9. Area of bellows : area of pipe= 16^{2} : 1^{2} =256 : 1 ∴ woight of water in pipe=188=141b=46 oz Av.
Now 1728 cubic inches in water weigh about 1000oz
∴ numbèr cubic inches in pipe=1000÷ 4 = 888 = height.

EUCLID.

TIME-TWO HOURS AND A HALF.

1. State the different conditions of equality of two triangles, as given in he first book of Euclid.

2. If two triangles have two sides in one equal to two sides in the other, each to each, and an angle, opposite an equal side, equal in each, are the triangles necessarily equal? Explain.

3. Any two sides of a triangle are together greater than the third side.

4. If a point be taken within a triangle and lines be drawn from it to the extremities of the base, the sum of these lines is less than the sum of the two sides of the triangle.

5. The three angles of a triangle are together equal to two right,

angles. 6. Three unlimited straight lines intersect one another not in a What is the sum of all the angles formed ?

7. If a line be divided into two equal parts and also into two unequal parts, the square upon the greater unequal part is equal to the square upon the less unequal part, together with four times the rectangle contained by the half line and the line between the points of section.

8. ABC is a transle, and CD bisects the base AB in D. that $AC^2 + CB^2 = 2AD^2 + 2DC^2$. Show

9. Show how to construct a square equal to a given triangle.

SOLUTIONS.

1. There are four cases. 4, 26, 8, 26. See Hamblin Smith's Geometry p. 15, or Potts's Euclid p. 54, Todhunter's Euclid p. 261. 2. If the angles opposite to the other equal sides be both acute or both obtuse or if one of them be a right angle the triangles are equal

in all respects. See H. Smith's Prop. E p. 42, Potts's p. 54, Todhunter p. 261. 3. I. 20. 4. I. 21. 5. I. 32.

- 6. Twelve right angles. I. 15 Cor. 1
- 7. С A D
 - $AC^2 = BC^2$

 $\begin{array}{l} = DB^{3} + \ CD^{2} + 2CD, DB \\ AC^{3} + CD^{2} = DB^{3} + 2CD^{2} + 2CD, DB \\ = DB^{3} + 2BO, CD \ (\Pi, 3) \end{array}$

 $AC^{2}+CD^{2}+2AC:CD=DB^{2}+4BC:CD$, since AC:CD=BC:CD. i.e. $AD^{2}=_{*}B^{2}+4BC:CD$. (II. 4.) Q. E. D. 8. Draw CE perpendicular to AB. There will be three figures

according as the triangle is isosceles, and B obtuse or acute Then 1st case follows from I. 47. In 2nd and 3rd cases $AC^2=AD^2+DC^2+2AD.DE$ (II. 12). $BC^2=BD^2+DC^2-2BD.DE$ (II. 13). But BD=AD

adding $AC^{2}+BC^{2}=2AD^{2}+2DC^{2}$. Q. E. D. 9. Particular case of II. 14, in which apply I. 42 instead of I. 45

ADMISSION TO HIGH SCHOOLS.—DEC., 1882.

ARITHMETIC.

1. From 935 take 846, explaining clearly the reason for each step.

The difference between 82610 and the product of two numbers is seventy million three hundred thousand. One of the numbers is 9402; find the other.

2. Find the amount of the following bill :-- 36 lbs. 8 oz. beef at 16c.; 16 lbs. 10 oz. mutton at 14c.; 7 lbs. 12 oz. pork chops at 12c.; 15 lbs. 6 oz. turkey at 18c.; 4 lbs. 10 oz. suct at 16c. 3. Find the L. O. M. of 11, 14, 28, 22, 7, 56, 42, 81; and the

G. C. M. of 40545, 124083.

1 of 1+3 of 5

4. Prove that $\frac{3}{4}$ of $1=\frac{1}{5}$ of 3. Similar $\frac{1}{5}$ of $\frac{1}{5}$ Simplify -

$$\frac{5}{36} + \frac{7}{12} \text{ of } 3\frac{1}{2} - (\frac{2}{8} \text{ of } \frac{37}{2} - \frac{1}{3}) \qquad 9\frac{1}{3} - 1\frac{2}{3}$$

5. Prove that $1.025 \div .05 = 20.5$.

Find the cost of .0625 of 112 lbs. sugar, when 1 lb. costs .0703125 . of 16s.

6. Reduce 45740108 square inches to acres.

7. The bottom of a cistern is 7 ft. 6 in. by 8 ft. 2 in. How deep must it be to contain 3750 lbs. of water, a cubic ft. of water weighing 1000 ounces?

8. A. runs a mile race with B. and loses; had his speed been a third greater he would have won by 22 yards. Find the ratio of A's, speed to B's. 9! A. does $\frac{3}{2}$ of a piece of work in 6 hours; B. does $\frac{3}{2}$ of what

remains in 2 hours; and C. finishes the remainder of the work in 30 minutes. In what time would all working together do the work?

10. By selling tea at 60c. per lb. a grocer loses 20 per cent. ; what should he sell it at to gain 20 per cent. ?

SOLUTIONS.

1. Book work. . See H. Smith's Arith. Can. Ed. p. 13. Product - 82610=70800000

- : Product =70300000+82610=70382610
- Reqd. factor =70382610+9402 =
- : Reqd. factor =70382010+3402 = 2. $375 @ \cdot16=5.94$ $165 @ \cdot14=2.823$ $75 @ \cdot12= \cdot93$ $158 @ \cdot18=2.763=$11.961.$ 3. L. C. M. =L. C. M. of 22, 56, 42, 81=L.C.M. of $11 \times 2, 7 \times 2^3, 7 \times 3 \times 2, 3^*=11 \times 8 \times 7 \times 81=49806$.
- $40545 = 5 \times 9 \times 17 + 53$, of which factors only 9 and 17 will divide 124088
 - : G. C. M. =153.
 - 4. Take a line 8 units in length, and divide it into 12 equal parts. Honco 1 unit in length will contain 4 of the equal parts
 - and 1 of a unit in length will contain 1

" 3 of a unit Again 1 of the whole 3 units in length will contain 3 of the equal parts

- i.e., $\frac{2}{3}$ of one unit in length, and $\frac{1}{3}$ of three units each contain 3 of the equal parts
 - : they are equal to each other.
 - Expn. $\frac{1}{16} \frac{1}{16} \times \frac{91}{5} 13}{\frac{5}{6} + 91} \times \frac{91}{26} \frac{1}{5} \times \frac{91}{5} 13}{\frac{1}{6} + 71} = \frac{1}{1} \times \frac{73}{73} = \frac{1}{7}$ 5. Quotient = 1.325 + 05 = 1025 + 50 = 20.5.
 - - 1tb. costs .0703125 of 16s.
 - : 112hs. cost 112 × 0703125 of 16s.
 - : 0625 of 112bs. cost 06?5 × 112 × 0703125 of 163.
 - $= 06\frac{1}{2} \times 112 \times 0703\frac{1}{5} \times 16 = 700 \times 1\frac{1}{5} = \pounds 35 \times 1\frac{1}{5} = \pounds 39 \times 7 \times 6.$ 12 45740108
 - 6. 12|3811675-8
 - 9|317631 7 : $7 \times 12 + 8 = 92$ sq. in.

 - 1210j35293-2 sq. ft.

20 roods -1093 sq. yds.

121 4372

4

- 36 percues 16 sq. yds.
- Ans. 5ac. " 36per. " 16sq. yds. " 2sq. ft. 22sq. in. 7. 3750lbs. = 6000002. and .. = 60cub. ft
- $\therefore \text{ depth } \times 7\frac{1}{2} \times 3\frac{1}{6} = 60; \text{ or, depth } = 60 \times \frac{1}{2} \times \frac{1}{5} = \frac{1}{6} = 2\text{ ft. } = 6\frac{1}{15} \text{ in.}$ 8. B's distance = 1760 + 22 yds. $\frac{1}{5}B's \text{ distance} = 1782 \text{ yds.}$

 - B's distance= # × 1782=1386}. : A's rate : B's rate=3520 : 2673=320 : 243.
- Otherwise : 22 yds. = 30 mile . in 2nd case A would go 20 and B \$3 ml.
 - : in 1st case A would go $\frac{6}{5}$ and $B \frac{3}{4}$ of $\frac{6}{50} = \frac{6}{525}$: rates are=320 : 243.
 - 9. A does $\frac{3}{5}$ work in 6 hrs.; $B \frac{3}{7} \times \frac{1}{5}$ in 2; $C, \frac{1}{7} \times \frac{1}{5}$ in $\frac{1}{5}$ hr. \therefore A does $\frac{1}{5}$ work \therefore $B \frac{1}{5}$ work \vdots and $C \frac{1}{5}$ work in one hour *i.e.* A, B and C do $\frac{1}{5} + \frac{1}{5} = \frac{29}{5}$ work in 1 hr. or """ work in $\frac{1}{5}$ hrs. = 214 hrs.
- 10. 20%=}. Cost \downarrow cost = 60°.,= \ddagger cost \therefore cost=75°. Selling price=cost \uparrow \ddagger cost= \ddagger cost= \ddagger × 75=90°.

In whatsoever thing thou hast thyself felt interest, in that or in noth-ing hope to inspire others with interest. —*Carlyle*.

Thought is the great art i thought can speed faster than the bird flice. The hand of the artisan may lose its cunning, but the discipline of thought is personal property upon which the grave shall have no mortgage.-Newman Smyth.