

SHREWSBURY SCHOOL.

ARITHMETIC PRIZE.

March, 1935.

1. The value of π is given by the formula $\pi = 16A - 4B$,
where $A = \left(\frac{1}{5}\right) - \frac{1}{3}\left(\frac{1}{5}\right)^3 + \frac{1}{5}\left(\frac{1}{5}\right)^5 - \frac{1}{7}\left(\frac{1}{5}\right)^7 + \frac{1}{9}\left(\frac{1}{5}\right)^9 - \dots$ etc.

$$B = \left(\frac{1}{239}\right) - \frac{1}{3}\left(\frac{1}{239}\right)^3 + \frac{1}{5}\left(\frac{1}{239}\right)^5 - \frac{1}{7}\left(\frac{1}{239}\right)^7 + \frac{1}{9}\left(\frac{1}{239}\right)^9 - \dots$$

Use this result to calculate π correct to 5 places of decimals.

2. A solid ingot of metal in the form of a right circular cone of height 3 feet, and diameter of base 2 feet 9 inches, is melted down and recast into 5 similar spheres. Find the diameter of each sphere.

3. The length and breadth of a rectangular water tank are 10 feet and 8 feet 6 inches respectively, and water stands in the tank to a depth of 3 feet. A heavy right regular prism of hexagonal base of 1 foot side, and height 5 feet, is lowered into the tank so that the hexagonal base is on the bottom. Find the height thro' which the water level rises.

4. The result of a certain calculation is given as 20.1, correct to 3 significant figures. Between what limits must the true result lie?

The length and breadth of a rectangular field are known to be 17 chains and 10 chains respectively, but in measuring up from a scale plan of the field, a surveyor is liable to an error of 0.5% in his calculation of the dimensions. Between what limits (in acres) will his estimate of the area of the field lie? What is the maximum possible error per cent?

5. If the manufacturer makes a profit of 10%, the wholesale dealer one of 15%, and the shopkeeper one of 20%, what was the cost to the manufacturer of an article bought at a shop for £6 6s. 6d.?

6. A person has a quantity of 3% stock which yields £240 a year. He sells out $\frac{1}{4}$ of the stock at 87 $\frac{1}{4}$, and invests the proceeds in stock at 174 $\frac{1}{2}$. What dividend ought the latter to pay in order that he may thereby increase his income by £40?

7. A sum of money was lent at Compound Interest. The interest for the first year was £7 14s. 6.50d., and the interest for the third year was £8 9s. 6.84d. Find the sum and the rate per cent.

8. The density of the moon is to that of the earth as 4891 to 4000, and the diameter of the moon is to that of the earth as 100 to 365. Find, to 3 decimal places, the mass of the earth in terms of that of the moon.

9. Two men are walking at 4 miles per hour in opposite directions. A train takes 15 seconds to pass one man and 12 seconds to pass the other. Find the length of the train in feet and its speed in miles per hour.