13. 15 sq. rds.                                    | 14. 3 hrs. 18 min. 21 6 sec. |                               |
| 30. $1\frac{1}{2}$ .   | 15. 2 yds. 1 ft. $2\frac{1}{2}$ in. | 16. 7 cwt. 36 19 lbs.                              | 17. 33 yds. 1 ft.            |                               |
|                        | 18. 1 mi. 533 yds. 1 ft. 6 in.      | 19. £1. 3s. 11d.                                   | 20. 1750 3 lbs.              |                               |
|                        | 21. 1 gal.                          | 22. 5 dys. 11 hrs. 18 min. 51 7 sec.               | 23. 2 mi. 316 3 rds.         |                               |

## V. PAGE 8.

- |                         |                              |                              |                              |                              |
|-------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 5. $40\frac{1}{2}$ .    | 1. \$254.                    | 2. \$76.25.                  | 3. \$768.                    | 4. \$2252.80.                |
| 10. 22.                 | 5. \$825.                    | 6. \$729.                    | 7. \$443.10.                 | 8. \$25.                     |
| 15. $44\frac{1}{2}$ .   | 9. \$467.50.                 | 10. \$1201.75.               | 11. \$1533.75.               | 12. \$1390.40.               |
| 20. 36.                 | 13. \$238.12 $\frac{1}{2}$ . | 14. \$2100.45.               | 15. \$334.33 $\frac{1}{2}$ . | 16. \$842.66 $\frac{2}{3}$ . |
| 25. $3056\frac{1}{3}$ . | 17. \$14.16 $\frac{2}{3}$ .  | 18. \$98.50.                 | 19. \$210.                   | 20. \$440.12 $\frac{1}{2}$ . |
| 30. 304.                | 21. \$361.62 $\frac{1}{2}$ . | 22. \$23.20 $\frac{1}{2}$ .  | 23. \$192.92.                | 24. \$49.65.                 |
|                         | 25. \$8500.                  | 26. \$61.68.                 | 27. \$28.65.                 | 28. \$68.28.                 |
|                         | 29. \$23.25.                 | 30. \$3875.                  | 31. \$66.66 $\frac{2}{3}$ .  | 32. \$21.                    |
|                         | 33. \$1.85.                  | 34. \$26.95.                 | 35. \$11.                    | 36. \$48.75.                 |
|                         | 37. \$9.04 $\frac{1}{2}$ .   | 38. \$326.19 $\frac{1}{2}$ . | 39. \$18437.50.              |                              |

## V. PAGE 8 (continued).

- |                    |                     |                      |
|--------------------|---------------------|----------------------|
| 40. £400. 7s. 6½d. | 41. £397. 10s. 10d. | 42. £159. 10s. 8½d.  |
| 43. £2596. 7s. 9d. | 44. £692. 6s. 6d.   | 45. £10034. 16s. 4d. |
| 46. \$12.36½.      | 47. \$17.10½.       | 48. \$165.06½.       |
| 49. \$3671.87½.    | 50. \$421.30½.      |                      |

## VI. PAGE 9.

- |        |        |        |        |          |
|--------|--------|--------|--------|----------|
| 1. ⅓.  | 2. ¼.  | 3. 1.  | 4. ⅔.  | 5. ⅞.    |
| 6. ⅓.  | 7. ⅔.  | 8. 14. | 9. 3.  | 10. 2½.  |
| 11. ⅞. | 12. 1. | 13. ½. | 14. ⅞. | 15. 600. |

## VII. PAGES 10-12.

- |                           |                         |                |                  |             |             |
|---------------------------|-------------------------|----------------|------------------|-------------|-------------|
| 1. \$10.                  | 2. \$360.               | 3. \$63.       | 4. 110 yds.      | 5. 156 men. | 6. 171 men. |
| 7. 9 dys.                 | 8. 7 wks.               | 9. \$24.58½.   | 10. 3 men.       | 11. \$15½.  |             |
| 12. 17½ mi.               | 13. 6½ wks.             | 14. 5 brls.    | 15. 700 yds.     |             |             |
| 16. 3000 inhabitants.     | 17. 3½ hrs.             | 18. 4 hrs.     | 19. 215 dinners. |             |             |
| 20. 3 dys.                | 21. 190 men.            | 22. 37½ cents. | 23. \$2½.        |             |             |
| 24. 11½ cwt.              | 25. 3527 cwt. (nearly). | 26. \$25.      | 27. 12 miles.    |             |             |
| 28. 19320 miles.          | 29. 48 days.            | 30. \$25.52½.  | 31. 4 qts.       |             |             |
| 32. 182 ft.               | 33. 307⅓ hrs.           | 34. 27 ft.     | 35. \$50.25.     | 36. \$2.45. |             |
| 37. 64 yds.               | 38. 14 feet.            | 39. \$36.26+   | 40. \$93.22.     |             |             |
| 41. 1 hr. 6 min. 11½ sec. | 42. 45 miles.           | 43. 84 cents.  |                  |             |             |
| 44. 36 hrs.               | 45. 7 lbs. 13 oz.       | 46. \$732.     |                  |             |             |

## VIII. A. PAGE 15.

- |                   |              |              |                 |                  |          |
|-------------------|--------------|--------------|-----------------|------------------|----------|
| 4. 5·3 m.         | 17·24 m.     | 24·049 m.    | 54380 m.        | 2309 m.          | 27056 m. |
| 5. 5·7473 Km.     |              | 5850 cm.     |                 | 53350 mm.        |          |
|                   | 94·71263 Km. | 4873·5 m.    |                 | 37275·75 cm.     |          |
| 6. 83·49 m.       |              | 7. 9·25 m.   |                 | 8. 174·52592 Km. |          |
| 9. 240·50 francs. | 10. 68½ m.   | 11. 3·99 Km. | 12. 45·1584 Km. |                  |          |

## VIII. B. PAGE 17.

- |                   |                    |                |                |
|-------------------|--------------------|----------------|----------------|
| 8. 15·6289 Ha.    | 9. 3 sq. m.        | 10. 52 sq. m.  | 11. 4·84 Ha.   |
| 12. 471·75 sq. m. | 13. 368 panes.     | 14. 17 fields. | 15. \$365·859. |
| 16. 19 m.         | 17. 402·875 sq. m. | 18. 649 fr.    | 19. 140·4 fr.  |

## VIII. C. PAGE 18.

- |                  |                    |
|------------------|--------------------|
| 3. ·027 cu. m.   | 5. 10·3823 cu. m.  |
| 13·000005 cu. m. | 6. \$12·375.       |
| ·005037 cu. m.   | 7. 169834·5 cu. dm |
| 15·000101 cu. m. |                    |

## VIII. D. PAGE 19.

4. 72·6385 Hl.      5. \$428 80.      6. 236591·203 francs.  
7. 7 l. (man); 3·5 l. (woman).      8. 32 weeks.      9. 8927 l.  
10. 8 Hl.      11. 4 m.

## VIII. E. PAGE 20.

8. 6 tons. 7. 25426 g.; ·025426 ton. 8. ·553273 Kg.; ·04863 Kg.;  
·000094 Kg. 9. 1311·20 francs. 10. 108 kilos. 11. \$48.75.  
12. \$14. 13. 2394 fr. 14. 768 loads. 15. \$59·856d.  
16. 37·125 m. 17. 5 m. 18. 13791·10 francs. 19. 214·5825 Km.

## VIII. F. PAGES 22-23.

1. 6500 l.      2. 745·6 Kg.      3. 207·36 Kg.      4. 1675 g.  
5. 4500 l.      6. ·6 cu. m.; 600 l.; 600 Kg.      7. 1·28 m.  
8. 1·56 Kg.      9. 2,250,000 g.      10. 45·1269 tons.

1. 32·8 m.      2. 4 yds. 0 ft. 3·63 in.      3. 5·48 Km.  
4. 11 mi. 109 rods.      5. 3·835 Kg.      6. 12·7 oz. (nearly.)  
7. 7 cwt. 85·1 lbs. 8. ·418 sq. m. 9. 53 sq. yds. 7 sq. ft. 54·72 in.  
10. 1·1635 Ha.      11. 8 ac. 103·76 sq. rods.      12. 16·47 l.  
13. 808·042125 gal.      14. 8·178 cu. m.      15. 10 gal. 2 qts. 0·3 pt.

## IX. PAGES 24-25.

1. 90½ sq. ft.      2. 1 sq. ft. 64 sq. in.      3. \$3456.      4. \$56.57½.  
5. \$0.99⅞. 6. 32½ yds. 7. \$90. 8. 60½ yds. (8 strips, each 7½ yds.)  
9. \$10.40. 10. 576 bricks.      11. 6 ft. 9 in.      12. 288 tiles.  
13. 5 ft. 4 in.      14. \$1.50.      15. 10½ rods.      16. 763⅞ acres.  
17. 660 yds.      18. 46656 cubes.      19. 16 cu. yds. 8 cu. ft.  
20. 135 cu. ft. 21. 1009½ gal.      22. 11½ cu. ft.      23. 7500 lbs.  
24. 124½ cu. yds.; 6½ dys.      25. 2250 tons.  
26. 1687½ lbs.      27. 96½ bus.

## X. PAGES 26-32.

- A. 5. 78 sq. ft.      6. 4 ac.      7. 4 ft. 2 in.      8. 840 sods.  
B. 5. 17·88 sq. ft.; 62·4 sq. ft.; 58⅞ sq. ft.      6. 5 ac. 109·8528 sq. rds.  
7. 11 yds.      8. 80 rods.      9. \$22.50.      10. \$49.50.

- C. 6. 47·124 ft.; 141·372 yds.; 314·16 rods. 7. 15·708 mi.; 471·24 yds.  
 8. 20·849 + ft.; 30 rods (nearly). 9. 100 yds. (nearly); 6·366 + mi.  
 10. (a) 78·54 sq. ft. (b) 314·16 sq. ft. (c) 7854 sq. ft.  
 (d) 11309·76 sq. rods. (e) 176·715 sq. ft.
11. 754·7694 sq. yds. 12. 1 ac. 94 rods. 13. 25 sq. ft. 31 in. (nearly).  
 14. 1 ac. 16·715 sq. rods. 15. 40·8408 in.
- D. 7. (a) 216 cu. ft.; 216 sq. ft.  
 (b) 25 cu. yds.; 5½ sq. yds.  
 (c) 1248 cu. ft.; 844·8 sq. ft.  
 (d) 108·029 cu. ft.; 155·5092 sq. ft.
8. 4084·08 sq. ft. 9. 45·9459 cu. ft. 10. 14·1372 sq. ft;  
 17·6715 sq. ft. 11. 18400 cu. ft. 12. 375 cu. in. 13. 37½ sq. ft.  
 14. 21 cu. yds. 11 ft. 1216 in. 15. 46 sq. yds. 2 ft. 96 in.  
 16. 8¼ cu. ft. 17. \$113½. 18. 804½ cu. ft.

## XI. A. PAGE 34.

1. 185021". 2. 5° 47' 16". 3. 102° 51' 25½". 4. 1010° 49' 15".  
 5. 5° 37' 19". 6. 15° 46' 35". 8. 25°. 9. 37°. 10. 6° 57' 12".  
 11. 10° 48' 6". 12. 105° 5' 15".

## XI. B. PAGE 35.

8. 4° 48'. 9. 1 hr. 22 min. 25 sec. 10. 48° 41' 55".  
 11. 7 hrs. 9 min. 19 sec. 12. 1 hr. 18 min. 36 sec. 13. 5 hrs. 3 min.  
 14. 2 min. 20 sec.; 56 min. 51 sec.; 3 hrs. 16 min. 4 sec.  
 15. 8 hrs. 57 min. 40 sec. A.M.; 8 hrs. 3 min. 9 sec. A.M.; 5 hrs.  
 43 min. 56 sec. A.M.  
 16. 10 hrs. 6 min. 20 sec. A.M.; 4 hrs. 56 min. P.M.;  
 8 hrs. 53 min. 48 sec. P.M.

## XII. C. PAGE 38.

1. 296·1. 2. 923·68. 3. \$0·696 4. \$62·50. 5. \$588.  
 6. \$2048·50. 7. \$311·85. 8. \$25. 9. \$48. 10. \$30.  
 11. \$20. 12. \$50. 13. \$350. 14. 24 men. 15. 21 ac.  
 16. 55 gal. 17. 4 days. 18. 39 sheep. 19. \$35·8234.  
 20. 886·033 mi. 21. ·3538. 22. \$64·8284. 23. \$16·25525.  
 24. 217·875. 25. ·000032. 26. 183 tons. 27. 210 marbles.  
 28. 131 eggs. 29. 104 soldiers. 30. 56 yards. 31. 106 boys.  
 32. 360 rods. 33. 700 bricks. 34. 2 oranges. 35. 4 bus. 36. 72 lbs.

## XII. D. PAGE 39.

11. \$743.75. 12. 45 people; 86 $\frac{1}{4}$  p.c. 13. The first by \$9.  
 14. \$2523.17. 15. \$771.87 $\frac{1}{2}$ . 16. \$70.95. 17. \$4.33 $\frac{1}{2}$ .  
 18. \$2047. 19. £1. 2s. 20. 709 $\frac{5}{8}$  lbs. 21. 213818 people.

## XIII. C. PAGES 41-42.

1. 37 $\frac{1}{2}$  p.c.; 88 $\frac{3}{4}$  p.c.; 14 $\frac{7}{8}$  p.c.; 6 p.c.  
 2. 16 p.c.; 5 p.c.; 6 $\frac{1}{4}$  p.c.; 22 $\frac{1}{2}$  p.c.  
 3. 8 $\frac{1}{2}$  p.c. 4. 15 p.c. 5. 6 $\frac{3}{4}$  p.c. 6. 8 p.c. 7. 7 $\frac{1}{2}$  p.c.  
 8. 16 $\frac{3}{4}$  p.c. 9. 5 p.c. 10. 4 $\frac{1}{2}$  p.c. 11. 4 p.c. 12. 10 p.c.  
 13. 12 $\frac{1}{2}$  p.c. 14. 23 $\frac{1}{4}$  p.c. 15. 66 $\frac{2}{3}$  p.c. 16. 87 $\frac{1}{2}$  p.c. 17. 94 p.c.  
 18. 66 $\frac{2}{3}$  p.c. 19. 14 $\frac{7}{8}$  p.c. 20. 12 $\frac{1}{2}$  p.c.

## XIV. PAGES 43-44.

- B. 1. 126. 2. 360. 3. 888. 4. \$275. 5. \$11552.94+ 6. 365 tons.  
 7. £1739 $\frac{1}{4}$ s. 8. \$19405.55 $\frac{1}{2}$ s. 9. \$330300. 10. \$155928.88+  
 C. 6. 4310 people. 7. \$2520. 8. 184 bus. 9. \$1060. 10. \$265.07.

## XV. B. PAGE 45.

1. \$2500. 2. \$2200. 3. \$3100. 4. \$7000. 5. \$95.92+  
 6. 6000. 7. 7000. 8. 15000. 9. 2234 $\frac{1}{4}$ . 10. 1363 $\frac{1}{4}$ r.  
 11. 300 sheep. 12. 300 sheep. 13. 5100 inhabitants.  
 14. 3850 persons. 15. \$1.87 $\frac{1}{2}$ . 16. 4717 persons. 17. 38 $\frac{1}{2}$  p.c.  
 18. 640 sheep. 19. \$4851. 20. \$3200. 21. 160 eggs.  
 22. \$4800; \$5.05 $\frac{1}{8}$ .

## XVI. B. PAGES 47-48.

1. \$102.29. 2. \$1787.50. 3. \$611.08 $\frac{1}{4}$ . 4. \$3235.29 $\frac{1}{4}$ r.  
 5. 16 $\frac{1}{2}$  p.c. 6. 18 p.c. 7. \$54. 8. \$28.75.  
 9. 12 p.c. 10. \$49. 11. 17 p.c. 12. 10 p.c.  
 13. 18 cts. 14. \$12500. 15. \$15.62 $\frac{1}{2}$ . 16. \$287.50.  
 17. \$19.80. 18. 14 $\frac{1}{4}$ r apples. 19. 33 $\frac{1}{2}$  cents. 20. \$30, \$1470.  
 21. \$34.80. 22. \$47.31. 23. 2 $\frac{1}{2}$  p.c. 24. 1 $\frac{1}{2}$  p.c. 25. \$112.50.

## XVII. B. PAGES 50-51.

1. \$62.70. 2. \$40.60. 3. \$145.60. 4. \$99. 5. \$5.81 $\frac{1}{2}$ .  
 6. \$3.50. 7. \$169.96. 8. \$2376. 9. \$81.70. 10. \$93.37 $\frac{1}{2}$ .  
 11. \$624.75. 12. \$183.33 $\frac{1}{2}$ . 13. \$216.85+ 14. \$518.10+  
 15. \$56.12+ 16. \$18.34+ 17. \$92.64+ 18. \$109.25.

XVII. B. PAGES 50-51 (*continued*).

19. \$3729; \$252.329. 20. \$2.75; \$277.75. 21. \$20.83½; \$5020.83½.  
 22. \$28352; \$2863552. 23. \$10.20; \$860.20. 24. \$13.40; \$683.40.  
 25. \$32.97; \$817.97. 26. \$12.33; \$1212.33. 27. \$7.72; \$362.47.  
 28. \$358.54; \$2232.54. 29. \$178.55; \$1862.55. 30. \$1456; \$7956.  
 31. \$48.55; \$1204.55. 32. \$143.04; \$4613.04. 33. \$30; \$1260.26.  
 34. \$2.47½. 35. \$15.75. 36. \$37.02. 37. \$85.28.  
 38. \$62.13. 39. \$79.75. 40. \$1.38. 41. \$3.45.  
 42. \$17.06. 43. \$34.75. 44. \$7.45. 45. \$199.66. 46. \$88.19.

## XVII. C. PAGE 52.

2. 3 p.c. 3. 3½ p.c. 4. 5 p.c. 5. 3½ p.c. 6. 8 p.c. 7. 8 p.c.  
 8. 7 p.c. 9. 20 p.c. 10. 4½ p.c. 11. 6½ p.c. 12. 19½ p.c.  
 13. 5 p.c. 14. 5 p.c. 15. 3½ p.c. 16. 1 p.c. 17. 4 p.c.  
 18. 4½ p.c. 19. 6 p.c.

## XVII. D. PAGE 53.

2. 3 yrs. 3. 2½ yrs. 4. 3 yrs. 5. 3 mos. 6. 8 mos. 7. 40 yrs.  
 8. 7 yrs. 9. 1 yr. 7 mos. 10. 2 yrs. 11. 8 yrs.  
 12. 33½ yrs. 13. 11½ yrs. 14. 2 yrs. 15. 2 yrs. 16. 5 yrs.  
 17. 4 yrs.

## XVII. E. PAGE 53.

2. \$450. 3. \$240.50. 4. \$390.62½. 5. \$500. 6. \$400.  
 7. \$365. 8. \$2146. 9. \$4900. 10. \$240. 11. \$500.  
 12. \$300. 13. \$179.24+ 14. \$220. 15. \$656.25. 16. \$250.

## PROBLEMS IN INTEREST. PAGES 54-55.

1. \$175.50. 2. 22½ yrs. 3. \$2.15½. 4. 10 yrs. 5. \$26.04½.  
 6. 3 p.c. 7. \$320. 8. \$111.66½. 9. 4½ yrs. 10. \$20,833½.  
 11. 6½ p.c. 12. 8½ p.c. 13. \$446428+. 14. 16½ yrs.  
 15. \$7.96. 16. \$9.17. 17. \$3.36. 18. \$25.65. 19. \$162.08.  
 20. \$375. 21. 4 p.c. 22. May 1, 1895. 23. \$260.  
 24. July 1, 1890. 25. \$24000; \$36500.

## XVIII. A. PAGES 57-58

1. Dec. 10; Dec. 22; Dec. 30; Nov. 21; Nov. 1; July 3.  
 2. Feb. 23; Dec. 16; Sept. 21; July 27; June 21; Sept. 4.  
 3. 52 days; 63 days; 119 days; 85 days; 17 days.  
 4. Due May 14; discount \$13.80; proceeds \$786.20.

## XVIII. A. PAGES 57-58 (continued).

- \$5020.83½.  
 10; \$683.40.  
 2; \$362.47.  
 56; \$7956.  
 ; \$1260.26.  
 . \$35.28.  
 . \$3.45.  
 6. \$88.19.
5. Due Nov. 6; discount \$2.17; proceeds \$573.80.  
 6. Due Aug. 14; discount \$4.34; proceeds \$715.66.  
 7. Due June 14; discount \$15.61; proceeds \$984.39.  
 8. Due Jan. 15; discount \$7.63; proceeds \$332.32.  
 9. \$334.81. 10. \$7820; \$7661.89; \$961.89.  
 11. \$493.87; \$498.28.

## XVIII. B. PAGES 58-59.

7. 8 p.c.  
 19½ p.c.  
 17. 4 p.c.
1. \$199.50. 2. \$4.25; \$2.97½; \$0.95½. 3. 12½ cents. 4. \$304.  
 5. \$511.65. 6. \$3623.39½. 7. \$5606.25. 8. \$483.60.  
 9. \$41.25. 10. \$7304.22. 11. \$804.11½. 12. \$4.

## XIX. PAGES 58-59.

7. 40 yrs.  
 1. 8 yrs.  
 6. 5 yrs.
1. \$100. 2. The same. 3. \$200. 4. \$400; \$20. 5. \$375; \$45.  
 6. \$1125; \$135. 7. \$150; \$20.50. 8. \$1000; \$18.  
 9. \$183.33½; \$3.66½. 10. \$315; \$7.35.

## XX. PAGE 60.

6. \$400.  
 1. \$500.  
 6. \$250.
1. \$82; \$64.06½. 2. \$30.60; \$63.24. 3. \$45.75; \$48.80.  
 4. \$264.60. 5. \$1157.62½. 6. \$19'4052.  
 7. \$8.29½+; \$60.92+ 8. \$7.81½.

## XXI. D. PAGES 66-67.

- \$26.04½.  
 \$20,833½.  
 16½ yrs.  
 \$162.08.  
 13. \$260.
1. 98362. 2. 111273. 3. 97592. 4. 82421.  
 5. 92430. 6. 88598. 7. 84216.  
 8. 44414. 9. 45515. 10. 42713. 11. 45787.  
 12. 50949. 13. 43610. 14. 43802. 15. 52364.  
 16. 47513. 17. 46196. 18. 59992. 19. 49723.  
 20. 37751. 21. 44563.  
 22. 44041. 23. 61897. 24. 49174. 25. 81508.  
 26. 40904. 27. 65581. 28. 79761.  
 29. 35943. 30. 15369. 31. 43535. 32. 30647.  
 33. 40117. 34. 35756. 35. 44330. 36. 26805.  
 37. 45072. 38. 28103. 39. 22912. 40. 11103.  
 41. 21758. 42. 21416.

43. 1013818.	44. 065304.	45. 732653.	46. 550089.
47. 753387.	48. 629461.		
49. 255840.	50. 300990.	51. 420935.	52. 368491.
53. 257089.	54. 385005.	55. 262599.	56. 469896.
57. 190627.	58. 299525.	59. 237693.	60. 429068.
61. 368236.	62. 137728.		
63. 756309.	64. 793394.	65. 987471.	66. 774053.
67. 698366.	68. 532763.		
69. 200712.	70. 314616.	71. 332466.	72. 430484.
73. 434048.	74. 447927.	75. 305408.	76. 316725.
77. 507137.	78. 311992.	79. 200345.	80. 194701.
81. 277740.	82. 228555.		

## XXI. E. PAGES 68-69.

1. \$5.57½.	2. \$10.58½.	3. \$21.27.	4. \$14.03¾.
5. \$401.17.	6. \$7.36½.	7. \$20.29.	8. \$39.19½.
9. \$162.09½.	10. \$36.34½.		

## XXI. F. PAGE 69.

1. 56334868710.	23. 2961 - 494.
2. 27259794324.	24. 4267762 - 159.
3. 47507529912.	25. 680076 - 121.
4. 3368917856.	26. 74142 - 695.
5. 4284519792.	27. 76983 - 308.
6. 36785628404.	28. 825302 - 383.
7. 877319686.	29. 50083 - 445.
8. 7705861100.	30. 56202 - 42.
9. 48664576.	31. 6918 - 584.
10. 15085456.	32. 12508 - 212.
11. 92313664.	33. 6564 - 2082.
12. 23376929.	34. 7817 - 7703.
13. 77369616.	35. 429 - 3380.
14. 334255384.	36. 716 - 2387.
15. 447697125.	37. 49983 - 2205.
16. 29218112.	38. 80449 - 576.
17. 706933718643.	39. 8238 - 5389.
18. 216973458729.	40. 222770446 - 1873.
19. 963259373376.	41. 10077203 - 28929.
20. 33427951656.	42. 196924 - 1298115.
21. 2450305865280.	43. 12345679012345 - 55.
22. 1420973578900.	9009009009009 - 1.
	90000900009 - 1



## MISCELLANEOUS EXAMPLES. PAGES 70-78.

- A. 1. 5403. 2. 14. 3. 100; 150. 4. 18; 882. 5. 4780.  
 6. 419; 481. 8. Seventy-two millions nine hundred and seventy-five thousand three hundred and eighty-nine. 9. 210 dozen.  
 10. 155708. 11. 723 - 36. 12. 157 pages. 13. 124727.  
 14. 76. 15. 11.
- B. 1.  $1\frac{1}{2}$ . 2.  $\frac{1}{2}$ . 3.  $11\frac{1}{2}$ . 4.  $\frac{1}{2}$ . 5. \$92 $\frac{1}{2}$ . 6.  $5\frac{1}{2}$ . 7. \$20 $\frac{1}{2}$ .  
 8.  $5\frac{1}{2}$  ft. 9.  $3\frac{1}{2}$ . 10. 6 times. 11.  $\frac{1}{2}$ . 12.  $\frac{1}{2}$ . 13. 100.  
 14. 100. 15. \$26752. 16. \$81. 17. 85 miles. 18. 112 lbs.  
 19.  $\frac{1}{2}$ . 20. \$60. 21. \$160. 22. A \$2133 $\frac{1}{2}$ , B \$800, C \$1066 $\frac{1}{2}$ .
- C. 5. .069783. 6. 3. 7. 80 times. 8. .14 $\frac{1}{2}$ . 9. \$37'3004.  
 10. 27'0125. 11. 6'242. 12. .575. 13. .00003627.  
 14. 857099 $\frac{1}{2}$ . 15. \$77.61. 16. \$340.40. 17. 63 ft.  
 18. 1 ft. 7'98 in. 19. \$12023.43 $\frac{1}{2}$ . 20. 1'32127 +
- D. 1. 7919 ft. 2. 13 yrs. 39 dys. 22 hrs. 37 min. 3. 18 min. 54 $\frac{1}{2}$  sec.  
 4. 2 ac. 367 $\frac{1}{2}$  sq. yds. 5. 17 min. 36 sec. 6. 620 yds. 10 in.  
 7. 18 ft. 8. 720 sixteenths. 9. £37. 1s. 10. 31 words.  
 11. 7 bu. 1 pk. 6 qts. 12. 502 days. 13. 60 times.  
 14. 102'7". 15. 3 minutes past 5 p.m. 16. 6 min. 36 sec.
- E. 1. 8 $\frac{1}{2}$  miles. 2. 10 $\frac{1}{2}$  days. 3. 500 times. 4. 219 days.  
 5. 30 lbs. 6. 112 $\frac{1}{2}$  lbs. 7. 146 days. 8. 64 persons.  
 9. 10 persons. 10. 12 men. 11. \$678.75. 12. \$0.28 $\frac{1}{2}$ .  
 13. 16 hrs. 40 min. 14. \$17.50. 15. 76 men.
- F. 1. \$43.12. 2. 12 boards. 3. 51 sq. yds. 6 $\frac{1}{2}$  sq. ft. 4. 2000 sq. yds.  
 6. 1200 times. 7. 3 mi. 1211 yds. 2 $\frac{1}{2}$  ft. 8. 8025 miles.  
 9. 157'08 sq. ft. 10. 8796'48 cu. in. 11. 540 cu. ft.  
 12. The circle by 33'47 sq. rods. 13. 5 ac. 1800 sq. yds.
- G. 1. 103'95 fr. 2. .8 Kg. 3. 41'1808 Km.; 25'738 mi.  
 4. 18705'594 in. 5. \$0.70. 6. 333 boxes. 7. 23'148 grains.  
 8. 19'5 Kg. 9. 224 lots. 10. 2'78 l. 11. 182812'5 m.  
 12. \$44.90. 13. \$15.12. 14. 65'975 Hl.
- H. 1. 75 p.c. 2. \$414. 3. 12'2 + p.c. 4. 14'7 + p.c. 5. \$20.  
 6. 53 $\frac{1}{2}$  p.c. 7. \$15.12. 8. \$24.25. 9. \$662.50. 10. \$1.87 $\frac{1}{2}$ .  
 11. \$45000. 12. \$21.66 $\frac{1}{2}$  lost. 13. 33 $\frac{1}{2}$  p.c. 14. \$10.50; 2 $\frac{1}{2}$  p.c.
- I. 1. \$75.03 $\frac{1}{2}$ . 2. \$16.11. 3. 5 p.c. 4. 3 p.c. 5. 4 years.  
 6. 3 $\frac{1}{2}$  years. 7. \$500. 8. \$325. 9. \$16. 10. \$380.19.  
 11. \$67.18 $\frac{1}{2}$ . 12. \$6.04; \$693.96. 13. \$4.78; \$495.22.  
 14. \$6.40; \$393.60. 15. \$103.61. 16. \$8.

## XXIII. TEST PAPERS. PAGES 86-92.

- A. 1. 50706. 2. \$6.79 $\frac{1}{2}$ . 3. 12320 sleepers. 4. \$44.37 $\frac{1}{2}$ .  
5. 6 days. 6. 69934 bricks.
- B. 1. 11 $\frac{1}{2}$  miles. 2. 2450 sq. rods. 3. 720 lbs. 4.  $\frac{1}{17}$ .  
5.  $\frac{1}{3}$ . 6. 80 p.c.; 25 p.c.
- C. 1. 97 $\frac{1}{2}$  miles. 2. \$25.37 $\frac{1}{2}$ . 3. 11 $\frac{1}{2}$ . 4. 0855.  
5. \$48.30. 6. 25 $\frac{3}{8}$  sq. ft.
- D. 1. 4 dys. 23 hrs. 23 min. 2.  $\frac{1}{2}$ ; 12 $\frac{1}{2}$  p.c.; 125. 3. \$5.95.  
4. \$74.25. 5. 6 tons 12 cwt. 18 $\frac{1}{10}$  lbs. 6. 48 lbs. 4 $\frac{1}{2}$  oz.
- E. 1. \$3.23 $\frac{3}{4}$ . 2. 11730 persons. 3. \$98.75. 4. \$17.75.  
5. 14 $\frac{11}{17}$ . 6. 63 $\frac{3}{4}$  yds.
- F. 1. 31 $\frac{1}{2}$ . 2. 8 cents. 3. 1440 pieces. 4. \$25.  
5. 003125. 6. 9 inches square.
- G. 1. \$15.76 $\frac{1}{2}$ . 2. \$116. 3. 20 p.c. 4. 972 lbs.  
5. 121 $\frac{1}{2}$  sq. in. 6. \$2000.
- H. 1. \$34.57. 2. \$2.55. 3. \$90. 4. \$260.71.  
5. 469; 1407. 6. 0322465.
- I. 1. 2 $\frac{9}{17}$ . 2. 30875. 3. £106 $\frac{1}{17}$ . 4. \$221.91.  
5. \$942.50. 6. 10 $\frac{1}{2}$  p.c.
- J. 1. 1.8. 2.  $\frac{1}{17}$ . 3. \$45.06. 4. \$52.80. 5. \$3. 6. \$0.504.
- K. 1. 9 $\frac{1}{2}$  loads. 2. \$18000. 3. \$14.95. 4.  $\frac{1}{17}$ .  
5. 61 $\frac{1}{2}$  cents. 6. 57 $\frac{1}{2}$  yards.
- L. 1. 200. 2. 9 $\frac{1}{2}$  lbs. 3. 1699 yds. 1 ft. 6 in. 4. 1500 lbs.;  
300 lbs.; 200 lbs. 5. \$3000. 6. \$105.60.
- M. 1. \$722.72. 2. 2 $\frac{11}{17}$  yrs. 3. \$60000. 4. 35802.  
5. \$10.87 $\frac{1}{2}$ . 6. 405 cu. ft.
- N. 1. \$6.81 $\frac{1}{2}$ . 2. 7 p.c. 3. \$1.76 $\frac{1}{17}$ . 4. \$9000.  
5. 210 $\frac{3}{8}$  mi. 6. \$9.33 $\frac{1}{2}$ .
- O. 1. 44 $\frac{1}{2}$  p.c. 2. 12. 3. \$297.83. 4. 22 min. 40 sec.  
5. \$6. 6. 307125 acres.
- P. 1. Too large by  $\frac{1}{17}$ . 2. \$183.90. 3. \$1200. 4. \$210.  
5. 7 years. 6. 167552 cu. ft.
- Q. 1. 1 $\frac{1}{2}$ . 2. 2142162 minutes. 3. 6 $\frac{1}{2}$  sec. 4. \$52.77 $\frac{1}{2}$ .  
5. \$367.20. 6. 146608 ft.; 171042 sq. ft.
- R. 1. 84 gal. 2. \$8 $\frac{1}{2}$ . 3. 864 bricks. 4. \$800.  
5. 13910285. 6. 25 p.c.

\$44.37½.

t. 175.

B. \$5.95.  
lbs. 4½ oz.  
\$17.75.

\$0.504.

600 lbs. ;

2.

0 sec.

t. \$210.

.77½.



