

8. In any triangle establish the following relations:

$$(1) \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}.$$

$$(2) \cos A = \frac{b^2 + c^2 - a^2}{2bc}.$$

$$(3) \text{Area} = \sqrt{s(s-a)(s-b)(s-c)}.$$

9. Having given two sides and the included angle of a triangle, obtain formulæ from which to find the other two angles and the third side.

10. Discuss the ambiguous case in the solution of triangles.

11. Find the sine and cosine of 45° and 30° , and deduce those of 75° and 15° .

ARITHMETICAL PROBLEMS.

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1. When 8 eggs cost 7 cents, how much should a man ask for 20 dozen so that he may gain $\frac{1}{4}$ of cost? *Ans.* \$2.52.

2. Cigars which cost \$60 a thousand are sold at the rate of three for 25 cents, what is the dealer's profit on \$100 thus expended? *Ans.* \$38.88.

3. A dealer pays \$60 for 1,000 cigars and sells part of them at 10 cents apiece, and part at the rate of three for 25 cents, realizing altogether \$90; how many did he sell at the first rate? *Ans.* 400.

4. If it costs \$3 to frame a picture 2 ft. by 3, how much will it cost to frame one 3 ft. by 4, with moulding costing $\frac{1}{4}$ times as much as in the first case? *Ans.* \$6.30.

5. On a collection plate were a number of 25 cent pieces, four times as many 10 cent pieces, and twelve times as many 5 cent pieces; had each coin been a 25 cent piece the collection would have been greater than it was by \$36; what was the value of the collection? *Ans.* \$15.

6. A person standing on a wharf sees two guns fired on board a vessel sailing directly towards him; the time between the first flash and the report is 18 seconds, and between the second flash and the report is 14 seconds; the interval between the flashes is 15 minutes.

Find the rate at which the vessel is sailing, given that sound travels 1,120 feet per second. *Ans.* $3\frac{1}{2}$ miles an hour.

7. The rate of interest on certain debentures is 4 per cent. half-yearly; how much should a man pay for these so that he may make 8 per cent. per annum, simple interest, on his money; the purchase taking place 2 years before the debentures are payable, and the interest on them remaining unpaid during that time? *Ans.* $(\frac{1}{18})^2 \times \frac{1}{18}$.

8. A grocer has tea which cost him 60 cents per lb., and some which cost him 90 cents per lb.; how must he mix them so that by selling the mixture at 84 cents per lb., he will be making 20 per cent. on cost?

Ans. 1 at 90; 2 at 60.

9. On January 1st, '81, a person invested \$8,000 in 6 per cent. stocks at 95; on July 1st he received a year's dividend on the stock he held; on September 1st he sold out at 97, and immediately invested \$5,000 in 7 per cent. stock at 110, and the rest of the proceeds in 5 per cents at 75; on July 1st, '83, he got a year's dividend on the 7 per cents, and sold out of both stocks—the 7 per cents at 108, and the 5 per cents at 80; how much did he make by his deal, calling money worth 8 per cent. per annum, simple interest.

Ans. \$192.60.

10. A man spends \$8,000 buying stocks on a 10 per cent. margin at 90 (*i.e.*, he paid 10 per cent. of the quoted price); he had to deposit a further sum of 5 per cent. of the quoted price of the stocks he had bought, with his broker as security. At the end of one month he sold out at 95, for cash, and paid up what was still due on his purchase, together with interest on unpaid part at 5 per cent. per annum. Calling money worth 8 per cent. per annum, how much did he clear on the transaction?

Solution: stocks secured, \$88,888.89; money laid out, \$12,000; price received for stocks, \$84,444.44; amount due, with interest, \$72,300; \$12,000 for one month amounts to \$12,080. Whole expenditure therefore is \$80,380. Whole receipts, \$84,444.44. — Gain, \$4,064.44.

11. Large shipments of bullion from Lon-