

4. A tax bill for \$291.60 may be paid in three instalments—\$111.60 on June 25th; \$90 on August 4th; and \$90 on October 4th. If all be paid on June 25th a reduction is allowed of $\frac{1}{100}$ of the instalments that might have been deferred. What rate per cent. per annum is this allowing for money?

If r be the rate per cent., $\frac{2}{100}$ of \$180

$$= \$\frac{18}{5},$$

$$\therefore \frac{40}{365} \times 90 \times \frac{r}{100} + \frac{101}{365} \times 90 \times \frac{r}{100} = \frac{18}{5},$$

$$r = 10.3 + \dots$$

5. A bankrupt's apparent assets are 80 per cent. of his liabilities; but on \$20,000 of these assets he recovers only 80 cents on the dollar, and 4 per cent. of the amount the estate actually realizes is consumed in the process of winding it up. He pays 60 cents on the dollar; what were his liabilities;

He should pay 80c. on the dollar, or $\frac{4}{5}$ of his liabilities, but on \$20,000 of his assets he loses $\frac{1}{5}$ or \$4000, and $\frac{1}{10}$ of his recovered assets go for expenses connected with winding up, after which he pays $\frac{3}{4}$ of his liabilities, $\therefore \frac{4}{5} - \frac{1}{10} = (\frac{1}{5} - \$4000)\frac{3}{4}$, whence unity, *i.e.* his liabilities = $\$ \frac{480000}{71}$.

6. *A* gives *B* \$210 on May 11th, and in return takes his note at 5 months, agreeing not to exact interest. On June 11th, *A* sells the note to *C* for \$205, and *B* makes good to *A* the \$5 so lost. When the note falls due, *C* exacts interest at 7 per cent. per annum. Find the rate per cent. per annum gained, lost or paid by the several parties to this transaction.

A, according to his agreement, neither loses nor gains. *B* pays altogether \$221.12 $\frac{1}{2}$ for the \$210 received May 11th, which is at the rate of 12 $\frac{1}{2}$ per cent. per annum, that is, not reckoning interest on the \$5 given by *B* to *A*; if interest be reckoned rate will be higher. *C* makes 7 per cent. per annum on his money.

7. A municipality whose property is assessed at \$1,000,000 borrows \$40,000; find an

expression for the tax (rate in the dollar) that must be levied to form a sinking fund that will repay this in 10 years, money being worth 6 per cent. per annum, the taxes being levied yearly and money compounded half-yearly.

$$\text{Ann. payment} = \text{amt. of debt} \times \frac{R^2 - 1}{1 - R^{-2n}},$$

$\therefore$ rate on the dollar

$$= \frac{40000}{1000000} \times \frac{(1.06)^2 - 1}{1 - (1.06)^{-20}}.$$

8. The sides of a triangle are 4, 5, 6; find its area.

$$\text{Area} = \sqrt{s \cdot s - a \cdot s - b \cdot s - c}, \text{ where } 2s = 15.$$

$$= \frac{1}{2} \sqrt{7}.$$

9. Eight equal spherical iron balls, radius 1 foot, are just enclosed in a cubical box, and the box is then filled up with water. Compare the weights of iron and water in the box, the specific gravity of iron being 7.79.

Give the expression for the surface of a sphere in terms of its radius.

Weight of iron = $\{8(\frac{4}{3}\pi)7.79\}$ times an equal weight of water.

Space unoccupied = $\{64 - 8(\frac{4}{3}\pi)\}$ cub. ft.

$$\therefore \text{weight of iron : weight of water} \\ = \frac{8^{\frac{2}{3}} \cdot \pi \cdot 7.79 : 64 - 8^{\frac{2}{3}} \pi}{= 8.569 : 1 (\pi = \frac{22}{7})}.$$

$$\text{Surface} = 4\pi r^2.$$

10. Shew how to determine the surface of a right circular cone.

The height of a frustrum of such a cone is 3 feet, radius of base 2 feet, and semi-vertical angle 30°; find its surface. If this surface were made of paper, and being cut from the cone were spread on a flat surface, find the dimensions of the curve formed by what was the bottom edge of the cone.

Bookwork.

Surface = $\frac{4}{3}(4\sqrt{3} - 3)$ feet. Curve is arc of a circle in length $\frac{4}{3}\pi$ feet.

ALGEBRA.

I. If $x^2 + y^2 + z^2 + 2xyz = 1$, then

$$x\{ (1 - x^2)(1 - y^2) \}^{\frac{1}{2}} + x\{ (1 - y^2)(1 - z^2) \}^{\frac{1}{2}} \\ + y\{ (1 - x^2)(1 - z^2) \}^{\frac{1}{2}} = 1 + xyz.$$