Trigonometry

1. A man observes a car from the top of a tower, which is moving towards the tower with a uniform speed. If the angle of depression of the car changes from 30° to 45° in 12 minutes, find the time taken by the car now to reach the tower.

TRIANGLES

1. Construct a triangle ABC with side $BC = 7\,\text{cm}$, $\angle B = 45^\circ$, and $\angle A = 105^\circ$. Then construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of the $\triangle ABC$.

LINEAR

1. A train covers a distance of 300 km at a uniform speed. If the speed of the train is increased by 5 km/hour, it takes 2 hours less in the journey. Find the original speed of the train.

ARITHMETIC PROGRESSIONS

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1. If the 10^{th} term of an arithmetic progression (A.P.) is 52 and the 17^{th} term is 20 more than the 13^{th} term, find the A.P.
2. If the ratio of the sum of the first n terms of two A.P.s is $\frac{7n+1}{4n+27}$, then find the ratio of their 9^{th} terms.

COORDINATE GEOMETRY

If the points $A(k+1, 2k)$, $B(3k, 2k+3)$, and $C(5k-1, 5k)$ are collinear, then find the value of k.

QUADRATIC EQUATION

If the roots of the equation $(c^2 - ab)x^2 - 2(a^2 - bc)x + b^2 - ac = 0$ in x are equal, then show that either $a = 0$ or $a^3 + b^3 + c^3 = 3abc$.

RATIONAL FRACTIONS

1. Solve for x:
$$\frac{1}{2x-3}+\frac{1}{x-5}=1\frac{1}{9}, \quad x\neq\frac{3}{2},5$$

PROBABILITY

1. A bag contains 15 white balls and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of black balls in the bag.

2. Two different dice are thrown together. Find the probability that the numbers obtained have:

   i. an even sum, and

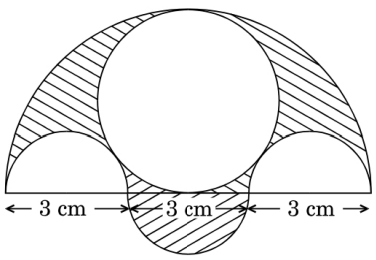
   ii. an even product.

SURFACE AREAS AND VOLUMES

1. From a solid right circular cylinder of height 2.4 cm and radius 0.7 cm, a right circular cone of the same height and same radius is cut out. Find the total surface area of the remaining solid.

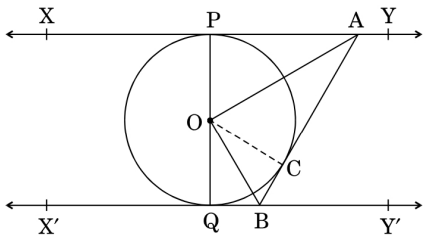
2. In a rain-water harvesting system, the rain-water from a roof of 22 m × 20 m drains into a cylindrical tank having a diameter of base 2 m and height 43.5 m. If the tank is full, find the rainfall in cm. Write your views on water conservation.

3. Three semicircles each of diameter 3 cm, a circle of diameter 4.5 cm, and a semicircle of radius 4.5 cm are drawn in the given figure. Find the area of the shaded region.



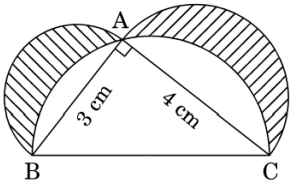
CIRCLES

1. In the given figure, XY and $X'Y'$ are two parallel tangents to a circle with center O and another tangent AB with point of contact C, intersecting XY at A and $X'Y'$ at B. Prove that $\angle AOB = 90°$.



MENSURATION

1. In the given figure, $\triangle ABC$ is a right-angled triangle in which $\angle A = 90°$. Semicircles are drawn on AB, AC, and BC as diameters. Find the area of the shaded region.



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