

3. The greater angle of every triangle has the greater side opposite to it.

4. The straight lines which join the extremities of two equal and parallel straight lines towards the same parts, are also themselves equal and parallel.

5. Equal triangles on the same base and on the same side of it are between the same parallels.

6. To describe a parallelogram equal to a given rectilinear figure, and having one of its angles equal to a given rectilinear angle.

7. The difference between any two sides of a triangle is less than the third side.

8. From a given point draw a line making equal angles with two given lines.

9. Straight lines bisecting two adjacent angles of a parallelogram intersect at right angles.

SOLUTIONS.

1. (b). Converse propositions. The 48th, however, a converse proposition, has a direct demonstration.

7. If a, b, c be the sides $c < a + b$; $\therefore c - a < b$, &c.

8. If the two given lines be parallel, through the given point draw a line perpendicular to them; if not, draw a line bisecting the angle between the two given lines, and through the given point draw a line at right angles to this.

9. Let $ABCD$ be the parallelogram, and let AE, BE bisect the angles at A and B . Then DAB, ABC being equal to two right angles, EAB, ABE are equal to one right angle, and therefore AEB is a right angle.

FIRST CLASS TEACHERS.

ARITHMETIC.

TIME—THREE HOURS.

Examiner—J. A. McLELLAN, LL.D.

1. Extract the square root of .000997199881 to six decimal places, and reduce to its simplest form

$$\sqrt[3]{(3.43) + \sqrt[3]{(.02744)}} \\ \sqrt[3]{(270) - \sqrt[3]{(.08)}}$$

2. A cistern holding 1299 gallons is filled by 3 taps, A, B, C , in 30 minutes; A conveys 10 gallons more than B every $2\frac{1}{2}$ minutes, and C 8 gallons less than B in the same time: how much does each supply per minute?

3. At the English Mint 1869 sovereigns are coined from 40 lbs. Troy of standard gold, which is 22 carats fine, and at the French Mint 155 twenty-franc pieces are coined from 2.2072 lbs. (avoirdupois) of gold 9J % fine. The value of the alloy being neglected, find the number of francs in a sovereign, correct to three places of decimals.

4. Two men form a partnership, A contributing \$5500, and B \$4500; it is agreed that each shall receive $7\frac{1}{2}$ % of the profits for managing the business, and that the remainder shall be divided according to the stocks and times of investment; at the end of 10 months B puts in \$2000 additional capital, but ceases to aid in the management, and agrees that A shall thenceforth receive 15 % of the profits for managing the business; at the end of 12 months from the time of starting, the profits are found to be \$4000: how much of this should each receive?

5. $\log 2 = .3010300$, $\log 3 = .4771213$, find $\log$ of .0000025.

In how many years will \$100 exceed \$1000 at 8 per cent. per annum compound interest?

6. A grocer sells coffee at a cash price which is $33\frac{1}{3}$ % above cost; he also sells on credit, giving 8 lbs. for what would buy 9 lbs. if paid in cash: how much per cent. above cost is his credit price?

7. Assuming 19 as the specific gravity of gold, and 2.6 as the s.g. of quartz, find the quantity of gold per oz. in a mixture whose s.g. is 7.

8. A dealer purchased on six months' credit, goods to the amount of \$520; after keeping them three months he sold them on credit for \$77.70, and allowing money to be worth 8 %, he found that he had made $16\frac{1}{3}$ % on the transaction; on what term of credit did he sell the goods?

9. A broker sold a farm for \$6000, charging a certain rate of commission, and invested the proceeds less his charges on both transactions in city property, receiving on the latter a commission of 4 % on the price paid; his entire commission was \$975: what rate did he charge on the sale of the farm?

10. (1) A field in the form of a sector of a circle has its radius 80 yards, and its angle $112^\circ 30'$: find its area and the length of its arc.

(2) The sides of a quadrilateral are 3, 4, 5, and 6, the first and last being parallel: find its area.

SOLUTIONS.

$$1. .031578 + \frac{7\sqrt[3]{.01} + 1.4\sqrt[3]{.01}}{3\sqrt[3]{10} - 2\sqrt[3]{10}} = \sqrt[3]{.001} = .01$$

2. A conveys 120 more than B in 30 minutes.

C " 96 less " " "

$\therefore$ all convey 3 times what B does + 24, = 1299;

$\therefore B$ conveys 425; A , 545; C , 329: or per minute $14\frac{1}{3}$, $18\frac{1}{3}$, $10\frac{2}{3}$.

3. One sov. contains $\frac{40 \times 5760}{1869} \times \frac{22}{24}$ grains pure gold.

One franc " $\frac{2.2072 \times 7000}{155 \times 20} \times \frac{90}{100}$ " "

$\therefore$ one sov. is equivalent to $\frac{40 \times 5760}{1869} \times \frac{22}{24} \times \frac{155 \times 20}{2.2072 \times 7000} \times$

$\frac{100}{90}$ francs = 25.192 +

4. There is 15 per cent. for management, i. e., \$600, and A 's share of this is \$350, and B 's \$250. A has \$5500 in for 12 months, —equivalent to 66000 for 1 month; B has in 4500 for 12 months and 2000 for two months, —equivalent to 58000 for 1 month. Dividing the 3400 left after deducting 600 for management, in the ratio of 66 : 58, we see that A will receive \$1809.67 $\frac{2}{3}$, and B , \$1590.32 $\frac{1}{3}$. Hence A 's share = $1809.67\frac{2}{3} + 350 = \$2159.67\frac{2}{3}$, and B 's share = $1590.32\frac{1}{3} + 250 = \$1840.32\frac{1}{3}$.

$$5. .0000025 = \frac{25}{10^7} = \frac{1}{2 \cdot 10^5}; \therefore \log .0000025 = \log \frac{1}{2 \cdot 10^5} =$$

$$-2 \log 2 - 5 = -.60206 - 5 = \bar{6}.39794.$$

If n be the number of years, $100(1.08)^n > 1000$, or $n(2 \log 2 +$

$$3 \log 3 - 2) > 1; n > \frac{1}{.0394239} > 29. +; \therefore n = 30.$$

6. If 100 be cost price, $133\frac{1}{3}$ is cash price; also credit price = $\frac{2}{3}$ of cash price; $\therefore$ credit price = $\frac{2}{3}$ of $133\frac{1}{3} = 150$, i. e., 50 per cent. above cash price.

7. Conceive the ounce divided into so many parts (bulk) of gold and so many quartz, and let unity be the weight of a quantity of water equal in bulk to one of the parts. Then $19 \times$ number of parts gold + $2.6 \times$ number of parts quartz = $7 \times$ number of parts gold + $7 \times$ number of parts quartz; or ratio of gold to quartz = $\frac{1}{15}$, or $\frac{1}{15} \frac{2}{3}$ oz.

8. Present worth of 520 for 3 months = $\frac{100}{102} \times 520$, and this with

$16\frac{1}{2}$ per cent. added = $\frac{467}{400} \times \frac{100}{102} \times 520$. And the question is in what time will this amount to 677.70 at 8 per cent.

$$677.70 - \frac{133}{100} \times \frac{133}{100} \times 520 \\ \frac{133}{100} \times \frac{133}{100} \times 520 \times \frac{1}{100} = \text{Ans. in years.}$$

9. For simplicity suppose 100 the price of the farm; then the entire commission is $\frac{1}{10}$. The broker first receives the unknown percentage. 4 % on the price paid is 4 out of every 104 entrusted.