Study Material Based on the

Latest **CBSE** Syllabus and **NCERT** Textbooks

Together with®

OBJECTIVE TYPE QUESTIONS

(MATHEMATICS)

Author

Lalit Gupta

BE Mechanical

Delhi College of Engineering

CLASS **10** TERM 2

RACHNA SAGAR

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4 QUADRATIC EQUATIONS

Multiple Choice Questions

1. If $(1 - p)$ is a root of the equation $x^2 + px + 1 - p = 0$, then roots are

(a) 0, 1 (b) $-1, 1$ (c) $0, -1$ (d) $-1, 2$

Sol. (c) $(1 - p)$ is a root

$\therefore \quad (1-p)^2 + p(1-p) + 1 - p = 0$

$\Rightarrow \quad (1-p)[1 - p + p + 1] = 0$

$\Rightarrow \quad (1-p)(2) = 0 \Rightarrow p = 1$

$x^2 + x = 0$

One root = 0 and another root = – 1

$\therefore$ roots are 0 and –1.

2. If p, q and r are rational numbers and $p \neq q \neq r$, then roots of the equation $(p^2 - q^2)x^2 - (q^2 - r^2)x + (r^2 - p^2) = 0$ are

(a) $\frac{p}{q}, \frac{r}{p}$ (b) $\frac{p^2}{q^2}, \frac{r^2}{q^2}$ (c) $1, \frac{p^2 - q^2}{r^2 - p^2}$ (d) $-1, \frac{p^2 - r^2}{p^2 - q^2}$

Sol. (d) Putting $x = -1$, we have

$(p^2 - q^2)(-1)^2 - (q^2 - r^2)(-1) + (r^2 - p^2)$

$\Rightarrow \quad p^2 - q^2 + q^2 - r^2 + r^2 - p^2 = 0$

$\therefore$ $x = -1$ is one root. Only option (d) has one root – 1.

3. If α, β are roots of the equation $x^2 + 5x + 5 = 0$, then equation whose roots are $\alpha + 1$ and $\beta + 1$ is

(a) $x^2 + 5x - 5 = 0$ (b) $x^2 + 3x + 5 = 0$ (c) $x^2 + 3x + 1 = 0$ (d) none of these

Sol. (c) $\alpha + \beta = -5$, $\alpha\beta = 5$.

Required equation is

$x^2 - (\alpha + 1 + \beta + 1)x + (\alpha + 1)(\beta + 1) = 0$

$\Rightarrow x^2 - (\alpha + \beta + 2)x + (\alpha\beta + \alpha + \beta + 1) = 0$

$\Rightarrow x^2 - (-5 + 2)x + (5 - 5 + 1) = 0$

$\Rightarrow x^2 + 3x + 1 = 0$

4 Objective Type Questions—10

4. Which of the following equations has two distinct real roots? **[NCERT Exemplar Problem]**

(*a*) $2x^2 - 3\sqrt{2}x + \frac{9}{4} = 0$ (*b*) $x^2 + x - 5 = 0$

(*c*) $x^2 + 3x + 2\sqrt{2} = 0$ (*d*) $5x^2 - 3x + 1 = 0$

Ans. (*b*) The equation which satisfies the condition D > 0 is having two distinct roots.

5. Which of the following equations has no real roots ? **[NCERT Exemplar Problem]**

(*a*) $x^2 - 4x + 3\sqrt{2} = 0$ (*b*) $x^2 + 4x - 3\sqrt{2} = 0$

(*c*) $x^2 - 4x - 3\sqrt{2} = 0$ (*d*) $3x^2 + 4\sqrt{3}x + 4 = 0$

Ans. (*a*) The equation which satisfies the condition D < 0 has no real roots

6. $(x^2 + 1)^2 - x^2 = 0$ has **[NCERT Exemplar Problem]**

(*a*) four real roots (*b*) two real roots (*c*) no real roots (*d*) one real root

Ans. (*c*) no real roots

7. If the difference of the roots of the equation $x^2 - bx + c = 0$ be 1, then

(*a*) $b^2 - 4c + 1 = 0$ (*b*) $b^2 + 4c = 0$

(*c*) $b^2 - 4c - 1 = 0$ (*d*) $b^2 - 4c = 0$

Sol. (*c*) Let roots are α and β

$$\Rightarrow \quad \alpha - \beta = 1$$

$$\because \quad (\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$$

$$\Rightarrow \quad 1 = b^2 - 4c \Rightarrow b^2 - 4c - 1 = 0$$

8. If the roots of $ax^2 + bx + c = 0$ are equal in magnitude but opposite in sign, then

(*a*) $a = 0$ (*b*) $b = 0$ (*c*) $c = 0$ (*d*) none of these

Sol. (*b*) $\because$ sum of roots = 0

$$\Rightarrow -\frac{b}{a} = 0 \Rightarrow b = 0$$

9. If $\alpha + \beta = 4$ and $\alpha^3 + \beta^3 = 44$, then α, β are the roots of the equation

(*a*) $2x^2 - 7x - 7 = 0$ (*b*) $3x^2 + 8x + 12 = 0$

(*c*) $3x^2 - 12x + 5 = 0$ (*d*) none of these

Sol. (*c*)

$$\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$$

$$\Rightarrow \quad 44 = (4)^3 - 3\alpha\beta \times 4$$

$$\Rightarrow \quad 44 - 64 = -12\,\alpha\beta$$

$$\Rightarrow \quad \alpha\beta = \frac{20}{12} = \frac{5}{3}$$

$\therefore$ quadratic equation is

$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

$$\Rightarrow \quad x^2 - 4x + \frac{5}{3} = 0$$

$$\Rightarrow \quad 3x^2 - 12x + 5 = 0$$

10. If the roots of equation $3x^2 + 2x + (p + 2)(p - 1) = 0$ are of opposite sign then which of the following cannot be the value of p?

(*a*) 0 (*b*) -1 (*c*) $\frac{1}{2}$ (*d*) -3

Sol. (*d*) $\because$ roots are of opposite sign

$\therefore$ product of the roots is negative

$\Rightarrow (p + 2)(p - 1)$ should be negative.

Clearly when $p = -3$, $(p + 2)(p - 1)$ is not negative.

11. The value of k for which the equation $x^2 + 2(k + 1)x + k^2 = 0$ has equal roots is **[KVS]**

(*a*) -1 (*b*) $-\frac{1}{2}$ (*c*) 1 (*d*) none of these

Sol. (*b*) For equal roots, D = 0

$\Rightarrow [2(k + 1)]^2 - 4 \times k^2 = 0$

$\Rightarrow 4(k + 1)^2 - 4k^2 = 0$

$\Rightarrow 4(k^2 + 2k + 1) - 4k^2 = 0$

$\Rightarrow 8k + 4 = 0 \Rightarrow k = \frac{-1}{2}$.

12. If the equation $x^2 - (2 + m)x + (-m^2 - 4m - 4) = 0$ has coincident roots, then

(*a*) $m = 0, m = 1$ (*b*) $m = 2, m = 2$ (*c*) $m = -2, m = -2$ (*d*) $m = 6, m = 1$

Sol. (*c*) For coincident roots, D = 0

$\Rightarrow [-(2 + m)]^2 - 4 \times 1 \times (-m^2 - 4m - 4) = 0$

$\Rightarrow (2 + m)^2 + 4(m^2 + 4m + 4) = 0$

$\Rightarrow (2 + m)^2 + 4(m + 2)^2 = 0$

$\Rightarrow 5(2 + m)^2 = 0$

$\Rightarrow (2 + m)^2 = 0 \Rightarrow m = -2.$

13. Which of the following is a solution of the equation $x^2 - 6x + 5 = 0$?

(*a*) 2 (*b*) 5 (*c*) 9 (*d*) 15

Sol. (*b*) Substituting $x = 5$, we have

$(5)^2 - 6(5) + 5 = 25 - 30 + 5 = 0$

$\therefore$ $x = 5$ is a solution of the given equation.

14. The roots of the quadratic equation $x^2 + 5x - (\alpha + 1)(\alpha + 6) = 0$, where α is a constant, are

(*a*) $\alpha + 1, \alpha + 6$ (*b*) $(\alpha + 1), -(\alpha + 6)$

(*c*) $-(\alpha + 1), (\alpha + 6)$ (*d*) $-(\alpha + 1), -(\alpha + 6)$

Sol. (*b*) $x^2 + 5x - (\alpha + 1)(\alpha + 6) = 0$

$\Rightarrow x^2 + (\alpha + 6)x - (\alpha + 1)x - (\alpha + 1)(\alpha + 6) = 0$

$\Rightarrow x[x + (\alpha + 6)] - (\alpha + 1)[x + (\alpha + 6)] = 0$

$\Rightarrow [x + (\alpha + 6)][x - (\alpha + 1)] = 0$

$\Rightarrow x = -(\alpha + 6), x = (\alpha + 1)$

$\therefore$ Correct option (*b*)

15. If a non zero root of the equations $x^2 + 2x + 3\lambda = 0$ and $2x^2 + 3x + 5\lambda = 0$ is common, the value of λ will be

(*a*) 2 (*b*) 1 (*c*) –1 (*d*) 0

Sol. (*c*) Let common root is α

$\Rightarrow \quad \alpha^2 + 2\alpha + 3\lambda = 0 \quad \ldots (i)$

and $\quad 2\alpha^2 + 3\alpha + 5\lambda = 0 \quad \ldots (ii)$

Solving (*i*) and (*ii*), we get

$$\alpha = -\lambda.$$

Equation (*i*) becomes

$$\lambda^2 - 2\lambda + 3\lambda = 0 \Rightarrow \lambda(\lambda + 1) = 0$$

$\Rightarrow \quad \lambda = 0 \quad$ or $\quad \lambda = -1$

$\because$ Common root is non-zero.

$\therefore \quad \lambda = -1.$

16. Let α, β be the roots of the equation $(x - a)(x - b) + c = 0, c \neq 0$.

The roots of the equation $(x - \alpha)(x - \beta) - c = 0$ are

(*a*) *a*, *c* (*b*) *b*, *c* (*c*) *a*, *b* (*d*) $a + c, b + c$

Sol. (*c*) $\because \alpha, \beta$ are roots of $(x - a)(x - b) + c = 0$

$\Rightarrow \quad (x - a)(x - b) + c = (x - \alpha)(x - \beta)$

$\Rightarrow \quad (x - a)(x - b) = (x - \alpha)(x - \beta) - c$

$\Rightarrow (x - a)(x - b)$ are the factors of $(x - \alpha)(x - \beta) - c$

$\therefore$ roots are *a* and *b*.

17. If α, β are the roots of the equation $x^2 - p(x + 1) - c = 0$, then $(\alpha + 1)(\beta + 1) =$

(*a*) *c* (*b*) $c - 1$ (*c*) $1 - c$ (*d*) $1 + c$

Sol. (*c*) $x^2 - p(x + 1) - c = 0$

$\Rightarrow \quad x^2 - px - p - c = 0$

$\therefore \quad \alpha + \beta = p$ and $\alpha\beta = -p - c$

Now $\quad (\alpha + 1)(\beta + 1) = \alpha\beta + \alpha + \beta + 1$

$$= -p - c + p + 1 = 1 - c.$$

18. If $x^2 + px + q = 0$ is the quadratic equation whose roots are $a - 2$ and $b - 2$, where *a*, *b* are the roots of $x^2 - 3x + 1 = 0$, then

(*a*) $p = 1, q = 2$ (*b*) $p = 2, q = 1$ (*c*) $p = -1, q = 1$ (*d*) $p = 1, q = -1$

Sol. (*d*) $x^2 - 3x + 1 = 0$

a and *b* are roots $\therefore a + b = 3$ and $ab = 1$

Now $a - 2, b - 2$ are roots of $x^2 + px + q$

$\Rightarrow a - 2 + b - 2 = -p \Rightarrow 3 - 4 = -p \Rightarrow p = 1$

and $(a-2)(b-2) = q$

$\Rightarrow$ $ab - 2a - 2b + 4 = q$

$\Rightarrow$ $1 - 2(a+b) + 4 = q$

$\Rightarrow$ $1 - 2(3) + 4 = q \Rightarrow q = -1$.

19. The quadratic equation whose roots are twice the roots of $2x^2 - 5x + 2 = 0$ is

(*a*) $8x^2 - 10x + 2 = 0$ (*b*) $x^2 - 4x + 4 = 0$

(*c*) $x^2 - 5x + 4 = 0$ (*d*) $2x^2 - 5x + 2 = 0$

Sol. (*c*) Let roots of the equation

$2x^2 - 5x + 2 = 0$ are α and β

$\therefore$ $\alpha + \beta = \frac{5}{2}$ and $\alpha\beta = \frac{2}{2} = 1$

Equation whose roots are 2α and 2β is

$x^2 - (2\alpha + 2\beta)x + 2\alpha.2\beta = 0$

$\Rightarrow$ $x^2 - 2(\alpha + \beta)x + 4\,\alpha\beta = 0$

$\Rightarrow$ $x^2 - 2 \times \frac{5}{2}x + 4 \times 1 = 0$

$\Rightarrow$ $x^2 - 5x + 4 = 0$

20. If $(1 - b)$ is a root of quadratic equation $x^2 + bx + 1 - b = 0$, then its roots are

(*a*) 0, 1 (*b*) 0, –1 (*c*) –1, 1 (*d*) 0, 2

Ans. (*b*)

21. The roots of the equation $x^2 + x - p(p+1) = 0$, where p is a constant, are

(*a*) $p, p+1$ (*b*) $-p, p+1$ (*c*) $p, -(p+1)$ (*d*) $-p, -(p+1)$

Ans. (*c*)

22. If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 + bx + c = 0$, then

(*a*) $(a-c)^2 = b^2 - c^2$ (*b*) $(a-c)^2 = b^2 + c^2$

(*c*) $(a+c)^2 = b^2 - c^2$ (*d*) $(a+c)^2 = b^2 + c^2$

Ans. (*d*)

23. In a quadratic equation with leading coefficient 1, Aseem reads the coefficient 16 of x wrongly as 19 and obtains the roots as –15 and – 4. The correct roots are

(*a*) 6, 10 (*b*) – 6, – 10 (*c*) 8, 8 (*d*) – 8, – 8

Ans. (*b*)

24. The number of real roots of the equation $(x-1)^2 + (x-2)^2 + (x-3)^2 = 0$ is

(*a*) 2 (*b*) 1 (*c*) 0 (*d*) 3

Ans. (*c*)

25. If the equation $x^2 - (2+m)x + (m^2 - 4m + 4) = 0$ has coincident roots, then

(*a*) $m = 0$ (*b*) $m = 0, 2$ (*c*) $m = 6, 2$ (*d*) none of these

Ans. (*d*)

26. Suppose the breadth of the hall is x m. Then, its length should be $(2x + 1)$m and area of the hall is 300 m^2. Choose the correct representation of quadratic equation.

(a) $2x^2 - x - 300 = 0$ (b) $2x^2 + x + 300 = 0$

(c) $2x^2 + x - 300 = 0$ (d) none of these

Ans. (c)

27. What is the degree of polynomial $p(x) = ax^2 + bx + c$?

(a) 1 (b) 2 (c) 3 (d) 0

Ans. (b)

28. Choose the correct quadratic equation from the following.

(a) $x^2 - 6x + 85 = 0$ (b) $x + 12 = 0$ (c) $\frac{x}{2} = 0$ (d) $\sqrt{x} + 2 = 0$

Ans. (a)

29. Choose the correct roots of the equation $2x^2 - 5x + 3 = 0$

(a) $\frac{2}{3}$, 1 (b) 1, $\frac{5}{6}$ (c) 1, $\frac{3}{2}$ (d) 1, $\frac{6}{5}$

Ans. (c) 1, $\frac{3}{2}$

30. If one of the roots of quadratic equation $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$ is $-\sqrt{2}$, then other root is

(a) $\frac{5}{\sqrt{2}}$ (b) $\frac{-\sqrt{2}}{5}$ (c) $\frac{\sqrt{3}}{5}$ (d) $\frac{-5}{\sqrt{2}}$

Ans. (d)

31. The altitude of a right triangle is 7 cm less than its base, If the hypotenuse is 13 cm, Choose the correct value of base and height respectively.

(a) 5 cm, 12 cm (b) 6 cm, 10 cm (c) 12 cm, 5 cm (d) 10 cm, 6 cm

Ans. (c)

32. Which of the following is not a quadratic equation?

(a) $2(x - 1)^2 = 4x^2 - 2x + 1$ (b) $3x - x^2 = x^2 + 6$

(c) $\left(\sqrt{3}x + \sqrt{2}\right)^2 = 2x^2 - 5x$ (d) $(x^2 + 2x)^2 = x^4 + 3 + 4x^2$ **[DoE]**

Ans. (d)

33. Which of the following equation has 2 as a root?

(a) $x^2 + 4 = 0$ (b) $x^2 - 4 = 0$

(c) $x^2 + 3x - 12 = 0$ (d) $3x^2 - 6x - 2 = 0$ **[DoE]**

Ans. (b)

34. Roots of quadratic equation $x^2 - 9x = 0$ will be

(a) 9 (b) 0, 9 (c) 0, – 9 (d) 0, 6

Ans. (b)

35. If $\frac{1}{2}$ is a root of $x^2 + px - \frac{5}{4} = 0$ then value of p is

(a) 2 (b) -9 (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

Ans. (a)

Assertion-Reason Questions

Directions: **In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:**

(a) Assertion (A) and Reason (R) are true but R is the correct explanation of Assertion (A)

(b) Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false

(d) Assertion (A) is false but Reason (R) is true.

36. **Assertion (A):** $(x^2 + 3)^2 - x^2$ has equal roots.

Reason (R): If $D = b^2 - 4ac < 0$, then it has equal roots

Ans. (c)

37. **Assertion (A):** Discriminant of the quadratic equation $3x^2 + 4x - 5 = 0$ is 76.

Reason (R): $D = b^2 + 4ac$

Ans. (c)

38. **Assertion (A):** $(x^2 + 2x)^2 = x^4 + 3 + 4x^2$ is not a quadratic equation.

Reason (R): $4x^3 - 3$ is not the type of quadratic equation.

Ans. (a)

Case-based Questions

39. Raj and Ajay are very close friends. Both the families decide to go to Ranikhet by their own cars. Raj's car travels at a speed of x km/h while Ajay's car travels 5 km/h faster than Raj's car. Raj took 4 hours more than Ajay to complete he journey of 400 km.

[CBSE Question Bank]

10 Objective Type Questions—10

(*i*) What will be the distance covered by Ajay's car in two hours?

(*a*) $2(x + 5)$ km (*b*) $(x - 5)$ km

(*c*) $2(x + 10)$ km (*d*) (2x + 5)km

(*ii*) Which of the following quadratic equation describe the speed of Raj's car?

(*a*) $x^2 - 5x - 500 = 0$ (*b*) $x^2 + 4x - 400 = 0$

(*c*) $x^2 + 5x - 500 = 0$ (*d*) $x^2 - 4x + 400 = 0$

(*iii*) What is the speed of Raj's car?

(*a*) 20 km/hour (*b*) 15 km/hour

(*c*) 25 km/hour (*d*) 10 km/hour

(*iv*) How much time took Ajay to travel 400 km?

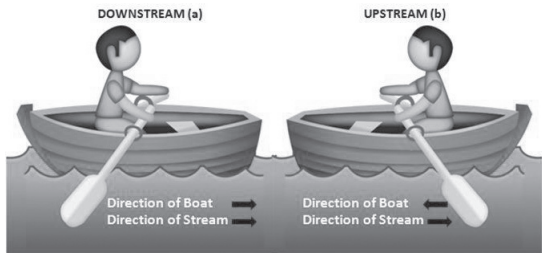
(*a*) 20 hours (*b*) 40 hours

(*c*) 25 hours (*d*) 16 hours

Ans. (*i*) (*a*) $2(x + 5)$ km (*ii*) (*c*) $x^2 + 5x - 500 = 0$

(*iii*) (*a*) 20 km/hour (*iv*) (*d*) 16 hour

40. The speed of a motor boat is 20 km/hr. For covering the distance of 15 km the boat took 1 hour more for upstream than downstream. **[CBSE Question Bank]**



(*i*) Let speed of the stream be x km/hr. then speed of the motorboat in upstream will be

(*a*) 20 km/hr (*b*) $(20 + x)$ km/hr

(*c*) $(20–x)$ km/hr (*d*) 2 km/hr

(*ii*) What is the relation between speed, distance and time?

(*a*) speed = (distance)/time (*b*) distance = (speed)/time

(*c*) time = speed × distance (*d*) speed = distance × time

(*iii*) Which is the correct quadratic equation for the speed of the current ?

(*a*) $x^2 + 30x - 200 = 0$ (*b*) $x^2 + 20x - 400 = 0$

(*c*) $x^2 + 30x - 400 = 0$ (*d*) $x^2 - 20x - 400 = 0$

(*iv*) What is the speed of current ?

(*a*) 20 km/hour (*b*) 10 km/hour

(*c*) 15 km/hour (*d*) 25 km/hour

(*v*) How much time boat took in downstream?

(*a*) 90 minutes (*b*) 15 minutes

(*c*) 30 minutes (*d*) 45 minutes

Ans. (*i*) (*c*), (*ii*) (*b*), (*iii*) (*c*), (*iv*) (*b*), (*v*) (*d*)

41. If $p(x)$ is a quadratic polynomial then $p(x) = 0$ is a quadratic equation. Hence $p(x) = ax^2 + bx + c = 0$ is known as quadratic equation. The roots of the quadratic equation $ax^2 + bx + c = 0$ and zeroes of the quadratic polynomial $ax^2 + bx + c$ are same. The roots of the quadratic equation are obtained by solving the quadratic by factorisation and by using quadratic formula or discriminant method. The roots of quadratic equation may be equal or unequal or not real

Answer the questions based on above

(*i*) The roots of the quadratic equation $\sqrt{3}x^2 + 8x + 5\sqrt{3} = 0$ by factorisation are

(*a*) $-\sqrt{3}, -5\sqrt{3}$ (*b*) $-\sqrt{3}, \frac{-5}{\sqrt{3}}$

(*c*) $\sqrt{3}, \frac{5}{\sqrt{3}}$ (*d*) $\sqrt{3}, 5\sqrt{3}$

(*ii*) The roots of the quadratic equation $100x^2 - 20x + 1 = 0$ are

(*a*) unequal (*b*) equal and real

(*c*) equal but not real (*d*) both zeroes

(*iii*) If k be any real number, then roots of the quadratic equation $2x^2 - (2 + k)x + k = 0$ are

(*a*) rational (*b*) irrational

(*c*) 1 and – 1 (*d*) – 1 and k

(*iv*) $x^4 + 1 + x^2 = 0$, has

(*a*) four real roots (*b*) two real roots

(*c*) no real roots (*d*) one real root

(*v*) Which of the following quadratic equation has no distinct real roots.

(*a*) $3x^2 + 2\sqrt{3}x + \frac{9}{4} = 0$ (*b*) $-x^2 - x + 9 = 0$

(*c*) $x^2 - 3x + -2\sqrt{2} = 0$ (*d*) $15x^2 - 13x + 1 = 0$

Ans. (*i*) (*c*), (*ii*) (*b*), (*iii*) (*a*), (*iv*) (*c*), (*v*) (*a*)

5 ARITHMETIC PROGRESSION

Multiple Choice Questions

1. If p, q, r are in AP, then $p^3 + r^3 - 8q^3$ is equal to

(*a*) $4pqr$ (*b*) $-6pqr$ (*c*) $2pqr$ (*d*) $8pqr$

Sol. (*b*) $\because$ p, q, r are in AP.

$$\therefore \quad 2q = p + r$$

$$\Rightarrow \quad p + r - 2q = 0$$

$$\therefore \quad p^3 + r^3 + (-2q)^3 = 3 \times p \times r \times -2q$$

[Using if $a + b + c = 0 \Rightarrow a^3 + b^3 + c^3 = 3abc$]

$$\Rightarrow \quad p^3 + r^3 - 8q^3 = -6pqr.$$

2. In an AP, if $a = 3.5$, $d = 0$, $n = 101$, then a_n will be

(*a*) 0 (*b*) 3.5 (*c*) 103.5 (*d*) 104.5

[NCERT Exemplar Problem]

Sol. (*b*) $a_{101} = 3.5 + 0\ (100) = 3.5$

3. The list of numbers –10, –6, –2, 2, ... is

(*a*) an AP with $d = -16$ (*b*) an AP with $d = 4$

(*c*) an AP with $d = -4$ (*d*) not an AP **[NCERT Exemplar Problem]**

Sol. (*b*) An AP with $d = 4$.

4. Two APs have the same common difference. The first term of one of these is –1 and that of the other is –8. Then the difference between their 4th terms is

(*a*) –1 (*b*) –8 (*c*) 7 (*d*) –9

[NCERT Exemplar Problem]

Sol. (*c*) $a_4 - b_4 = (a_1 + 3d) - (b_1 + 3d)$

$$= a_1 - b_1 = -1 - (-8) = 7$$

5. In an AP, if $d = -2$, $n = 5$ and $a_n = 0$, the value of a is

(*a*) 10 (*b*) 5 (*c*) –8 (*d*) 8

Sol. (*d*) $d = -2$, $n = 5$, $a_n = 0$

$\because$ $a_n = 0$

$\Rightarrow \quad a + (n-1)d = 0$

$\Rightarrow \quad a + (5-1)(-2) = 0 \Rightarrow a = 8$

Correct option is (*d*).

6. If the common difference of an AP is 3, then $a_{20} - a_{15}$ is

(*a*) 5 (*b*) 3 (*c*) 15 (*d*) 20

Sol. (*c*) Common difference, $d = 3$

$$a_{20} - a_{15} = (a + 19d) - (a + 14d)$$
$$= 5d = 5 \times 3 = 15$$

7. The next term of the AP $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots$ is

(*a*) $\sqrt{146}$ (*b*) $\sqrt{128}$ (*c*) $\sqrt{162}$ (*d*) $\sqrt{200}$

Sol. (*c*) $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots = 3\sqrt{2}, 5\sqrt{2}, 7\sqrt{2}, \ldots$

$\therefore$ Next term is $9\sqrt{2} = \sqrt{162}$

8. The common difference of the AP $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}, \ldots$ is

(*a*) p (*b*) $-p$ (*c*) -1 (*d*) 1

Sol. (*c*) Common difference $= a_2 - a_1 = \frac{1-p}{p} - \frac{1}{p} = \frac{1-p-1}{p} = -1$

9. The first term of an AP is p and the common difference is q, then its 10th term is **[CBSE 2020]**

(*a*) $q + 9p$ (*b*) $p - 9q$ (*c*) $p + 9q$ (*d*) $2p + 9q$

Sol. (*c*) as $a_{10} = p + (10-1)q = p + 9q$

10. If the nth term of an AP is $(2n + 1)$, then the sum of its first three terms is

(*a*) $6n + 3$ (*b*) 15 (*c*) 12 (*d*) 21

Sol. (*b*) $a_1 = 2 \times 1 + 1 = 3$,

$a_2 = 2 \times 2 + 1 = 5$, $a_3 = 2 \times 3 + 1 = 7$

$\therefore$ Sum $= 3 + 5 + 7 = 15$

11. An AP consists of 31 terms. If its 16th term is m, then sum of all the terms of this AP is

(*a*) 16 m (*b*) 47 m (*c*) 31 m (*d*) 52 m

Sol. (*c*) $S_{31} = \frac{31}{2}(2a + 30d)$

$a_{16} = a + 15d = m$

$\Rightarrow \quad S_{31} = \frac{31}{2} \times 2(a + 15d) \Rightarrow S_{31} = 31m$

12. The first term of an AP of consecutive integers is $p^2 + 1$. The sum of $2p + 1$ terms of this AP is

(*a*) $(p + 1)^2$ (*b*) $(2p + 1)(p + 1)^2$ (*c*) $(p + 1)^3$ (*d*) $p^3 + (p + 1)^3$

Sol. (*d*) $\because$ $a = p^2 + 1$ and $d = 1$.

$$S_{2p+1} = \frac{2p+1}{2}(2p^2 + 2 + (2p)1)$$

$$= \frac{2p+1}{2}(2)(p^2 + p + 1)$$

$$= (2p + 1)(p^2 + p + 1) = p^3 + (p + 1)^3$$

13. If the sum of first n terms of an AP is $An + Bn^2$ where A and B are constants, the common difference of AP will be

(*a*) A + B (*b*) A – B (*c*) 2A (*d*) 2B

Sol. (*d*) $S_n = An + Bn^2$

$S_1 = A \times 1 + B \times 1^2 = A + B$

$\because$ $S_1 = a_1$

$\therefore$ $a_1 = A + B$ ... (*i*)

and $S_2 = A \times 2 + B \times 2^2$

$\Rightarrow$ $a_1 + a_2 = 2A + 4B$

$\Rightarrow$ $(A + B) + a_2 = 2A + 4B$ [Using (*i*)]

$\Rightarrow$ $a_2 = A + 3B$

$\therefore$ $d = a_2 - a_1 = 2B$

14. If the third term of an AP is 12 and the seventh term is 24, then the 10th term is

(*a*) 34 (*b*) 35 (*c*) 36 (*d*) 33

Sol. (*d*) $\because$ $a_3 = 12$ and $a_7 = 24$.

$\Rightarrow$ $a + 2d = 12$ and $a + 6d = 24$.

$\Rightarrow$ $4d = 12 \Rightarrow d = 3; \therefore a = 6$.

$\Rightarrow$ $a_{10} = 33$

15. If a, b, c, d, e and f are in AP, then $e - c$ is equal to

(*a*) $2(c - a)$ (*b*) $2(f - d)$ (*c*) $2(d - c)$ (*d*) $d - c$

Sol. (*c*) $e = a + 4$ common difference

$c = a + 2$ common difference

$e - c = 2$ common difference

$e - c = 2(d - c)$

16. If the numbers a, b, c, d, e form an AP, then the value of $a - 4b + 6c - 4d + e$ is

(*a*) 1 (*b*) 2 (*c*) 0 (*d*) none of these

Sol. (*c*) $a - 4b + 6c - 4d + e = a - 4(b + d) + 6c + e$

$= a - 8c + 6c + e = a - 2c + e = 0$

17. If the roots of the equation

$(b - c)x^2 + (c - a)x + (a - b) = 0$ are equal, then

(*a*) $2b = a + c$ (*b*) $a = b = c$ (*c*) $b^2 = ac$ (*d*) none of these

Sol. (*a*) $\because$ Roots are equal.

$\therefore \quad (c - a)^2 - 4(b - c)(a - b) = 0$

$\Rightarrow \quad c^2 + a^2 - 2ac - 4(ab - b^2 - ac + bc) = 0$

$\Rightarrow \quad c^2 + a^2 - 2ac - 4ab + 4b^2 + 4ac - 4bc = 0$

$\Rightarrow \quad c^2 + a^2 + 4b^2 + 2ac - 4bc - 4ab = 0$

$\Rightarrow \quad (c + a - 2b)^2 = 0 \Rightarrow c + a - 2b = 0$

$\Rightarrow \quad c + a = 2b.$

18. Sum of the n terms of the series

$\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + \ldots$ is

(*a*) $\frac{n(n+2)}{\sqrt{2}}$ (*b*) $\sqrt{2}(n)(n+1)$ (*c*) $\frac{n(n+1)}{\sqrt{2}}$ (*d*) 1

Sol. (*c*) Here $a = \sqrt{2}$, $d = \sqrt{8} - \sqrt{2} = \sqrt{2}$

$$S_n = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}[2\sqrt{2} + (n-1)\sqrt{2}]$$

$$= \frac{n}{2}[\sqrt{2} + \sqrt{2}n] = \frac{n(n+1)}{\sqrt{2}}$$

19. The 10th term of the sequence $\sqrt{3}, \sqrt{12}, \sqrt{27}, \ldots$ is

(*a*) $\sqrt{243}$ (*b*) $\sqrt{300}$ (*c*) $\sqrt{363}$ (*d*) $\sqrt{432}$

Ans. (*b*)

20. If x, y, z are in AP, then the value of $(x + y - z)(y + z - x)$ is

(*a*) $8yz - 3y^2 - 4z^2$ (*b*) $4xz + 3y^2$

(*c*) $8xy + 4x^2 - 3y^2$ (*d*) none of these

Ans. (*a*)

21. The second term of an AP is $(x - y)$ and 5th term is $(x + y)$, its first term is

(*a*) $x - \frac{1}{3}y$ (*b*) $x - \frac{2}{3}y$ (*c*) $x - \frac{4}{3}y$ (*d*) $x - \frac{5}{3}y$

Ans. (*d*)

22. The 15th term of the sequence $x - 7, x - 2, x + 3, \ldots$ is

(*a*) $x + 63$ (*b*) $x + 73$ (*c*) $x + 83$ (*d*) $x + 53$

Ans. (*a*)

23. The sum of n terms of the series 2, 5, 8, 11, ... is 60100, then n is

(*a*) 100 (*b*) 200 (*c*) 150 (*d*) 250

Ans. (*b*)

24. If $S_n = nP + \frac{n(n-1)}{2}Q$, where S_n denotes the sum of the first n terms of an AP, then common difference is

(*a*) P + Q (*b*) 2P + 3Q (*c*) 2Q (*d*) Q

Ans. (*d*)

25. If $p - 1$, $p - 3$, $3p - 1$ are in AP, then p is equal to

(*a*) $p = 2$ (*b*) $p = 3$ (*c*) $p = -2$ (*d*) $p = 5$

Ans. (*c*)

26. If the first term of an AP is 2 and common difference is 4, then sum of its first 40 term is

(*a*) 3000 (*b*) 3200 (*c*) 3600 (*d*) 3800

Ans. (*b*)

27. 7th term of an AP is 40. The sum of its first 13th terms is

(*a*) 500 (*b*) 510 (*c*) 520 (*d*) 540

Ans. (*c*)

28. Three numbers in an AP have sum 24. Its middle term is

(*a*) 6 (*b*) 7 (*c*) 8 (*d*) 9

Ans. (*c*)

29. Sum of first n terms of a series is $5n^2 + 2n$, its second term is

(*a*) 17 (*b*) 16 (*c*) 15 (*d*) 20

Ans. (*a*)

30. For what value of k will the consecutive terms $2k + 1$, $3k + 3$ and $5k - 1$ from an A.P.?

(*a*) $k = 4$ (*b*) $k = 7$ (*c*) $k = 9$ (*d*) $k = 6$

Ans. (*d*)

31. The 9th term from the end of the AP. 5, 9, 43, ... 185 is

(*a*) 153 (*b*) 150 (*c*) 147 (*d*) 140

Ans. (*a*)

32. Which of the following form an AP?

(*a*) 0, 0, 0, 0 (*b*) 0, 5, 0, 5 (*c*) 2, 3, 5, 7, 11 (*d*) 0.3, 0.2, 0.3, 0.2

Ans. (*a*)

33. Which of the following is not an AP?

(*a*) $\frac{-1}{5}, \frac{-2}{5}, \frac{-3}{5}...$ (*b*) $\frac{4}{3}, \frac{7}{3}, \frac{9}{3}, \frac{12}{3}...$

(*c*) $3, 3 + \sqrt{2}, 3 + 2\sqrt{2}, 3 + 3\sqrt{2}...$ (*d*) –1.2, 0.8, 2.8...

Ans. (*d*)

34. If –7, x, 9 are consecutive terms in an AP, then the value of x is

(a) $x = 1$ (b) $x = 2$ (c) $x = -1$ (d) $x = -2$

Ans. (a)

35. The common difference of an AP, whose nth term is $a_n = 4n + 9$ is

(a) 4 (b) 10 (c) 13 (d) 15

Ans. (a)

36. The value of a for which $2a$, $(a + 10)$ and $(3a + 2)$ are the three consecutive terms of an AP is

(a) –18 (b) 6 (c) –6 (d) 18

Ans. (b)

37. The value of m for which $(2m + 1)$, 10 and $(5m + 5)$ are three consecutive term of an AP is

(a) 1 (b) 2 (c) –2 (d) –1

Ans. (b)

38. The four terms of an AP whose first term is –4 and the common difference is –4, are

(a) –4, 0, 4, 8 (b) –4, 8, –16, 24 (c) –4, –8, 16, 24 (d) –4, –8, –12, –16

Ans. (d)

Assertion-Reason Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

39. **Assertion (A):** Let the positive numbers m, n, o be in AP then $\frac{1}{no}, \frac{1}{mo}, \frac{1}{mn}$ are also in AP.

Reason (R): If each term of an AP is divided by mno, then the resulting sequence is also in AP.

Ans. (a)

40. **Assertion (A):** Common difference of the AP –5, –1, 3, 7, ... is 4.

Reason (R): Common difference of the AP a, $a + d$, $a + 2d$ ... is given by d = 2nd term – Ist term.

Ans. (a)

41. **Assertion (A):** Sum of first 10 terms of the arithmetic progression –0.5, –1.0, –1.5, ... is 27.5.

Reason (R): Sum of n terms of an AP is given as $S_n = \frac{n}{2}[2a + (n-1)d]$. Where a = first term d = common difference.

Ans. (*a*)

Case-based Questions

42. India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year. **[CBSE Question Bank]**

Based on the above information, answer the following questions:

(*i*) Find the production during first year.

(*a*) 5000 (*b*) 4000 (*c*) 6000 (*d*) 5500

(*ii*) Find the production during 8th year.

(*a*) 10,400 (*b*) 20,600 (*c*) 20,400 (*d*) 20,000

(*iii*) Find the production during first 3 years.

(*a*) 20,600 (*b*) 20,900 (*c*) 20,400 (*d*) 21,600

(*iv*) In which year, the production is ₹ 29,200.

(*a*) N = 12 (*b*) N = 21 (*c*) N = 14 (*d*) N = 16

(*v*) Find the difference of the production during 7th year and 4th year.

(*a*) 6400 (*b*) 3200 (*c*) 3300 (*d*) 6600

Ans. (*i*) (*a*) ₹ 5000

(*ii*) (*c*) Production during 8th year is $(a + 7d) = 5000 + 2(2200) = 20400$

(*iii*) (*d*) Production during first 3 year = 5000 + 7200 + 9400 = 21600

(*iv*) (*a*) N=12

(*v*) (*d*) Difference = 18200 – 11600 = 6600

43. Your friend Veer wants to participate in a 200 m race. He can currently run that distance in 51 seconds and with each day of practice it takes him 2 seconds less. He wants to do in 31 seconds. **[CBSE Question Bank]**

(*i*) Which of the following terms are in AP for the given situation

(*a*) 51, 53, 55…. (*b*) 51, 49, 47…. (*c*) –51, –53, –55…. (*d*) 51, 55, 59…

(*ii*) What is the minimum number of days he needs to practice till his goal is achieved

(*a*) 10 (*b*) 12 (*c*) 11 (*d*) 9

(*iii*) Which of the following term is not in the AP of the above given situation

(*a*) 41 (*b*) 30 (*c*) 37 (*d*) 39

(*iv*) If n^{th} term of an AP is given by

$a_n = 2n + 3$ then common difference of an AP is

(*a*) 2 (*b*) 3 (*c*) 5 (*d*) 1

(*v*) The value of x, for which $2x$, $x + 10$, $3x + 2$ are three consecutive terms of an AP

(*a*) 6 (*b*) –6 (*c*) 18 (*d*) –18

Ans. (*i*) (*b*) (*ii*) (*c*) (*iii*) (*b*) (*iv*) (*a*) (*v*) (*a*)

44. Rampal deposits some money in bank and gets an increment on it every year

For example, Rampal deposits some money ₹ p in bank and get an interest of ₹ I on it every year then this is represented as

$p, p + \text{I}, p + 2\text{I}, p + 3\text{I}...$

The sequence $p, p + \text{I}, p + 2\text{I}, p + 3\text{I}....$ form an AP, with 1st term p and common difference I. Using the AP apply formula and its application.

Answer the questions based on above

(*i*) If $4p + 8$, $2p^2 + 3p + 6$ and $3p^2 + 4p + 4$ form three consecutive terms of an AP, then p =

(*a*) $p = 0$ or $p = 2$ (*b*) $p = -2$ or $p = 2$

(*c*) $p = 0$ or $p = -2$ (*d*) $p = 2$ or $p = -3$

(*ii*) The 12th term of AP, 10.0, 10.5, 11.0, 11.5 is .....

(*a*) 0.5 (*b*) 15.0 (*c*) 15.5 (*d*) 12.0

(*iii*) The 17th term of an AP exceeds its 10th term by 14, then common difference =

(*a*) 0 (*b*) 2 (*c*) 3 (*d*) – 2

(*iv*) The common difference of an AP $\frac{1}{x}, \frac{1-x}{x}, \frac{1-2x}{x}$ is ...

(*a*) 2 (*b*) 0 (*c*) 1 (*d*) – 1

(*v*) The qth term of the AP $\frac{1}{p}, \frac{1+p}{p}, \frac{1+2p}{p}$ is ...

(*a*) $\frac{1+(q-1)p}{p}$ (*b*) $1 + (q - 1)p$ (*c*) $\frac{1-(q-1)p}{p}$ (*d*) $\frac{1-p(q-1)}{2}$

Sol. (*i*) (*a*), $4p + 8, 2p^2 + 3p + 6, 3p^2 + 4p + 4$ from three consecutive terms of an AP.

$\therefore\ 2p^2 + 3p + 6 - 4p - 8 = 3p^2 + 4p + 4 - 2p^2 - 3p - 6$

$\Rightarrow \quad 2p^2 - p - 2 = p^2 + p - 2$

$\Rightarrow \quad p^2 - 2p = 0$

$\Rightarrow \quad p(p - 2) = 0$

$\Rightarrow \quad p = 0 \text{ or } p = 2$

(*ii*) (*c*), $a = 10.0$

$d = 10.5 - 10 = 0.5$

$a_{12} = a + 11d = 10.0 + 11(0.5)$

$= 10 + 5.5 = 15.5$

(*iii*) (*b*), Let a be the 1st term and d be the common difference

$\therefore \quad a_{17} = 14 + a_{10}$

$$\Rightarrow \quad a + 16d = 14 + a + 9d$$

$$\Rightarrow \quad 16d - 9d = 14$$

$$\Rightarrow \quad 7d = 14$$

$$\Rightarrow \quad d = 2$$

(*iv*) (*d*), Here AP is $\frac{1}{x}, \frac{1-x}{x}, \frac{1-2x}{x}$

$$\therefore \text{ Common difference } = \frac{1-x}{x} - \frac{1}{x}$$

$$= \frac{1}{x} - 1 - \frac{1}{x} = -1$$

$$\text{Common difference } = \frac{1-2x}{x} - \frac{1-x}{x}$$

$$= \frac{1-2x-1+x}{x} = \frac{-x}{x} = -1$$

(*v*) (*a*) AP is $\frac{1}{p}, \frac{1+p}{p}, \frac{1+2p}{p}$

Here 1st term = $\frac{1}{p}$,

common difference = $\frac{1+p}{p} - \frac{1}{p} = \frac{1+p-1}{p} = \frac{p}{p} = 1$

qth term = $a + (q-1)d = \frac{1}{p} + (q-1)1 = \frac{1+(q-1)p}{p}$

9 SOME APPLICATIONS OF TRIGONOMETRY

Multiple Choice Questions

1. The angle of depression of a car, standing on the ground, from the top of a 75 m high tower, is 30°. The distance of the car from the base of the tower (in m) is:

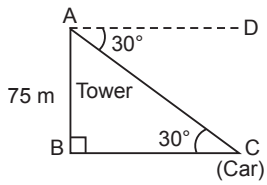
(*a*) $25\sqrt{3}$ (*b*) $50\sqrt{3}$ (*c*) $75\sqrt{3}$ (*d*) 150

Sol. (*c*) In ΔABC,

$$\frac{AB}{BC} = \tan 30°$$

$$\Rightarrow \quad \frac{75}{BC} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad BC = 75\sqrt{3} \text{ m}$$



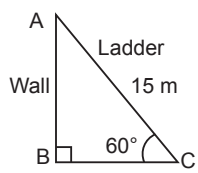
2. A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then the height of the wall is **[KVS]**

(*a*) $15\sqrt{3}$ m (*b*) $\frac{15\sqrt{3}}{2}$ m (*c*) $\frac{15}{2}$ m (*d*) 15 m

Sol. (*b*) In ΔABC,

$$\frac{AB}{AC} = \sin 60°$$

$$\Rightarrow \quad \frac{AB}{15} = \frac{\sqrt{3}}{2} \quad \Rightarrow \quad AB = \frac{15\sqrt{3}}{2} \text{ m}$$



3. The line drawn from the eye of an observer to the point in the object viewed by the observer is known as

(*a*) horizontal line (*b*) vertical line (*c*) line of sight (*d*) transversal line

Sol. (*c*)

4. The tops of two poles of heights 20 m and 14 m are connected by a wire. If the wire makes an angle of 30° with the horizontal, then the length of the wire is

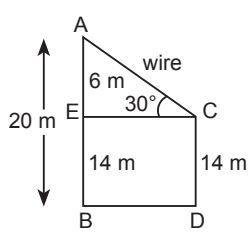
(*a*) 8 m (*b*) 10 m (*c*) 12 m (*d*) 14 m

Sol. (*c*)

$$\frac{AE}{AC} = \sin 30°$$

$$\Rightarrow \quad \frac{6}{AC} = \frac{1}{2}$$

$$\Rightarrow \quad AC = 12 \text{ m}$$



5. If two towers of heights h_1 and h_2 subtend angles of 60° and 30° respectively at the mid-point of the line joining their feet, then $h_1 : h_2 =$

(*a*) 1 : 2 (*b*) 1 : 3 (*c*) 2 : 1 (*d*) 3 : 1

Sol. (*d*)

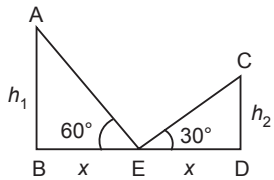
$$\frac{h_1}{x} = \tan 60° = \sqrt{3}$$

$$\Rightarrow \quad h_1 = \sqrt{3}x \qquad \ldots (i)$$

$$\frac{h_2}{x} = \tan 30° = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad h_2 = \frac{1}{\sqrt{3}}x$$

$$\frac{h_1}{h_2} = \frac{\sqrt{3}x}{\frac{1}{\sqrt{3}}x} = \frac{3}{1} \Rightarrow h_1 : h_2 = 3 : 1$$



6. The angle of elevation of the top of a 15 m high tower at a point 15 m away from the base of the tower is _____.

(*a*) 30° (*b*) 40° (*c*) 45° (*d*) 60°

Sol. (*c*)

7. The angle of elevation of the top of a tower from a point 20 metres away from its base is 45°. The height of the tower is

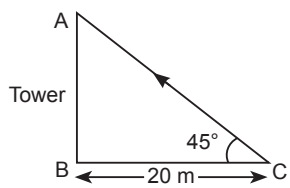
(*a*) 10 m (*b*) 20 m (*c*) 30 m (*d*) $20\sqrt{3}$ m

Sol. (*b*)

$$\frac{AB}{BC} = \tan 45°$$

$$\Rightarrow \quad \frac{AB}{20} = 1$$

$$\Rightarrow \quad AB = 20 \text{ m.}$$



8. Two poles are 25 m and 15 m high and the line joining their tops makes an angle of 45° with the horizontal. The distance between these poles is

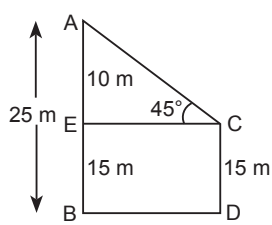
(*a*) 5 m (*b*) 8 m (*c*) 9 m (*d*) 10 m

Sol. (*d*)

$$\frac{AE}{EC} = \tan 45°$$

$$\Rightarrow \quad \frac{10}{EC} = 1$$

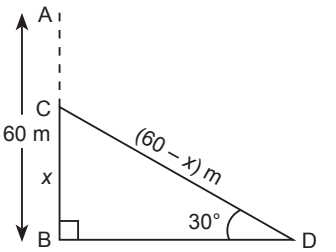
$$\Rightarrow \quad EC = 10 \text{ m.}$$



9. A portion of a 60 m long tree is broken by tornado and the top struck up the ground making an angle of 30° with the ground level. The height of the point where the tree is broken is equal to

(*a*) 30 m (*b*) 35 m (*c*) 40 m (*d*) 20 m

Sol. (*d*) Let AB is the tree which is broken at C.



$$\frac{BC}{DC} = \sin 30°$$

$$\Rightarrow \quad \frac{x}{60 - x} = \frac{1}{2}$$

$$\Rightarrow \quad 2x = 60 - x$$

$$\Rightarrow \quad x = 20 \text{ m}$$

10. If at some time, the length of the shadow of a tower is $\sqrt{3}$ times its height, then the angle of elevation of the Sun, at that time, is

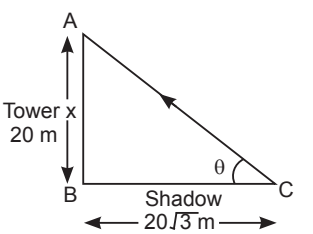
(*a*) 15° (*b*) 30° (*b*) 45° (*d*) 60°

Sol. (*b*)

11. The angle of elevation of the Sun, if the length of the shadow of a tower of height 20 m is $20\sqrt{3}$ m is

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 75°

Sol. (*a*)



$$\tan \theta = \frac{20}{20\sqrt{3}}$$

$$\Rightarrow \quad \tan \theta = \frac{1}{\sqrt{3}} = \tan 30°$$

$$\Rightarrow \quad \theta = 30°$$

12. A person standing on the bank of a river finds that the angle of elevation of the top of a tower on the opposite bank is 45°. Which of the following statements is correct?

(*a*) Breadth of the river is twice the height of the tower.

(*b*) Breadth of the river is half of the height of the tower.

(*c*) Breadth of the river is equal to the height of the tower.

(*d*) None of the above.

Ans. (*c*) Breadth of the river is equal to the height of the tower.

13. If the elevation of the Sun is 30°, then the length of the shadow cast by a tower of 150 feet height is

(*a*) 150 feet (*b*) $50\sqrt{3}$ feet (*c*) $150\sqrt{3}$ feet (*d*) 200 feet

Sol. (*c*) $\tan 30° = \frac{150}{x} \Rightarrow x = 150\sqrt{3}$ feet, where x = length of shadow

14. At some time of the day, the length of the shadow of a tower is equal to its height. Then the Sun's altitude at that time is

(*a*) 30° (*b*) 60° (*c*) 90° (*d*) 45°

Ans. (*d*)

15. A kite is flying at a height of 30 m from the ground. The length of string from the kite to the ground is 60 m. Assuming that here is no slack in the string, the angle of elevation of the kite at the ground is

(*a*) 45° (*b*) 30° (*c*) 60° (*d*) 90°

Ans. (*b*)

16. Length of the shadow of a person is x when the angle of elevation of the Sun is 45°. If the length of the shadow increases by $(\sqrt{3} - 1)\,x$, then the angle of elevation of the Sun should become

(*a*) 60° (*b*) 45° (*c*) 30° (*d*) 20°

Ans. (*c*)

17. When the length of the shadow of a pole of height 10 m is equal to 10 m, then the elevation of source of light is

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*b*)

18. The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of sun is.

(*a*) 45° (*b*) 30° (*c*) 60° (*d*) 90°

Ans. (*b*)

19. The top of the poles of height 16 m and 10 m are connected by a wire of length l m. If the wire makes an angle of 30° with the horizontal, then l =

(*a*) 26 m (*b*) 16 m (*c*) 12 m (*d*) 10 m

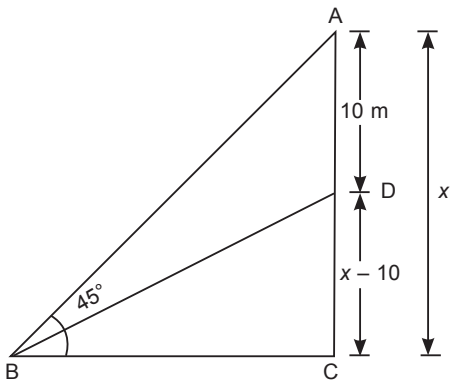
Ans. (*c*)

20. The length of the shadow of a pillar is $\sqrt{3}$ times its height. The angle of elevation of the source of light is:

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*a*)

21. The value of DC is:



(*a*) 20 m (*b*) 30 m (*c*) 40 m (*d*) 60 m

Ans. (*d*)

22. The angle of elevation of a point which is at a distance of 30 m from the base of a tower $10\sqrt{3}$ m high is:

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*a*)

23. A ladder, learning against a wall, makes an angle of 60° with the horizontal. If the foot of the ladder is 9.5 m away from the wall. The length of the ladder is: **[NCERT Exemplar]**

(*a*) 10 m (*b*) 16 m (*c*) 18 m (*d*) 19 m

Ans. (*d*)

24. A bridge on a river makes an angle of 30° with its edge. If the length along the bridge from one edge to the other is 130 m, then the width of the river is:

(*a*) 45 m (*b*) 55 m (*c*) 65 m (*d*) 75 m

Ans. (*d*)

25. The tops of two towers of height x and y, standing on level ground, subtend angles of 30° and 60° respectively at the centre of the line joining their feet, then find $x : y$. **[Delhi 2015]**

(*a*) 2 : 1 (*b*) 3 : 1 (*c*) 1 : 3 (*d*) 1 : 5

Ans. (*c*)

26. An observer, 1.7 m tall, is $20\sqrt{3}$ m away from a tower. The angle of elevation from the eye of observer to the top of tower is 30°. Find the height of tower. **[Foreign 2016]**

(*a*) 20.5 m (*b*) 21.7 m (*c*) 22.8 m (*d*) 23.7 m

Ans. (*b*)

27. When the length of the shadow of a pole of height 7 m is equal to 7 m then find the elevation of the source of light.

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*b*)

28. If a pole 6 m high throws shadow of $2\sqrt{3}$ m, then find the angle of elevation of the sun.

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*c*)

29. Angle of elevation of the top of a tower from a point on the ground which is 60 m away from the foot of the tower is 45°. The height of the tower is:

(*a*) 30 m (*b*) 60 m (*c*) 90 m (*d*) 120 m

Ans. (*b*)

30. A plane is observed to be approaching the airport. It is at a distance of 10 km from the point of observation and makes an angle of elevation 30°. The height above the ground of the plane is:

(*a*) 2 km (*b*) 3 km (*c*) 5 km (*d*) 7 km

Ans. (*c*)

31. Two poles are 20 m and 10 m high and the line joining their tops make an angle of 45° with the horizontal. The distance between these poles is:

(*a*) 5 m (*b*) 7 m (*c*) 9 m (*d*) 10 m

Ans. (*d*)

Case-based Questions

32. A group of students of class X visited India Gate on an education trip. The teacher and students had interest in history as well. The teacher narrated that **India Gate**, official name **Delhi Memorial**, originally called **All-India War Memorial**, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919. The teacher also said that India Gate, which is located at the eastern end of the Rajpath (formerly called the Kingsway), is about 138 feet (42 metres) in height.

[CBSE Question Bank]

(*i*) What is the angle of elevation if they are standing at a distance of 42 m away from the monument?

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 0°

(*ii*) They want to see the tower at an angle of 60°. So, they want to know the distance where they should stand and hence find the distance.

(*a*) 25.24 m (*b*) 20.12 m (*c*) 42 m (*d*) 24.64 m

(*iii*) If the altitude of the Sun is at 60°, then the height of the vertical tower that will cast a shadow of length 20 m is

(*a*) $20\sqrt{3}$ m (*b*) $\frac{20}{\sqrt{3}}$ m (*c*) $\frac{15}{\sqrt{3}}$ m (*d*) $15\sqrt{3}$ m

(*iv*) The ratio of the length of a rod and its shadow is 1 : 1. The angle of elevation of the Sun is

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

(*v*) The angle formed by the line of sight with the horizontal when the object viewd is below the horizontal level is

(*a*) corresponding angle (*b*) angle of elevation

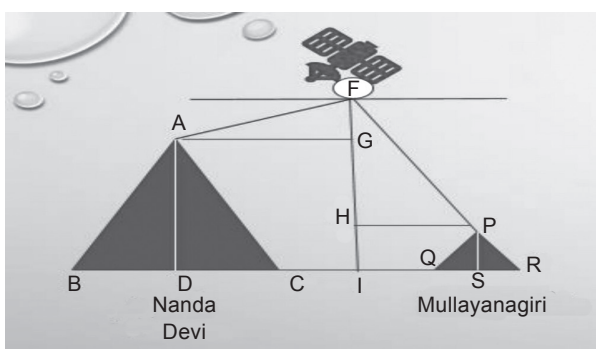
(*c*) angle of depression (*d*) complete angle

Ans. (*i*) (*b*) 45° (*ii*) (*a*) 25.24 m (*iii*) (*a*) $20\sqrt{3}$ m

(*iv*) (*b*) 45° (*v*) (*a*) Corresponding angles

33. A Satellite flying at height *h* is watching the top of the two tallest mountains in Uttarakhand and Karnataka, them being Nanda Devi (height 7,816 m) and Mullayanagiri (height 1,930 m). The angles of depression from the satellite, to the top of Nanda Devi and Mullayanagiri are 30° and 60° respectively. If the distance between the peaks of two mountains is 1937 km, and the satellite is vertically above the midpoint of the distance between the two mountains.

[CBSE Question Bank]



(*i*) The distance of the satellite from the top of Nanda Devi is

(*a*) 1139.4 km (*b*) 577.52 km (*c*) 1937 km (*d*) 1025.36 km

(*ii*) The distance of the satellite from the top of Mullayanagiri is

(*a*) 1139.4 km (*b*) 577.52 km (*c*) 1937 km (*d*) 1025.36 km

(*iii*) The distance of the satellite from the ground is

(*a*) 1139.4 km (*b*) 577.52 km (*c*) 1937 km (*d*) 1025.36 km

(*iv*) What is the angle of elevation if a man is standing at a distance of 7816 m from Nanda Devi?

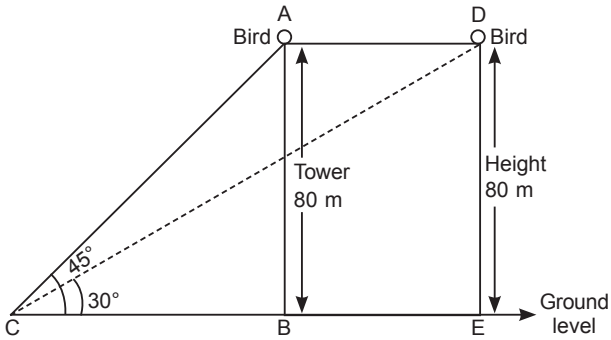
(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 0°

(*v*) If a mile stone very far away from, makes 45° to the top of Mullanyangiri montain. So, find the distance of this mile stone form the mountain.

(*a*) 1118.327 km (*b*) 566.976 km (*c*) 1937 km (*d*) 1025.36 km

Ans. (*i*) (*a*) 1139.4 km, (*ii*) (*c*) 1937 km, (*iii*) (*b*) 577.52 km, (*iv*) (*b*) 45, (*v*) (*c*) 1937 km

34. In figure, a tower is shown of height 80 m. A bird is sitting on the top of tower as shown at point A. After 2 seconds the birds flies away horizontally but remain at constant height. Now, the angle of elevation from observation point C, changes from 45° to 30° as shown.



Answer the questions based on above

(*i*) Distance BC =

(*a*) 10 m (*b*) 80 m (*c*) 800 m (*d*) 100 m

(*ii*) Distance CE =

(*a*) x m (*b*) $\frac{80}{\sqrt{3}}$ m (*c*) $80\sqrt{3}$ m (*d*) 80 m

(*iii*) Distance BE =

(*a*) $80\left(\sqrt{3}-1\right)$ m (*b*) $80\left(\sqrt{3}+1\right)$ m (*c*) $80\sqrt{3}$ m (*d*) $\frac{\sqrt{3}+1}{\sqrt{3}}$ m

(*iv*) Speed of bird, when flies from point A to D is

(*a*) $\sqrt{3}$ m/s (*b*) $40\left(\sqrt{3}+1\right)$ m/s (*c*) $40\sqrt{3}$ m/s (*d*) $40\left(\sqrt{3}-1\right)$ m/s

(*v*) If bird covers distance AD in 5 seconds then speed of bird in m/s is

(*a*) $\frac{16}{\sqrt{3}}$ m/s (*b*) $16\sqrt{3}$ m/s

(*c*) $16\left(\sqrt{3}-1\right)$ m/s (*d*) $16\left(\sqrt{3}+1\right)$ m/s

Ans. (*i*) (*b*) (*ii*) (*c*) (*iii*) (*a*) (*v*) (*d*) (*v*) (*c*)

10 CIRCLES

Multiple Choice Questions

1. How many tangents can a circle have?

(*a*) 1 (*b*) 2

(*c*) Infinitely many (*d*) None of these

Ans. (*c*)

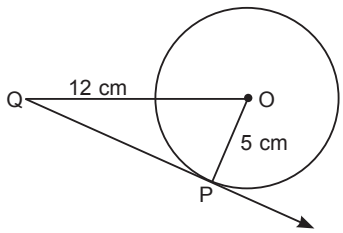
2. A tangent PQ at a point P of a circle of radius 5 cm meets a line through the centre O at a point Q so that OQ = 12cm. Length of PQ is

(*a*) 12 cm (*b*) 13 cm (*c*) 8.5 cm (*d*) $\sqrt{119}$ cm

Sol. Radius of the circle = 5 cm

OQ = 12 cm

$\angle OPQ = 90°$



[The tangent to a circle is perpendicular to the radius through the point of contact]

$PQ^2 = OQ^2 - OP^2$ [By Pythagoras theorem]

$PQ^2 = 12^2 - 5^2 = 144 - 25 = 119$

$PQ = \sqrt{119}$ cm.

Hence, correct option is (*d*).

3. From a point Q, the length of the tangent to a circle is 24 cm and the distance of Q from the centre is 25 cm. The radius of the circle is

(*a*) 7 cm (*b*) 12 cm (*c*) 15 cm (*c*) 24.5 cm

Sol. From figure

$OQ^2 = OP^2 + PQ^2$

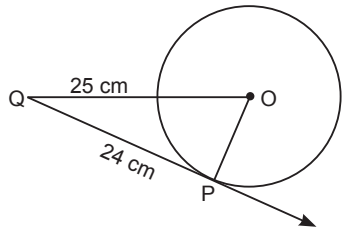
$(25)^2 = OP^2 + (24)^2$

$\Rightarrow \quad 625 - 576 = OP^2$

$\Rightarrow \quad 49 = OP^2$

$\Rightarrow \quad OP = \sqrt{49}$

$OP = 7$ cm

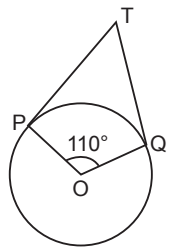


Radius of the circle = 7cm. Hence, correct option is (*a*).

4. In figure, if TP and TQ are the two tangents to a circle with centre O so that $\angle POQ = 110°$, then $\angle PTQ$ is equal to

(*a*) 60° (*b*) 70° (*c*) 80° (*d*) 90°

Sol. $\angle OPT = 90°$; $\angle OQT = 90°$; $\angle POQ = 110°$



TPOQ is a quadrilateral

$\Rightarrow \quad \angle PTQ + \angle POQ = 180°$

$\Rightarrow \quad \angle PTQ + 110° = 180°$

$\Rightarrow \quad \angle PTQ = 180° - 110° = 70°$

5. If tangents PA and PB from a point P to a circle with centre O are inclined to each other at angle of 80°, then $\angle POA$ is equal to

(*a*) 50° (*b*) 60° (*c*) 70° (*d*) 80°

Sol. In ΔOAP and ΔOBP

$OA = OB$ [Radii]

$PA = PB$ [Length of tangents from an external point are equal]

$OP = OP$ [Common]

$\therefore \quad \Delta OAP \cong \Delta OBP$ [SSS congruence rule]

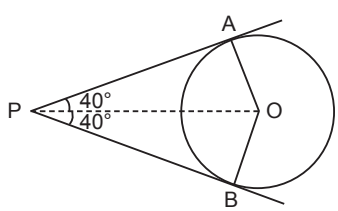
$\Rightarrow \quad \angle POA = \angle POB = \frac{1}{2}\angle AOB$

$\angle AOB + \angle APB = 180°$

$\Rightarrow \quad \angle AOB + 80° = 180°$

$\Rightarrow \quad \angle AOB = 180° - 80° = 100°$

$\angle POA = \frac{1}{2} \times 100° = 50°$



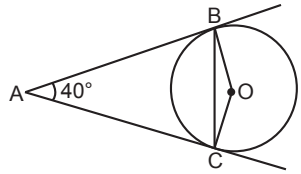
Hence, correct option is (*a*).

6. The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm find the radius of the circle.

(*a*) 3 cm (*b*) 6 cm (*c*) 2 cm (*d*) 9 cm

Ans. (*a*)

7. In the given figure, AB and AC are tangents to the circle with centre O such that $\angle BAC = 40°$, then $\angle BOC$ is equal to **[AI 2011]**



(*a*) 40°

(*b*) 50°

(*c*) 140°

(*d*) 150°

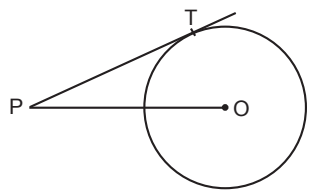
Sol. (*c*) In quadrilateral ABOC

$$\angle ABO + \angle BOC + \angle OCA + \angle BAC = 360^\circ$$

$$\Rightarrow \quad 90^\circ + \angle BOC + 90^\circ + 40^\circ = 360^\circ$$

$$\Rightarrow \quad \angle BOC = 360^\circ - 220^\circ = 140^\circ$$

8. In the given figure, point P is 26 cm away from the centre O of a circle and the length PT of the tangent drawn from P to the circle is 24 cm. Then the radius of the circle is **[Foreign 2011]**

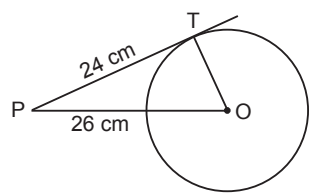


(*a*) 25 cm (*b*) 26 cm (*c*) 24 cm (*d*) 10 cm

Sol. (*d*) $\because$ OT is radius and PT is tangent

$\therefore$ OT $\perp$ PT

Now, in ΔOTP,



$$OP^2 = PT^2 + OT^2$$

$$\Rightarrow \quad 26^2 = 24^2 + OT^2$$

$$\Rightarrow \quad 676 - 576 = OT^2$$

$$\Rightarrow \quad 100 = OT^2 \Rightarrow 10 \text{ cm} = OT$$

9. A line through point of contact and passing through centre of circle is known as

(*a*) tangent (*b*) chord (*c*) normal (*d*) segment

Ans. (*c*) normal

10. C(O, r_1) and C(O, r_2) are two concentric circles with $r_1 > r_2$. AB is a chord of C(O, r_1) touching C(O, r_2) at C then

(*a*) AB = r_1 (*b*) AB = r_2

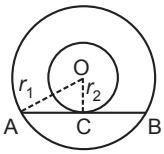
(*c*) AC = BC (*d*) AB = $r_1 + r_2$

Sol. (*c*) ∵ AB touches $C(O, r_2)$

$\therefore$ OC $\perp$ AB

Also, perpendicular from the centre to a chord bisects the chord.

$\therefore$ AC = BC



11. Two parallel lines touch the circle at points A and B respectively. If area of the circle is 25π cm^2, then AB is equal to

(*a*) 5 cm (*b*) 8 cm (*c*) 10 cm (*d*) 25 cm

Sol. (*c*) Let radius of circle = R

$\therefore \quad \pi R^2 = 25\pi$

$\Rightarrow \quad R = 5$ cm

$\therefore$ Distance between two parallel tangents = diameter = $2 \times 5 = 10$ cm.

12. A circle touches *x*-axis at A and *y*-axis at B. If O is origin and OA = 5 units, then diameter of the circle is

(*a*) 8 units (*b*) 10 units (*c*) $10\sqrt{2}$ units (*d*) $8\sqrt{2}$ units

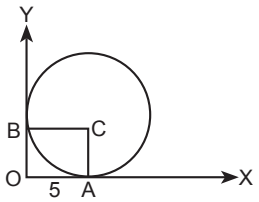
Sol. (*b*) OA = OB $\Rightarrow$ OB = 5

AC = BC [Radii]

$\Rightarrow$ OACB is a square.

$\Rightarrow \quad AC = OA = 5$

$\Rightarrow$ Diameter = 10 units.



13. From a point P which is at a distance of 13 cm from the centre O of a circle of radius 5 cm, the pair of tangents PQ and PR to the circle are drawn. Then the area of the quadrilateral PQOR is **[NCERT Exemplar Problem]**

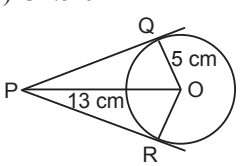
(*a*) 60 cm^2 (*b*) 65 cm^2 (*c*) 30 cm^2 (*d*) 32.5 cm^2

Sol. (*a*) Here, $PQ = \sqrt{OP^2 - OQ^2}$

$= \sqrt{13^2 - 5^2} = 12$ cm

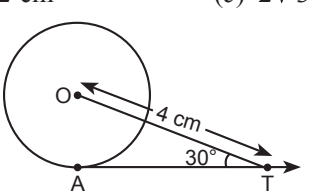
Area of quadrilateral PQOR = ar. of ΔPOQ + ar. of ΔPOR

$= \frac{1}{2} \times 12 \times 5 + \frac{1}{2} \times 12 \times 5 = 30 + 30 = 60$ cm^2.



14. In figure AT is a tangent to the circle with centre O such that OT = 4 cm and $\angle OTA = 30°$. Then AT is equal to **[NCERT Exemplar Problem]**

(*a*) 4 cm (*b*) 2 cm (*c*) $2\sqrt{3}$ cm (*d*) $4\sqrt{3}$ cm



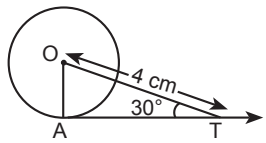
Sol. (*c*) $\angle OAT = 90^\circ$ [$\because$ Tangent and radius are $\perp$ to each other at the point of contact]

In right-angled ΔOAT,

$$\frac{AT}{OT} = \cos 30^\circ$$

$$\Rightarrow \quad \frac{AT}{4} = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \quad AT = 2\sqrt{3} \text{ cm.}$$



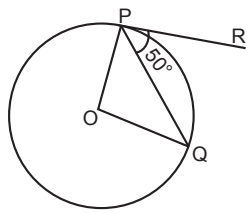
15. In figure if O is centre of a circle, PQ is a chord and the tangent PR at P makes an angle of 50° with PQ, then $\angle POQ$ is equal to **[NCERT Exemplar Problem, DoE]**

(*a*) 100°

(*b*) 80°

(*c*) 90°

(*d*) 75°



Sol. (*a*) $OP \perp PR$ [$\because$ Tangent and radius are $\perp$ to each other at the point of contact]

$$\angle OPQ = 90^\circ - 50^\circ = 40^\circ$$

$$OP = OQ \qquad \text{[Radii]}$$

$$\therefore \quad \angle OPQ = \angle OQP = 40^\circ$$

In ΔOPQ,

$$\Rightarrow \quad \angle POQ + \angle OPQ + \angle OQP = 180^\circ$$

$$\Rightarrow \angle POQ + 40^\circ + 40^\circ = 180^\circ$$

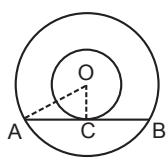
$$\angle POQ = 180^\circ - 80^\circ = 100^\circ.$$

16. Two concentric circles are of radii 13 cm and 5 cm. The length of the chord of larger circle which touches the smaller circle is _____. **Hint:** $\because$ AB touches the smaller circle

Sol. 24 cm.

$\therefore$ $OC \perp AB$ and hence $AC = BC$

In right ΔOCA,



$$OA^2 = OC^2 + AC^2$$

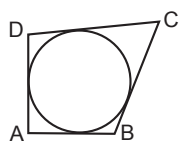
$$\Rightarrow \quad AC^2 = 13^2 - 5^2$$

$$\Rightarrow \quad AC = 12$$

$$\therefore \quad AB = 2 \times 12 = 24 \text{ cm.}$$

17. A quadrilateral ABCD is drawn to circumscribe a circle. If AB = 12 cm, BC = 15 cm and CD = 14 cm, then AD is equal to _____. **Hint:** AB + CD = BC + AD

Sol. 11 cm.



$$\Rightarrow \quad 12 + 14 = 15 + AD$$

$$\Rightarrow \quad AD = 11 \text{ cm.}$$

18. Match the column:

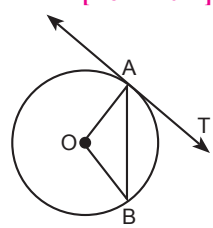
(1) The tangent at any point of a circle is ...	(A) known as a tangent to the circle
(2) The line containing the radius through the point of contact is ...	(B) perpendicular to the radius through the point of contact
(3) The lengths of tangents drawn from an external point to a circle are ...	(C) called the 'normal' to the circle
(4) When two end points of the corresponding chord of a secant coincide, it is ...	(D) equal

(*a*) 1 → A, 2 → B, 3 → C, 4 → D (*b*) 1 → B, 2 → A, 3 → D, 4 → C

(*c*) 1 → D, 2 → A, 3 → C, 4 → B (*d*) 1 → B, 2 → C, 3 → D, 4 → A

Sol. Properties of circle.

19. In figure, O is the centre of a circle, AB is a chord and AT is the tangent at A. If $\angle AOB = 100°$, then $\angle BAT$ is equal to **[Delhi 2011]**



(*a*) 100°

(*b*) 40°

(*c*) 50°

(*d*) 90°

Sol. (*c*) $\angle AOB = 100°$

$\angle OAB = \angle OBA$ ($\because$ OA and OB are radii)

Now, in ΔAOB,

$\angle AOB + \angle OAB + \angle OBA = 180°$ (Angle sum property of Δ)

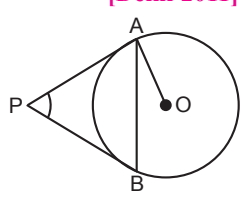
$\Rightarrow$ $100° + x + x = 180°$ [Let $\angle OAB = \angle OBA = x$]

$\Rightarrow$ $2x = 180° - 100° \Rightarrow 2x = 80° \Rightarrow x = 40°$

Also, $\angle OAB + \angle BAT = 90°$ [$\because$ OA is radius and TA is tangent at A]

$\Rightarrow$ $40° + \angle BAT = 90° \Rightarrow \angle BAT = 50°$

20. In the figure PA and PB are tangents to the circle with centre O. If $\angle APB = 60°$, then $\angle OAB$ is **[Delhi 2011]**



(*a*) 30°

(*b*) 60°

(*c*) 90°

(*d*) 15°

Sol. (*a*) Given $\angle APB = 60°$

$\because$ $\angle APB + \angle PAB + \angle PBA = 180°$

$\Rightarrow$ $\angle APB + x + x = 180°$ [$\because$ PA = PB $\therefore$ $\angle PAB = \angle PBA = x$ (say)]

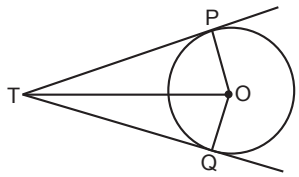
$\Rightarrow$ $60° + 2x = 180° \Rightarrow 2x = 180° - 60°$

$\Rightarrow$ $2x = 120° \Rightarrow x = \frac{120°}{2} = 60°$

Also, $\angle OAP = 90° \Rightarrow \angle OAB + \angle PAB = 90°$

$\Rightarrow$ $\angle OAB + 60° = 90° \Rightarrow \angle OAB = 30°$

21. In the given figure, TP and TQ are two tangents to a circle with centre O, such that $\angle POQ = 110°$. Then $\angle PTQ$ is equal to **[Foreign 2011]**



(*a*) 55°

(*b*) 70°

(*c*) 110°

(*d*) 90°

Sol. (*b*) In quadrilateral POQT,

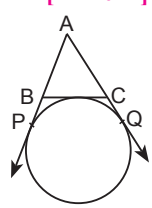
$\angle PTQ + \angle TPO + \angle TQO + \angle POQ = 360°$

$\Rightarrow$ $\angle PTQ + 90° + 90° + 110° = 360°$

$\Rightarrow$ $\angle PTQ + 290° = 360°$

$\Rightarrow$ $\angle PTQ = 360° - 290° = 70°$

22. In figure, AP, AQ and BC are tangents to the circle. If AB = 5 cm, AC = 6 cm and BC = 4 cm, then the length of AP (in cm) is **[AI 2012]**



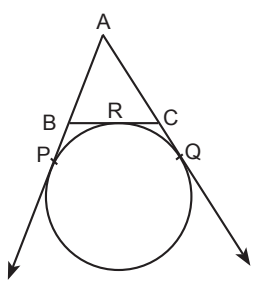
(*a*) 7.5

(*b*) 15

(*c*) 10

(*d*) 9

Sol. (*a*)



$AP = AQ$

$\Rightarrow$ $AB + BP = AC + CQ$

$\Rightarrow$ $5 + BP = 6 + CQ$

$BP = 1 + CQ$

$BP = 1 + CR$ ($\because$ CQ = CR)

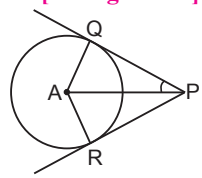
$BP = 1 + (BC - BR)$

$BP = 1 + (4 - BP)$ ($\because$ BR = BP)

$2BP = 5 \Rightarrow BP = \frac{5}{2} = 2.5$ cm

Now, $AP = AB + BP = 5 + 2.5 = 7.5$ cm

23. In figure, PQ and PR are tangents to a circle with centre A. If $\angle QPA = 27°$, then $\angle QAR$ equals to **[Foreign 2012]**



(*a*) 63°
(*b*) 153°
(*c*) 126°
(*d*) 117°

Sol. (*c*) $\angle QPA = \angle RPA$ [$\because \Delta AQP \cong \Delta ARP$ (RHS congruence rule)]

$\Rightarrow \angle RPA = 27°$

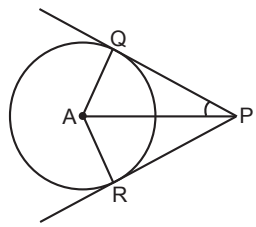
$\therefore \angle QPR = \angle QPA + \angle RPA = 27° + 27° = 54°$

Now,

$\angle QAR + \angle AQP + \angle ARP + \angle QPR = 360°$

$\Rightarrow \angle QAR = 90° + 90° + 54° = 360°$

$\Rightarrow \angle QAR = 360° - 234° = 126°$

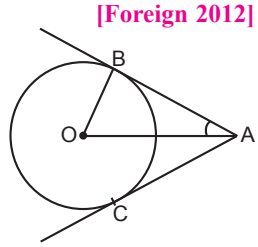


24. A tangent PQ at a point P of a circle of radius 7 cm meets a line through centre O at a point Q so that OQ = 25 cm length is _____.

(*a*) 26 cm (*b*) 14 cm (*c*) 24 cm (*d*) 34 cm

Ans. (*c*)

25. In figure, AB and AC are tangents to a circle with centre O and radius 8 cm. If OA = 17 cm, then the length of AC (in cm) is **[Foreign 2012]**



(*a*) $\sqrt{353}$
(*b*) 15
(*c*) 9
(*d*) 25

Sol. (*b*) In right ΔABO,

$OA^2 = OB^2 + AB^2$

$\Rightarrow (17)^2 = (8)^2 + AB^2$

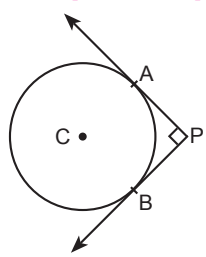
$\Rightarrow 289 = 64 + AB^2$

$\Rightarrow AB^2 = 225$

$AB = \sqrt{225} = 15$ cm

AC = AB = 15 cm (Length of tangents from an exterior point)

26. In figure, PA and PB are two tangents drawn from an external point P to a circle with centre C and radius 4 cm. If PA ⊥ PB, then the length of each tangent is: **[Delhi 2013]**



(*a*) 3 cm
(*b*) 4 cm
(*c*) 5 cm
(*d*) 6 cm

Sol. (*b*) $CA \perp AP$

$CB \perp BP$

and $PA \perp PB$

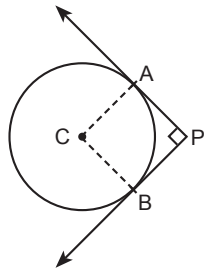
In ACBP,

$\angle ACB = 90°$

Also $AP = PB$

$\therefore$ BPAC is a square.

$\Rightarrow$ $AP = PB = BC = AC = 4$ cm



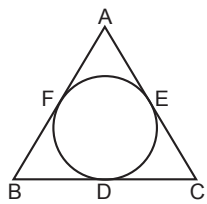
27. A triangle ABC is drawn to circumscribe a circle. If AB = 13 cm, BC = 14 cm and AE = 7 cm, then AC is equal to

(*a*) 12 cm

(*b*) 15 cm

(*c*) 11 cm

(*d*) 16 cm



Sol. (*b*) $AE = AF \Rightarrow AF = 7$ cm

$\Rightarrow$ $BF = AB - AF = 13 - 7 = 6$ cm

Also, $BD = BF \Rightarrow BD = 6$ cm

$\Rightarrow$ $CD = BC - BD$

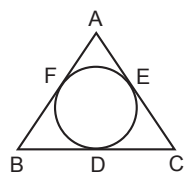
$= 14 - 6 = 8$ cm

$\because$ $CE = CD$

$\Rightarrow$ $CE = 8$ cm

$\therefore$ $AC = AE + EC$

$= 7 + 8 = 15$ cm.



28. A right ΔABC right angled at A is drawn to circumscribe a circle of radius 5 cm with centre O. If AC = 17 cm and AB = 18 cm, then OC is equal to

(*a*) 10 cm (*b*) 9 cm (*c*) 12 cm (*d*) 13 cm

Sol. (*d*) Here, $OE \perp AC$ [Radius is perpendicular to the tangent at point of contact]

$OF \perp AB$, $\angle A = 90°$ (given)

$OE = OF$ (Radii)

$\therefore$ AEOF is a square

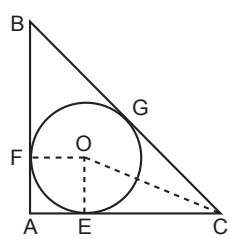
$\Rightarrow$ $AE = 5$ cm

$\Rightarrow$ $CE = 17 - 5 = 12$ cm

Now, In ΔOCE

$OC^2 = EC^2 + OE^2$

$= 12^2 + 5^2$



29. Distance between two parallel lines is 14 cm. The radius of circle which will touch both lines is

(*a*) 6 cm (*b*) 7 cm (*c*) 12 cm (*d*) 14 cm

Sol. (*b*) ∵ Circle touches both the parallel lines

∴ Diameter of circle = Distance between the parallel lines

∴ Radius = $\frac{14}{2}$ = 7 cm

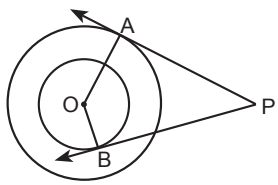
30. A line '*m*' is tangent to a circle with radius 5 cm. Distance between the centre of circle and the line *m* is

(*a*) 3 cm (*b*) 4 cm (*c*) 5 cm (*d*) 6 cm

Sol. (*c*) ∵ Line is tangent to the circle

∴ Distance from centre = Radius of the circle = 5 cm.

31. In the figure, there are two concentric circles with centre O and radii 5 cm and 3 cm. PA and PB are tangents to these circles from an external point P. If PA = 12 cm, then length of PB (in cm) is **[Foreign 2013]**



(*a*) 10 (*b*) $4\sqrt{10}$ (*c*) 12 (*d*) $\sqrt{178}$

Ans. (*b*)

32. A line touches a circle of radius 4 cm. Another line is drawn which is tangent to the circle. If the two lines are parallel, then distance between them is

(*a*) 4 cm (*b*) 6 cm (*c*) 7 cm (*d*) 8 cm

Ans. (*d*)

33. The distance between two parallel tangents of a circle of radius 4 cm is

(*a*) 2 cm (*b*) 4 cm (*c*) 6 cm (*d*) 8 cm

Ans. (*d*)

34. If radii of two concentric circles are 4 cm and 5 cm, then length of each chord of one circle, which is tangent to the other circle is

(*a*) 3 cm (*b*) 6 cm (*c*) 9 cm (*d*) 1 cm

Ans. (*b*)

35. The length of tangent from an external point P on a circle with centre O is always less than OP.

(*a*) True (*b*) False

(*c*) can't determined (*d*) None of these

Ans. (*b*)

36. The length of the tangents to the circle from a point at any distance of 10 cm from centre of the circle of radius 6 cm is

(*a*) 4 cm (*b*) 8 cm (*c*) 16 cm (*d*) None of these

Ans. (*b*)

37. The length of the tangent drawn from a point 8 cm away from the centre of radius 6 cm is

(*a*) $\sqrt{7}$ cm (*b*) $2\sqrt{7}$ cm (*c*) 10 cm (*d*) 5 cm

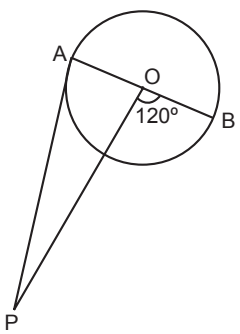
Ans. (*b*)

38. PQ is a tangent to a circle with centre O at the point P. If ΔOPQ is an isosceles triangle then $\angle OPQ$ is equal to

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*b*)

39. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle POB = 120°$, then $\angle APO$ is



(*a*) 25° (*b*) 20° (*c*) 30° (*d*) 65°

Ans. (*c*)

Assertion-Reason Questions

Directions: **In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:**

(*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(*b*) Both assertion (A) and reason (R) true but reason (R) is not the correct explanation of assertion (A).

(*c*) Assertion (A) is true but reason (R) is false.

(*d*) Assertion (A) is false but reason (R) is true.

40. **Assertion (A):** If in a circle, the radius of the circle is 3 cm and distance of a point from the centre of a circle is 5 cm, then length of the tangent will be 4 cm.

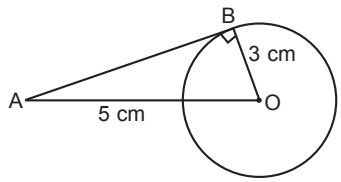
Reason (R): $(\text{hypotenuse})^2 = (\text{base})^2 + (\text{height})^2$

Ans.

$$OA^2 = AB^2 + OB^2$$

$$5^2 = AB^2 + 3^2$$

$$AB = \sqrt{25 - 9} = 4 \text{ cm}$$



Both assertion (A) and reason (R) are true and reason (R) is correct explanation of assertion (A).

Thus (*a*) is correct option.

41. **Assertion (A):** The two tangents are drawn to a circle from an external point, then they subtend equal angles at the centre.

Reason (R): A parallelogram circumscribing a circle is a rhombus.

Ans. From an external point the two tangents drawn subtend equal angles at the centre.

So, assertion is true.

Also, a parallelogram circumscribing a circle is a rhombus, so reason is also true but R is not correct explanation of A.

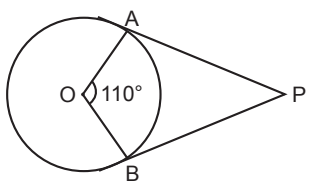
Thus (*b*) is correct option.

42. **Assertion (A):** PA and PB are two tangents to a circle with centre O. Such that $\angle AOB = 110°$, then $\angle APB = 90°$.

Reason (R): The length of two tangents drawn from an external point are equal.

Ans. (*d*) Assertion (A) is false but reason (R) is true.

As per information given in question we have figure below:



Radius is perpendicular to the tangent at point of conctant.

Thus, $OA \perp AP$ and $OB \perp PB$

In quadrilateral, OAPB, we have

$$\angle OAP + \angle APB + \angle PBO + \angle AOB = 360°$$

$$90° + \angle APB + 90° + 110° = 360°$$

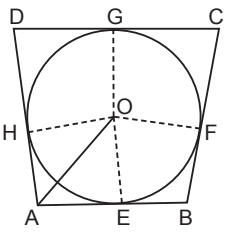
$$\angle APB = 70°$$

Assertion (A) is false but reason (R) is true.

Thus (*d*) is correct option.

Case-based Questions

43. A welfare society of birds constructed a circular tank to serve as a bird bath as shown in figure



Here, ABCD is a quadrilateral sides AB, BC, CD, DA act as tangents to circle at E, F, G and H. Here AB = 5 m, CD = 6 m and BC = 7 m

Answer the questions based on above information.

(*i*) Distance BC =

(*a*) 11 m (*b*) 4 m (*c*) 7 m (*d*) 6 m

(*ii*) If O is centre of tank and AH and AE inclined to each other at angle 100°, then ∠HOE =

(*a*) 80° (*b*) 100° (*c*) 40° (*d*) 140°

(*iii*) If ∠GOF = $(3x - 8)°$ and ∠GCF = $(2x + 3)°$ then x =

(*a*) 80° (*b*) 100° (*c*) 37° (*d*) 73°

(*iv*) ΔOHA is an/a

(*a*) right angled triangle (*b*) equilateral triangle

(*c*) both (*a*) and (*b*) (*d*) None of these

(*v*) ∠HAO =

(*a*) ∠HOE (*b*) ∠AEO

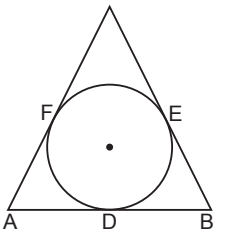
(*c*) ∠AEB (*d*) ∠OAE

Ans. (*i*) (*b*) 4 m (*ii*) (*a*) 80°

(*iii*) (*c*) $x = 37°$ (*iv*) (*a*) right-angled triangle

(*v*) (*d*) ∠HAO = ∠OAE

44. Varun has been selected by his School to design logo for Sports Day T-shirts for students and staff . The logo design is as given in the figure and he is working on the fonts and different colours according to the theme. In given figure, a circle with centre O is inscribed in a ΔABC, such that it touches the sides AB, BC and CA at points D, E and F respectively. The lengths of sides AB, BC and CA are 12 cm, 8 cm and 10 cm respectively. **[CBSE Question Bank]**



(*i*) Find the length of AD.

(*a*) 7 (*b*) 8 (*c*) 5 (*d*) 9

(*ii*) Find the Length of BE.

(*a*) 8 (*b*) 5 (*c*) 2 (*d*) 9

(*iii*) Find the length of CF.

(*a*) 9 (*b*) 5 (*c*) 2 (*d*) 3

(*iv*) If radius of the circle is 4 cm, Find the area of ΔOAB.

(*a*) 20 (*b*) 36 (*c*) 24 (*d*) 48

(*v*) Find area of ΔABC.

(*a*) 50 (*b*) 60 (*c*) 100 (*d*) 90

Ans. (*i*) (*a*) 7 (*ii*) (*b*) 5 (*iii*) (*d*) 3 (*iv*) (*c*) 24 (*v*) (*b*) 60

11 CONSTRUCTIONS

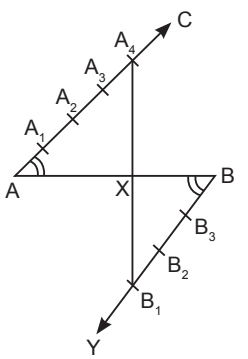
Multiple Choice Questions

1. To divide a line segment AB in the ratio 4 : 3, first a ray AX is drawn, so that ∠BAX is an acute angle and then at equal distances points are marked one the ray AX such that the maximum number of these points is:

(*a*) 4 (*b*) 3 (*c*) 6 (*d*) 7

Ans. (*d*)

2.



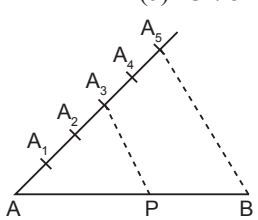
In the given figure, find the ratio, when X divides AB internally.

(*a*) 3 : 4 (*b*) 4 : 3 (*c*) 5 : 2 (*d*) 3 : 5

Ans. (*b*)

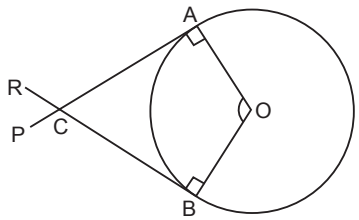
3. The ratio of division of the line segment AB by the point P from A in the following figure is:

(*a*) 2 : 3 (*b*) 3 : 2 (*c*) 3 : 5 (*d*) 2 : 5



Ans. (*d*)

4. We draw pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 40°. Then, ∠AOB =



(*a*) 100° (*b*) 120° (*c*) 140° (*d*) 160°

Ans. (*c*)

5. A pair of tangents can be constructed to a circle inclined at an angle of 130°

(*a*) False (*b*) True

(*c*) Can't determined (*d*) Insufficient information

Ans. (*b*)

6. From the following ratios, a line segment cannot be divided into a ratio:

(*a*) $A \rightarrow \sqrt{2} : \frac{1}{\sqrt{2}}$ (*b*) $A \rightarrow \frac{1}{\sqrt{2}} : \frac{1}{\sqrt{2}}$

(*c*) $A \rightarrow \frac{3}{\sqrt{5}} : \frac{\sqrt{5}}{3}$ (*d*) $A \rightarrow \frac{1}{2} : 1$

Ans. (*c*)

7. To draw a pair of tangents to a circle, which are inclined to each other at an angle of 60°, it is required to draw tangents at end points of those two radii of the circle, the angle between them should be

(*a*) 135° (*b*) 90° (*c*) 60° (*d*) 120°

Ans. (*d*)

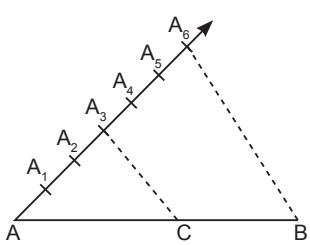
8. To divide a line segment AB in the ratio 4 : 5. First a ray AX is drawn, so that ∠BAX is an acute angle and then at equal distances points are marked on the ray AX such that the maximum number of these points are:

(*a*) 4 (*b*) 5 (*c*) 7 (*d*) 9

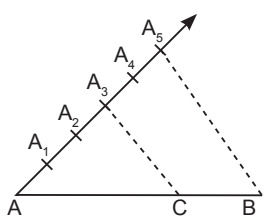
Ans. (*d*)

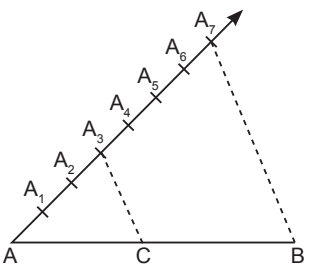
9. A line segment of length 8 cm is drawn and divide it in the ratio 3 : 2. Choose the correct construction.

(*a*)



(*b*)



(*c*) 

(*d*) None of these

Ans. (*d*)

10. To draw a pair of tangents to a circle, which are inclined to each other at an angle of 50°, it is required to draw tangents at end points of those two radii of the circle, the angle between them should be

(*a*) 50° (*b*) 120° (*c*) 100° (*d*) 200°

Ans. (*c*)

11. To divide a line segment AB in the ratio 3 : 4 first a ray AX is drawn making ∠BAX an acute angle and then points A_1, A_2...at equal distances are marked on the ray AX and the point B is joined to

(*a*) A_3 (*b*) A_9 (*c*) A_5 (*d*) A_7

Ans. (*d*)

12. A pair of tangents can be constructed from a point P to a circle of radius 5 cm situated at a distance of 12 cm from the centre.

(*a*) True (*b*) False

(*c*) Can't determined (*d*) None of these

Ans. (*a*)

13. To divide a line segment AB in the ratio 5 : 3, first a ray AX is drawn, so that ∠BAX is an acute angle and then at equal distances points are marked one the ray AX such that the maximum number of these points is:

(*a*) 5 (*b*) 3 (*c*) 8 (*d*) 2

Ans. (*c*)

14. A pair of tangents can be constructed from a point P to a circle of radius 3.5 cm situated at a distance of 5 cm from the centre.

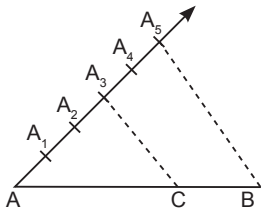
(*a*) True (*b*) False

(*c*) Can't say (*d*) None of these

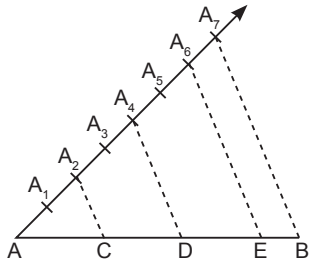
Ans. (*a*)

15. A line segment of length 5 cm is drawn and divide it in the ratio 3 : 4. Choose the correct construction.

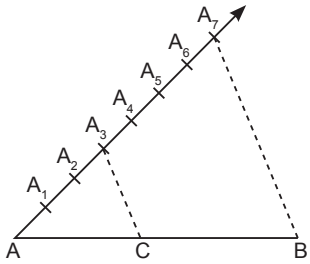
(*a*)



(*b*)



(*c*)



(*d*) None of these

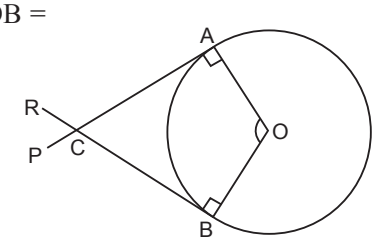
Ans. (*d*)

16. A pair of tangents can be constructed from a point P to a circle of radius 2 cm situated at a distance of 1.5 cm from the centre.

(*a*) True (*b*) False (*c*) Can't determined (*d*) None of these

Ans. (*b*)

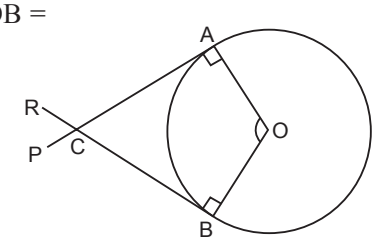
17. We draw pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 70°. Then, ∠AOB =



(*a*) 100° (*b*) 70° (*c*) 110° (*d*) 160°

Ans. (*c*)

18. We draw pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 90°. Then, ∠AOB =



(*a*) 90° (*b*) 120° (*c*) 140° (*d*) 180°

Ans. (*a*)

19. By geometrical construction, is it possible to divide a line segment in the ratio $\sqrt{5} : \frac{1}{\sqrt{3}}$.

(*a*) Yes (*b*) No

(*c*) Can't determined (*d*) None of these

Ans. (*a*)

20. To draw a pair of tangents to a circle, which are inclined to each other at an angle of 55°, it is required to draw tangents at the end points of these two radii of the circle, the angle between two radii is:

(*a*) 105° (*b*) 70° (*c*) 125° (*d*) 135°

Ans. (*c*)

Assertion-Reason Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(*a*) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(*b*) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(*c*) Assertion (A) is true but Reason (R) is false.

(*d*) Assertion (A) is false but Reason (R) is true.

21. **Assertion (A):** Construct a triangle with sides 5 cm, 6 cm and 7 cm. Can we construct another triangle whose sides are $\frac{7}{5}$ of the corresponding sides of first triangle.

Reason (R): Sum of the lengths of any two sides of a triangle is greater than the length of the third side.

Sol. (*c*)

22. **Assertion (A):** In line segment AB, we want to divide it in the ratio of $m : n$. Let the value of $n = 4$ and $n = 3$.

Reason (R): A line must be divided into 10 equal parts.

Sol. (*b*)

23. **Assertion (A):** It line segment of length 7.6 cm & divide if in the ratio of 5 : 8.

Reason (R): A line must be divided into 13 equal parts.

Sol. (*c*)

24. **Assertion (A):** In the construction of tangents to a circle from a point outside it. Where O is centre of the circle and a point A outside it.

Reason (R): In ΔAOC, $AC \perp OC$ and in ΔAOB, $AB \perp OB$.

Sol. (*c*)

25. **Assertion (A):** Draw a pair of tangents to a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle.

Reason (R): The figure formed after construction shows the $\angle AOB$ is equal to 150°.

Sol. (*b*)

13 SURFACE AREAS AND VOLUMES

Multiple Choice Questions

1. A cube whose edge is 20 cm long, has circles on each of its faces painted black. What is the total area of the unpainted surface of the cube if the circles are of the largest possible areas?

(*a*) 90.72 cm^2 (*b*) 256.72 cm^2 (*c*) 330.3 cm^2 (*d*) 514.28 cm^2

Sol. (*d*) Diameter of largest circle = 20 cm.

$\therefore$ Area of circle = 100π cm^2

$\therefore$ Area of 6 circles = $6 \times 100\pi = 600\pi$ cm^2 ($\because$ there are six faces in a cube)

Also, Area of cube = $6 \times (20)^2 = 2400$ cm^2

Area of unpainted surface = $2400 - 600\pi = 2400 - 600 \times \frac{22}{7} = 514.28$ cm^2.

2. If two solid hemispheres of the same base radius r are joined together along their bases, then curved surface area of this new solid is **[NCERT Exemplar Problem]**

(*a*) $4\pi r^2$ (*b*) $6\pi r^2$ (*c*) $3\pi r^2$ (*d*) $8\pi r^2$

Ans. (*a*) $4\pi r^2$

3. A cube of side 4 cm is cut into cubes of side 1 cm, then total surface area of all the small cubes is _____.

(*a*) 384 cm^2 (*b*) 374 cm^2 (*c*) 324 cm^2 (*d*) 284 cm^2

Sol. (*a*) 384 cm^2

Volume of bigger cube = $4 \times 4 \times 4 = 64$ cm^3

Volume of one smaller cube = $1 \times 1 \times 1 = 1$ cm^3

Number of smaller cubes = $\frac{64}{1} = 64$

Surface area of one smaller cube = $6 \times 1^2 = 6$ cm^2

$\therefore$ Total surface area = $6 \times 64 = 384$ cm^2

4. The radius (in cm) of the largest right circular cone that can be cut out from a cube of edge 4.2 cm is **[AI 2011]**

(*a*) 4.2 (*b*) 2.1 (*c*) 8.1 (*d*) 1.05

Sol. (*b*) Edge of the cube = 4.2 cm

Diameter of base of largest possible cone = 4.2 cm

$\therefore$ Radius = $\frac{4.2}{2} = 2.1$ cm

5. How many bags of grain can be stored in a cuboid granary 12 m × 6 m × 5 m. If each bag occupies a space of 0.48 m^3?

(*a*) 750 (*b*) 75 (*c*) 1500 (*d*) 375

Sol. (*a*) No. of bags $= \dfrac{\text{volume of granary}}{\text{volume of one bag}} = \dfrac{12 \times 6 \times 5}{0.48}$

$= 750.$

6. The ratio of the volume of a cube to that of a sphere which will fit inside the cube is _____.

Sol. [6 : π]

Let side of cube = x ∴ Volume of cube = x^3

Diameter of sphere = x ⇒ radius = $\dfrac{x}{2}$

Volume of sphere = $\dfrac{4}{3}\pi\left(\dfrac{x}{2}\right)^3$

∴ Required ratio

$$x^3 : \frac{4}{3}\pi\left(\frac{x}{2}\right)^3 = 6 : \pi.$$

7. In a swimming pool measuring 90 m × 40 m, 150 men take a dip. If the average displacement of water by a man is 8 m^3, then rise in water level is

(*a*) 27.33 cm (*b*) 30 cm (*c*) 31.33 cm (*d*) 33.33 cm

Sol. (*d*) Volume of water displaced = 150 × 8 = 1200 m^3

$$\Rightarrow \quad 90 \times 40 \times h = 1200$$

$$\Rightarrow \quad h = \frac{1200}{90 \times 40} \text{ m} = 33.33 \text{ cm}.$$

8. Match the column:

(1) Volume of right cylinder	(A) $2lbh$
(2) Volume of cuboid	(B) $l \times b \times h$
(3) Volume of right cone	(C) $\pi r^2 h$
(4) Volume of sphere	(D) $\frac{1}{3}\pi r^2 h$ (E) $2\pi r^2 h$ (F) $\frac{4}{3}\pi r^3$

(*a*) 1 → C, 2 → A, 3 → D, 4 → F (*b*) 1 → C, 2 → A, 3 → D, 4 → E

(*c*) 1 → C, 2 → B, 3 → D, 4 → F (*d*) 1 → C, 2 → A, 3 → F, 4 → D

Sol. (*c*) Formulae.

9. Two cylindrical cans have equal base areas. If one of the can is 15 cm high and other is 20 cm high, find the ratio of their volumes.

(*a*) 2 : 3 (*b*) 3 : 4 (*c*) 4 : 3 (*d*) 3 : 2

Sol. Let the base area of first cylinder is πr^2.

$\therefore$ Base area of second cylinder is also πr^2.

$$h_1 = 15 \text{ cm}, h_2 = 20 \text{ cm}$$

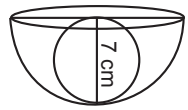
$$\text{Ratio of volumes} = \frac{\pi r^2 h_1}{\pi r^2 h_2} = \frac{15}{20} = \frac{3}{4}$$

volume of first cylinder : volume of second cylinder = 3 : 4

10. A sphere of maximum volume is cut out from a solid hemisphere of radius 7 cm. What is the ratio of the volume of the hemisphere to that of the cut out sphere?

(*a*) 4 : 1 (*b*) 2 : 5 (*c*) 1 : 4 (*d*) 5 : 2

Sol. Radius of the sphere cut $= \frac{1}{2}$ radius of the hemisphere $= \frac{7}{2}$ cm



Volume of hemisphere : volume of sphere

$$= \frac{2}{3}\pi(7)^3 : \frac{4}{3} \times \pi \times \left(\frac{7}{2}\right)^3$$

$$= 1 : 2 \times \frac{1}{8} = 1 : \frac{1}{4} = 4 : 1$$

11. A sphere of diameter 18 cm is dropped into a cylindrical vessel of diameter 36 cm, partly filled with water. If the sphere is completely submerged, then the water level rises (in cm) by **[Delhi 2011]**

(*a*) 3 (*b*) 4 (*c*) 5 (*d*) 6

Sol. (*a*) Volume of sphere = Volume of water in cylindrical vessel

$$\frac{4}{3}\pi r^3 = \pi r^2 h$$

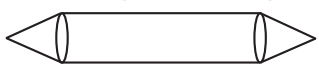
$$\Rightarrow \quad \frac{4}{3} \times 9 \times 9 \times 9 = 18 \times 18 \times h \qquad \left[\because r = \frac{d}{2}\right]$$

$$\Rightarrow \quad \frac{4 \times 9 \times 9 \times 9}{3 \times 18 \times 18} = h$$

$$\Rightarrow \quad h = 3 \text{ cm}$$

$\therefore$ Water level rises by 3 cm

12. The shape of a *gilli*, in the *gilli-danda* game (see Fig.), is a combination of



(*a*) two cylinders (*b*) a cone and a cylinder

(*c*) two cones and a cylinder (*d*) two cylinders and a cone

[NCERT Exemplar Problem]

Sol. (*c*) Two cones and a cylinder.

13. A right circular cylinder of radius r cm and height h cm ($h > 2r$) just encloses a sphere of diameter **[NCERT Exemplar Problem]**

(a) r cm (b) $2r$ cm (c) h cm (d) $2h$ cm

Sol. (b) $2r$ cm.

14. During conversion of a solid from one shape to another, the volume of the new shape will **[NCERT Exemplar Problem]**

(a) increase (b) decrease

(c) remain unaltered (d) be doubled

Sol. (c) Remain unaltered.

15. Three cubes of iron whose edges are 6 cm, 8 cm and 10 cm respectively are melted and formed into a single cube. The edge of the new cube formed is _____.

(a) 10 cm (b) 14 cm (c) 12 cm (d) 13 cm

Sol. 12 cm

Hint: $6^3 + 8^3 + 10^3 = l^3$

$\Rightarrow$ $216 + 512 + 1000 = l^3$

$\Rightarrow$ $1728 = l^3 \Rightarrow l = 12$ cm.

16. A rectangular block 6 cm × 12 cm × 15 cm is cut into exact number of equal cubes. The least possible number of cubes will be

(a) 6 (b) 11 (c) 33 (d) 40

Sol. (d) Volume of rectangular block = $6 \times 12 \times 15 = 1080$ cm^3

Side of largest cube = HCF of 6, 12, 15 = 3

$\therefore$ Volume of 1 cube = $3^3 = 27$ cm^3

$$\text{Number of cubes} = \frac{6 \times 12 \times 15}{27} = 40$$

17. A river 1.5 m deep and 36 m wide is flowing at the rate of 3.5 km per hour. The amount of water that runs into the sea per minute (in cubic metres) is

(a) 31500 (b) 3150 (c) 3150000 (d) 6300

Sol. (b) $\therefore$ $\text{Length of water per minute} = \frac{35 \times 1000}{60 \times 10}$ m

Amount (volume) of water that runs into the sea per minute

$$= \frac{15 \times 36 \times 35 \times 100}{60 \times 10} = 3150 \text{ m}^3.$$

18. A copper sphere of radius 3 cm is beaten and drawn into a wire of diameter 0.2 cm. The length of the wire is _____.

(a) 34 m (b) 36 m (c) 38 m (d) 40 m

Ans. (b)

19. The number of coins, 1.5 cm in diameter and 0.2 cm thick to be melted to form a right circular cylinder of height 10 cm and diameter 4.5 cm is

(*a*) 350 (*b*) 400 (*c*) 450 (*d*) 500

Sol. (*c*) Volume of one coin $= \pi \times \frac{1.5}{2} \times \frac{1.5}{2} \times 0.2 \text{ cm}^3$

Volume of cylinder $= \pi \times \frac{4.5}{2} \times \frac{4.5}{2} \times 10 \text{ cm}^3$

$\therefore$ Number of coins $= \dfrac{\pi \times \frac{4.5}{2} \times \frac{4.5}{2} \times 10}{\pi \times \frac{1.5}{2} \times \frac{1.5}{2} \times 0.2} = 450$

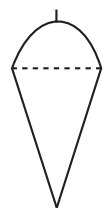
20. A plumbline (*sahul*) is the combination of (see Fig.)

(*a*) a cone and a cylinder

(*b*) a hemisphere and a cone

(*c*) frustum of a cone and a cylinder

(*d*) sphere and cylinder



Sol. (*b*) a hemisphere and a cone

21. Three cubes each of volume 216 m^3 are joined end to end. The surface area of the resulting solid is _____.

(*a*) 216 m^2 (*b*) 480 m^2 (*c*) 432 m^2 (*d*) 504 m^2

Sol. (*d*) Side of each cube $= \sqrt[3]{216} = 6$ m.

Length of resulting solid $= 3 \times 6 = 18$ m.

Breadth $= 6$ m, Width $= 6$ m

Surface area $= 2[18 \times 6 + 6 \times 6 + 18 \times 6] = 504 \text{ m}^2$.

22. A spherical ball of lead, 3 cm in diameter is melted and recast into three spherical balls. The diameter of two of the balls are 1.5 cm and 2 cm respectively. The diameter of the third balls is

(*a*) 2.4 cm (*b*) 2.5 cm (*c*) 2.7 cm (*d*) 2.8 cm

Sol. (*b*) Let the radius of third ball be x

Volume of big spherical ball $= \frac{4}{3} \pi \left(\frac{3}{2}\right)^3 \text{ cm}^3$

Volume of Ist smaller ball $= \frac{4}{3} \pi \left(\frac{1.5}{2}\right)^3$

Volume of IInd smaller ball $= \frac{4}{3} \pi \left(\frac{2}{2}\right)^3$

Volume of IIIrd smaller ball $= \frac{4}{3} \pi (x)^3$

A.T.Q, $\frac{4}{3}\pi\left(\frac{3}{2}\right)^3 = \frac{4}{3}\pi\left[\left(\frac{1.5}{2}\right)^3 + (1)^3 + (x)^3\right]$

$\Rightarrow \left(\frac{3}{2}\right)^3 = \left(\frac{1.5}{2}\right)^3 + 1 + x^3$

$\Rightarrow x = 1.25$ cm

$d = 2x = 2 \times 1.25 = 2.5$ cm

23. A solid sphere of radius 10 cm is moulded into 8 spherical solid balls of equal radius, then the radius of each ball is_____.

(*a*) 10 cm (*b*) 20 cm (*c*) 5 (*d*) 15 cm

Sol. 5 cm Volume of solid sphere $= \frac{4}{3}\pi \times (10)^3$

$\therefore$ Let radius of one smaller ball $= x$

Volume of one smaller ball $= \frac{4}{3}\pi (x)^3$

$\Rightarrow 8 \times \frac{4}{3}\pi (x)^3 = \frac{4}{3}\pi \times (10)^3$

$\Rightarrow x = 5$ cm.

24. The radii of two cylinders are in the ratio 2 : 3 and their heights are in the ratio 5 : 3. The ratio of their volumes is

(*a*) 3 : 4 (*b*) 5 : 3 (*c*) 27 : 20 (*d*) 20 : 27

Ans. (*d*)

25. A cone, a hemisphere and a cylinder stand on equal bases and have the same height. The ratio of their volumes is _____.

(*a*) 2 : 1 : 3 (*b*) 3 : 1 : 2 (*c*) 3 : 2 : 1 (*d*) 1 : 2 : 3

Ans. (*d*)

26. Two metallic right circular cones having their heights 4.1 cm and 4.3 cm and radii of their bases 2.1 cm each, have been melted together and recast into a sphere. The diameter of the sphere is

(*a*) 3.5 cm (*b*) 4.2 cm (*c*) 4.9 cm (*d*) 5.6 cm

Ans. (*b*)

27. A right circular cylindrical vessel is full of water. How many right cones having the same radius and height as those of the right cylinder will be required to store that water?

(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5

Ans. (*b*)

28. Three cubes each of side 2 cm are joined end to end, then the surface area of the resulting solid is

(*a*) 28 cm^2 (*b*) 128 cm^2 (*c*) 56 cm^2 (*d*) 48 m^2

Ans. (*c*)

29. A solid ball is exactly fitted inside the cubical box of side S. The volume of the ball is

(*a*) $\frac{1}{6}\pi S^3$ (*b*) $\frac{4}{3}\pi S^3$ (*c*) $\frac{1}{3}\pi S^3$ (*d*) None of these

Ans. (*b*)

Assertion-Reason Questions

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(*b*) Both assertion (A) and reason (R) true but reason (R) is not the correct explanation of assertion (A).

(*c*) Assertion (A) is true but reason (R) is false.

(*d*) Assertion (A) is false but reason (R) is true.

30. **Assertion (A):** Total surface area of the cylinder having radius of the base 14 cm and height 30 cm is 3872 cm^2.

Reason (R): If r be the radius and h be the height of the cylinder, then total surface area = $(2\pi rh + 2\pi r^2)$.

Ans. (*a*) Total surface area = $2\pi rh + 2\pi r^2 = 2\pi rh(h + r)$

$= 2 \times \frac{22}{7} \times 14(30 + 14)$

$= 88(44)$

$= 3872\ cm^2$

31. **Assertion (A):** If the height of a cone is 24 cm and diameter of the base is 14 cm, then the slant height of the cone is 15 cm.

Reason (R): If r be the radius and h the slant height of the cone, then slant height = $\sqrt{h^2 + r^2}$.

Ans. (*d*) Slant height = $\sqrt{\left(\frac{14}{2}\right)^2 + (24)^2}$

$= \sqrt{49 + 576}$

$= \sqrt{625} = 25$

32. **Assertion (A):** Two identical solid cube of side 5 cm are joined end to end. Then total surface area of the resulting cuboid is 300 cm^2.

Reason (R): Total surface area of a cuboid is $2(lb + bh + lh)$

Ans. (*d*) When cubes are joined end to end, it will form a cuboid.

$$l = 2 \times 5 = 10 \text{ cm}, \; b = 5 \text{ cm}$$

and $$h = 5 \text{ cm}$$

$$\text{Total surface area} = 2(lb + bh + lh)$$

$$= 2(10 \times 5 + 5 \times 5 + 10 \times 5)$$

$$= 2 \times 125 = 250 \text{ cm}^2$$

33. **Assertion (A):** If the radius of a cone is halved and volume is not changed, then height remains same.

Reason (R): If the radius of a cone is halved and volume is not changed then height must become four times of the original height.

Ans. (*d*)

$$\frac{V_1}{V_2} = \frac{\left(\frac{1}{3}\right)\pi r^2 h_1}{\left(\frac{1}{3}\right)\pi\left(\frac{\pi}{2}\right)^2 h^2} = \frac{4h_1}{h_2}$$

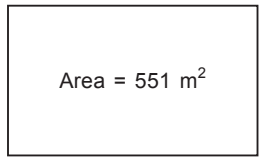
$$V_1 = V_2$$

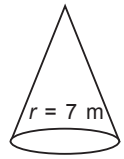
$$h_2 = 4h_1$$

Case-based Questions

34. Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a hemispherical cup whose dimensions are shown below. After that they went for a jungle trek. The jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area 551 m^2. Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to 1 m^2, the students put the tents. The radius of the tent is 7 m.

[CBSE Question Bank]





(*i*) The volume of cylindrical cup is

(*a*) 295.75 cm^3 (*b*) 7415.5 cm^3 (*c*) 384.88 cm^3 (*d*) 404.25 cm^3

(*ii*) The volume of hemispherical cup is

(*a*) 179.67 cm^3 (*b*) 89.83 cm^3 (*c*) 172.25 cm^3 (*d*) 210.60 cm^3

(*iii*) Which container had more juice and by how much?

(*a*) Hemispherical cup, 195 cm^3 (*b*) Cylindrical glass, 207 cm^3

(*c*) Hemispherical cup, 280.85 cm^3 (*d*) Cylindrical glass, 314.42 cm^3

(*iv*) The height of the conical tent prepared to accommodate four students is

(*a*) 18 m (*b*) 10 m (*c*) 24 m (*d*) 14 m

(*v*) How much space on the ground is occupied by each student in the conical tent

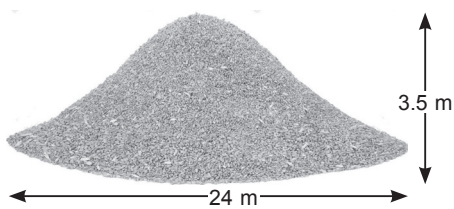
(*a*) 54 m^2 (*b*) 38.5 m^2 (*c*) 86 m^2 (*d*) 24 m^2

Ans. (*i*) (*d*) 404.25 cm^3 (*ii*) (*b*) 89.83 cm^3

(*iii*) (*d*) Cylindrical glass, 314.42 cm^3 (*iv*) (*c*) 24 m

(*v*) (*b*) 38.5 m^2

35. The farmers in the field make a heap of wheat in the field in the form of a cone. The base diameter of heap formed in the field is 24 m and height of heap formed is 3.5 m.



Answer the questions based on above:

(*i*) What will be the slant height of heap formed in the field?

(*a*) 12.5 m (*b*) 10.5 m (*c*) 14.5 m (*d*) 13.5 m

(*ii*) How much canvas cloth is required to just cover the heap?

(*a*) 371. 42 m^2 (*b*) 421.54 m^2 (*c*) 471.42 m^2 (*d*) 321.54 m^2

(*iii*) Find the volume of heap of wheat?

(*a*) 408 m^2 (*b*) 428 m^2 (*c*) 508 m^2 (*d*) 528 m^2

(*iv*) Farmers packed the wheat into bags. If volume of each bag of wheat is 0.48 m^3, then two many bags of wheat can be made?

(*a*) 1 (*b*) 10 (*c*) 2 (*d*) 3

(*v*) What is the base area of field used for making heap?

(*a*) 452.57 m^2 (*b*) 452 m^2 (*c*) 352 m^2 (*d*) 450.57 m^2

Sol. (*i*) (*a*) Diameter of base of heap = 24 m

$$\text{Radius of base of heap} = \frac{24}{2}\text{ m} = 12\text{ m}$$

$$\text{Height of heap} = 3.5\text{ m}$$

Let l be the slant height of heap

$$\therefore \quad l = \sqrt{h^2 + r^2}$$

$$= \sqrt{(12)^2 + (3.5)^2}$$

$$= \sqrt{144 + 12.25} = \sqrt{156.25}$$

$$l = \sqrt{156.25} = 12.5\text{ m}$$

(*ii*) (*c*) Canvas cloth required to cover the heap = πrl

$$= \frac{22}{7} \times 12 \times 12.5$$

$$= 471.42\ m^2$$

(*iii*) (*d*) Volume of heap of wheat = $\frac{1}{3}\pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5$$

$$= 22 \times 4 \times 12 \times 0.5 = 528\ m^3$$

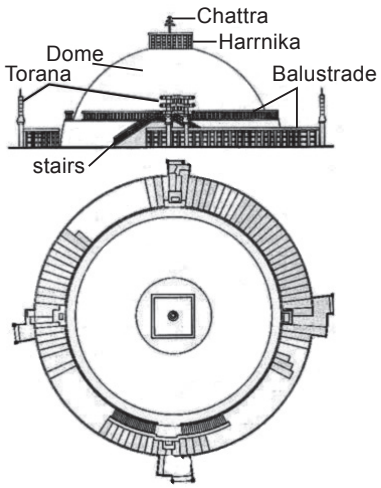
(*iv*) (*a*) Volume of one bag = 0.48 m^3

$$\text{Number of bags required} = \frac{528}{0.48} = 1100 = 1$$

(*v*) (*a*) Base area of heap = πr^2

$$= \frac{22}{7} \times 12 \times 12 = 452.57\ m^2$$

36. The Great **Stupa** at **Sanchi** is one of the oldest stone structures in India, and an important monument of Indian Architecture. It was originally commissioned by the emperor Ashoka in the 3rd century BCE. Its nucleus was a simple hemispherical brick structure built over the relics of the Buddha. It is a perfect example of combination of solid figures. A big hemispherical dome with a cuboidal structure mounted on it. (Take = $\frac{22}{7}$) **[CBSE Question Bank]**



Top view

(*i*) Calculate the volume of the hemispherical dome if the height of the dome is 21 m

(*a*) 19404 cu. m (*b*) 2000 cu .m (*c*) 15000 cu. m (*d*) 19000 cu. m

(*ii*) The formula to find the Volume of Sphere is

(*a*) $\frac{2}{3}\pi r^3$ (*b*) $\frac{4}{3}\pi r^3$ (*c*) $4\pi r^3$ (*d*) $2\pi r^3$

(*iii*) The cloth require to cover the hemispherical dome if the radius of its base is 14 m is

(*a*) 1222 sq. m (*b*) 1232 sq. m (*c*) 1200 sq. m (*d*) 1400 sq. m

(*iv*) The total surface area of the combined figure i.e. hemispherical dome with radius 14 m and cuboidal shaped top with dimensions 8 m × 6 m × 4 m is

(*a*) 1200 sq. m (*b*) 1232 sq. m (*c*) 1392 sq. m (*d*) 1932 sq. m

(*v*) The volume of the cuboidal shaped top is with dimensions mentioned in question 4

(*a*) 182.45 m^3 (*b*) 282.45 m^3 (*c*) 292 m^3 (*d*) 192 m^3

Ans. (*i*) (*a*) 19404 cu. m (*ii*) (*b*) $\frac{4}{3}\pi r^3$ (*iii*) (*b*) 1232 sq. m

(*iv*) (*c*) 1392 sq. m (*v*) (*d*) 192 m^3

14 STATISTICS

Multiple Choice Questions

1. d_i is the deviation of x_i from assumed mean a.

If mean $= x + \dfrac{\Sigma f_i d_i}{\Sigma f_i}$, then x is

(a) class size (b) number of observations

(c) assumed mean (d) none of these

Sol. (c) $\because$ Mean = assumed mean + $\dfrac{\Sigma f_i d_i}{\Sigma f_i}$

$\therefore$ x = assumed mean.

2. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is

(a) 48 (b) 49 (c) 50 (d) 60

Sol. (c) Sum of 100 observations = $100 \times 49 = 4900$

Correct sum = $4900 - [40 + 20 + 50\ ] + [60 + 70 + 80] = 5000$

$\therefore$ Correct mean = $\dfrac{5000}{100} = 50$.

3. Choose the correct answer from the given four options : In the formula

[NCERT Exemplar Problem]

$$\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$$

for finding the mean of grouped data d_i's are deviation from a of

(a) lower limits of the classes (b) upper limits of the classes

(c) mid-points of the classes (d) frequencies of the class marks

Ans. (c) mid-points of the classes.

4. While computing mean of grouped data, we assume that the frequencies are

[NCERT Exemplar Problem]

(a) evenly distributed over all the classes (b) centred at the classmarks of the classes

(c) centred at the upper limits of the classes (d) centred at the lower limits of the classes

Ans. (b) centred at the classmarks of the classes.

5. The A.M. of a set of 50 numbers is 38. If two numbers of the set namely 55 and 45 are discarded, the A.M. of the remaining set of numbers is _____.

(*a*) 40.9 (*b*) 38.6 (*c*) 37.5 (*d*) 35.4

Ans. (*c*) 37.5

6. The class mark of class 10 - 25 is

(*a*) 14.3 (*b*) 16.7 (*c*) 17.5 (*d*) 20.9

Ans. (*c*)

7. If $\Sigma f_i = 11$, $\Sigma f_i x_i = 2p + 52$ and the mean of any distribution is 6, find the value of p.

(*a*) 4 (*b*) 5 (*c*) 6 (*d*) 7

Ans. (*d*)

8. A car travels from city A to city B, 120 km apart at an average speed of 50 km/h. It then makes a return trip at an average speed of 60 km/h. It covers another 120 km distance at an average speed of 40 km/h. The average speed over the entire 360 km will be

(*a*) $\frac{50+60+40}{3}$ km/h (*b*) $\left(\frac{3}{\frac{1}{50}+\frac{1}{60}+\frac{1}{40}}\right)$ km/h

(*c*) $\frac{300}{50+60+40}$ km/h (*d*) none of these

Sol. (*b*) $T_1 = \frac{120}{50}$hrs, $T_2 = \frac{120}{60}$ and $T_3 = \frac{120}{40}$

$$\text{Total time} = \left(\frac{120}{50}+\frac{120}{60}+\frac{120}{40}\right) \text{ hrs}$$

$$\text{Total distance} = 3 \times 120 \text{ km}$$

$$\text{Average speed} = \frac{3\times120}{\frac{120}{50}+\frac{120}{60}+\frac{120}{40}} = \left(\frac{3}{\frac{1}{50}+\frac{1}{60}+\frac{1}{40}}\right) \text{km/h}$$

9. Mean of n numbers $x_1, x_2, \ldots x_n$ is m. If x_n is replaced by x, then new mean is

(*a*) $m - x_n + x$ (*b*) $\frac{nm - x_n + x}{n}$

(*c*) $\frac{(n-1)m + x}{n}$ (*d*) $\frac{m - x_n + x}{n}$

Sol. (*b*) $\text{Mean} = \frac{x_1+x_2+x_3+\ldots+x_n}{n} = m$

$$\Rightarrow \quad x_1 + x_2 + \ldots + x_n = nm$$

$$\Rightarrow \quad x_1 + x_2 + \ldots x_{n-1} + x_n = nm$$

$$\Rightarrow \quad x_1 + x_2 + \ldots + x_{n-1} = nm - x_n$$

$$\text{New sum} = x_1 + x_2 + \ldots + x_{n-1} + x$$

$$\text{New mean} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n} = \frac{nm - x_n + x}{n}$$

10. The abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data gives its

(*a*) mean (*b*) median

(*c*) mode (*d*) all the three above

[NCERT Exemplar Problem]

Ans. (*b*) median

11. If $\bar{x}$ is the mean of a distribution, then $\Sigma f_i (x_i - \bar{x})$ is equal to.

(*a*) 1 (*b*) –1 (*c*) 0 (*d*) $\bar{x}$

Ans. (*c*)

12. For the following distribution:

Marks	Number of Students
Below 10	3
Below 20	12
Below 30	27
Below 40	57
Below 50	75
Below 60	80

the modal class is

(*a*) 10 – 20 (*b*) 20 – 30 (*c*) 30 – 40 (*d*) 50 – 60

Ans. (*c*)

13. A set of numbers consists of four 5's, six 7's, ten 9's, eleven 12's, three 13's, two 14's. The mode of this set of numbers is _____.

(*a*) 10 (*b*) 11 (*c*) 12 (*d*) 13

Ans. (*c*) 12

14. The mode of the numbers 2, 3, 4, 4, 3, 5, 3, 6 is _____.

(*a*) 3 (*b*) 2 (*c*) 4 (*d*) 6

Ans. (*a*) 3

15. The times, in seconds, taken by 150 atheletes to run a 110 m hurdle race are tabulated below:

Class	Frequency
13.8 – 14.0	2
14.0 – 14.2	4
14.2 – 14.4	5
14.4 – 14.6	71
14.6 – 14.8	48
14.8 – 15.0	20

[NCERT Exemplar Problem]

The number of atheletes who completed the race in less then 14.6 seconds is:

(*a*) 11 (*b*) 71 (*c*) 82 (*d*) 130

Ans. (*c*) 82.

16. Mode is the value of the variable which has: **[CBSE 2012]**

(*a*) maximum frequency (*b*) minimum frequency

(*c*) mean frequency (*d*) middle most frequency

Ans. (*a*) Maximum frequency.

17. Mode and mean of a data are $12k$ and $15k$. Median of the data is

(*a*) $12k$ (*b*) $14k$ (*c*) $15k$ (*d*) $16k$

Sol. (*b*) $\because$ Mode $= 3$ median $- 2$ mean

$\Rightarrow$ $12k = 3$ median $- 2 \times 15k$

$\Rightarrow$ $42k = 3$ median

$\Rightarrow$ Median $= 14k$.

18. If mean = (3 median – mode). k, then the value of k is

(*a*) 1 (*b*) 2 (*c*) $\frac{1}{2}$ (*d*) $\frac{3}{2}$

Sol. (*c*) $\because$ Mode $= 3$ median $- 2$ mean

$\Rightarrow$ 2 mean $= 3$ median $-$ mode

$\Rightarrow$ mean $= \frac{1}{2}(3 \text{ median} - \text{mode})$

$\Rightarrow$ $k = \frac{1}{2}$

19. If the mode of a data is 18 and the mean is 24, then median is:

(*a*) 10 (*b*) 15 (*c*) 22 (*d*) 24

Ans. (*c*)

20. Construction of Cumulative frequency table is useful in determining the:

(*a*) median (*b*) mean (*c*) class mark (*d*) assumed mean

Ans. (*a*)

21. The median of set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set.

(*a*) is increased by 2

(*b*) is decreased by 2

(*c*) is two times of the original number

(*d*) Remains the same as that of the original set.

Sol. (*d*) No. of observations = 9

$\therefore$ median = 5th observation

$\because$ The largest four observations are increased

$\therefore$ 5th observation remains unchanged.

22. The median from the table is

Value	7	8	9	10	11	12	13
Frequency	2	1	4	5	6	1	3

(*a*) 11 (*b*) 10 (*c*) 12 (*d*) 11.5

Sol. (*b*)

Value	7	8	9	10	11	12	13
f	2	1	4	5	6	1	3
c.f.	2	3	7	12	18	19	22

$n = 22 \Rightarrow \frac{n}{2} = 11$, so, median is 10

Median = mean of 11th and 12th observations = 10.

23. The relationship between mean, median and mode for a moderately skewed distribution is

(*a*) mode = median – 2 mean (*b*) mode = 3 median – 2 mean

(*c*) mode = 2 median – 3 mean (*d*) mode = median – mean

Ans. (*b*) Mode = 3 median – 2 mean

24. In an arranged series of an even number of $2n$ terms, the median is:

(*a*) mean of n^{th} term (*b*) Both (*a*) and (*b*)

(*c*) mean of $(n + 1)^{th}$ term (*d*) Neither (*a*) nor (*b*)

Ans. (*c*)

25. The mean age of combined group of men and women is 30 years. If the mean of the age of men and women are respectively 32 and 27, then the percentage of women in the group is

(*a*) 30 (*b*) 20 (*c*) 50 (*d*) 40

Sol. (*d*) Let no. of men = x, women = y.

Total age of the group = $30(x + y)$

Total age of men = $32x$,

Total age of women = $27y$

$\Rightarrow \quad 30(x + y) = 32x + 27y$

$\Rightarrow \quad 30x + 30y = 32x + 27y$

$\Rightarrow \quad x = \frac{3}{2}y$

$\therefore \quad \%$ of women $= \frac{y}{x+y} \times 100$

$\Rightarrow \quad \frac{y}{\frac{3}{2}y+y} \times 100 = 40\%$

26. The middle most observation of a statistical data has value which is called

(*a*) mean of the data (*b*) mode of the data

(*c*) median of the data (*d*) none of these

Ans. (*c*) Definition of median

27. The mean and median of the same data are 24 and 26 respectively. The value of mode is: **[CBSE 2011]**

(*a*) 23 (*b*) 26 (*c*) 25 (*d*) 30

Sol. (*d*) Mode = 3 median – 2 mean = $3 \times 26 - 2 \times 24 = 78 - 48 = 30$

28. Which of the following is not a measure of central tendency: **[CBSE 2011]**

(*a*) Mean (*b*) Median (*c*) Class interval (*d*) Mode

Ans. (*c*) Class Interval.

29. The mean of 5 numbers is 18. One number is excluded their mean becomes 16. Then the excluded number is _____.

(*a*) 15 (*b*) 25 (*c*) 26 (*d*) 30

Ans. (*c*) 26

30. The mean of first n natural numbers is;

(*a*) $\frac{n}{2}$ (*b*) $\frac{n+1}{2}$ (*c*) $\frac{n-1}{2}$ (*d*) $\frac{n^2}{2}$

Ans. (*b*)

31. If the difference of mode and median of a data is 26, then the difference of median and mean is

(*a*) 13 (*b*) 26 (*c*) 8 (*d*) 32

Ans. (*a*)

32. The arithmetic mean of the following frequency distribution is 70, the value of p is:

Class	Frequency
0 – 10	12
10 – 20	10
20 – 30	p
30 – 40	20
40 – 50	30

(*a*) 50 (*b*) 57 (*c*) 67 (*d*) 77

Ans. (*c*)

Assertion and Reasoning

33. **Assertion (A):** The arithmetic mean of the following given distribution table is 20.

x	7	10	13	16	19
y	2	6	8	10	12

Reason (R): Mean $= l + \left(\dfrac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

Ans. (*b*)

34. **Assertion (A):** If the value of mode and mean is 60 and 66 respectively, then the value of median is 64.

Reason (R): Median = (mode + 2 mean)

Ans. (*c*)

35. **Assertion (A):** If the median of the given data 30, 20, 40, 50, x, $x + 2$, 70, 80 is 68, then the value of x is 59.

Reason (R): When the number of observations (n) is odd, the median is the value of the $\left(\dfrac{n+1}{2}\right)^{\text{th}}$ observation

Ans. (*b*)

36. The modal value of a Mathematics test in a school

In a school there are a total of 130 students studying in class X. In a mathematic test of maximum marks 60 the scoring pattern of the students is given in the following table.

Marks	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	Total
	12	35	45	25	13	130

Answer the following questions based on the above information.

(*i*) Which is the modal class out of the following:

(*a*) 10 – 20 (*b*) 12 – 30 (*c*) 30 – 40 (*d*) 40 – 50

(*ii*) What is the lower limit of the modal class?

(*a*) 20 (*b*) 30 (*c*) 40 (*d*) 50

(*iii*) What is the modal frequency?

(*a*) 45 (*b*) 35 (*c*) 25 (*d*) 13

(*iv*) What is the mode of frequency distribution correct upto two places of decimal?

(*a*) 23.33 (*b*) 33.33 (*c*) 43.44 (*d*) 36.33

(*v*) How many students scored more than 40?

(*a*) 45 (*b*) 37 (*c*) 83 (*d*) 38

Ans. (*i*) (*c*), (*ii*) (*b*), (*iii*) (*a*), (*iv*) (*b*), (*v*) (*d*)

37. In a village of 150 people, the 40 plus age group have already been vaccinated. the rest of 100 people are to be vaccinated in the next round. the frequency distribution of age group is given as follows:

Age in yrs	No. of people
0 – 5	7
5 – 10	10
10 – 15	17
15 – 20	13
20 – 25	20
25 – 30	10
30 – 35	14
35 – 40	9
Total	**100**

Based on the above information answer the following questions.

(*i*) What is the median of class?

(*a*) 10 – 20 (*b*) 15 – 20 (*c*) 20 – 25 (*d*) 25 – 30

(*ii*) What is the lower limit of the median class?

(*a*) 20 (*b*) 15 (*c*) 10 (*d*) 25

(*iii*) What is the median of the frequency distribution?

(*a*) 20 (*b*) 20.75 (*c*) 25.75 (*d*) 22.75

(*iv*) What is the modal class of the distribution?

(*a*) 5 – 10 (*b*) 10 – 15 (*c*) 15 – 20 (*d*) 20 – 25

(*v*) What is the mode of the frequency distribution?

(*a*) 20.12 (*b*) 22.12 (*c*) 22.05 (*d*) 26.12

Sol. The cumulative frequency distribution of the given distribution is as follows:

Class	No. of people	Cumulative frequency
0 – 5	7	7
5 – 10	10	17
10 – 15	17	34
15 – 20	13	47
20 – 25	20	67
25 – 30	10	77
30 – 35	14	91
35 – 40	9	100

(*i*) (*c*) Here we have $n = 100$ Then $\frac{n}{2} = 50$. Therefore cumulative frequency just above 50 is 67. Therefore the Median class is 20 – 25.

(*ii*) (*a*) The lower limit of the Median class is I = 20.

(*iii*) (*b*) For Median I = 20, $\frac{n}{2} = 50$, $cf = 47$, $h = 5$

$$\text{Therefore Median} = l + \left[\frac{\left(\frac{n}{2} - cf\right)}{20}\right] \times 5 = 20 + \left[\frac{(50-47)}{20}\right] \times 5 = 20 + \frac{3}{4} = 20.75$$

(*iv*) (*d*) As the maximum frequency is 20. Therefore the Modal class is 20 – 25.

(*v*) (*c*) For Mode I = 20, $f_m = 20, f_1 = 13, f_2 = 10, h = 5$

$$\text{Therefore} \qquad \text{Mode} = \text{I} + \left\{\frac{f_m - f_1}{2f_m - f_1 - f_2}\right\} \times 5$$

$$= 20 + \frac{20-13}{2(20)-13-10} \times 5 = 20 + \frac{7}{17} \times 5$$

$$= 20 + 2.05 = 22.05$$

38. A survey regarding the height (in cm) of 51 girls of class X in a school was conducted and the following data was obtained:

Height (in cm)	No. of girls
Less than 140	4
Less than 145	11
Less than 150	29
Less than 155	40
Less than 160	46
Less than 165	51

From the above information answer the following questions.

(*i*) How many girls are below 55 cm?

(*a*) 29 (*b*) 46 (*c*) 51 (*d*) 40

(*ii*) What is the median class?

(*a*) 145 – 150 (*b*) 140 – 145 (*c*) 150 – 155 (*d*) 155 –160

(*iii*) What is the length of each class?

(*a*) 2 (*b*) 4 (*c*) 5 (*d*) 10

(*iv*) What is the Median frequency?

(*a*) 29 (*b*) 18 (*c*) 11 (*d*) 40

(*v*) What is the median value of the heights of the girls? (correct upto two places of decimal)

(*a*) 149.03 (*b*) 145.03 (*c*) 140.03 (*d*) 159.03

Ans. (*i*) (*d*), (*ii*) (*i*), (*iii*) (*c*), (*iv*) (*b*), (*v*) (*a*)

Part-II

[Practice Papers]

1 | PRACTICE PAPER

[Time Allowed: 90 minutes] [Maximum Marks: 40]

General Instructions:

1. This question paper contains three parts A, B and C.
2. Section A consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.
3. Section B consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.
4. Section C consists of 10 questions based on two Case Studies. Attempt any 8 questions.
5. There is no negative marking.

Section A

Section A consists of 20 questions of 1 mark each. Any 16 questions are to be attempted

1. If $(1 - p)$ is a root of the equation $x^2 + px + 1 - p = 0$, then roots are

(a) 0, 1 (b) – 1, 1 (c) 0, – 1 (d) – 1, 2

Sol. (c) $(1 - p)$ is a root

$\therefore \quad (1-p)^2 + p(1-p) + 1 - p = 0$

$\Rightarrow \quad (1-p)[1 - p + p + 1] = 0$

$\Rightarrow \quad (1-p)(2) = 0 \Rightarrow p = 1$

$x^2 + x = 0$

One root = 0 and another root = – 1

$\therefore$ roots are 0 and –1.

2. A tangent PQ at a point P of a circle of radius 5 cm meets a line through the centre O at a point Q so that OQ = 12cm. Length of PQ is

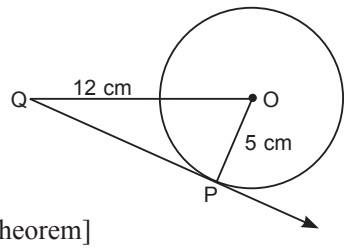
(a) 12 cm (b) 13 cm (c) 8.5 cm (d) $\sqrt{119}$ cm

Sol. (*d*) Radius of the circle = 5 cm

OQ = 12 cm

$\angle OPQ = 90°$

[The tangent to a circle is perpendicular to the radius through the point of contact]



$PQ^2 = OQ^2 - OP^2$ [By Pythagoras theorem]

$PQ^2 = 12^2 - 5^2 = 144 - 25 = 119$

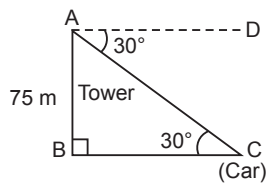
$PQ = \sqrt{119}$ cm.

Hence, correct option is (*d*).

3. The angle of depression of a car, standing on the ground, from the top of a 75 m high tower, is 30°. The distance of the car from the base of the tower (in m) is:

(*a*) $25\sqrt{3}$ (*b*) $50\sqrt{3}$ (*c*) $75\sqrt{3}$ (*d*) 150

Sol. (*c*) In ΔABC,



$$\frac{AB}{BC} = \tan 30°$$

$$\Rightarrow \quad \frac{75}{BC} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad BC = 75\sqrt{3} \text{ m}$$

4. Match the column:

(1) Volume of right cylinder	(A) $2lbh$
(2) Volume of cuboid	(B) $l \times b \times h$
(3) Volume of right cone	(C) $\pi r^2 h$
(4) Volume of sphere	(D) $\frac{1}{3}\pi r^2 h$ (E) $2\pi r^2 h$ (F) $\frac{4}{3}\pi r^3$

(*a*) 1 → C, 2 → A, 3 → D, 4 → F (*b*) 1 → C, 2 → A, 3 → D, 4 → E

(*c*) 1 → C, 2 → B, 3 → D, 4 → F (*d*) 1 → C, 2 → A, 3 → F, 4 → D

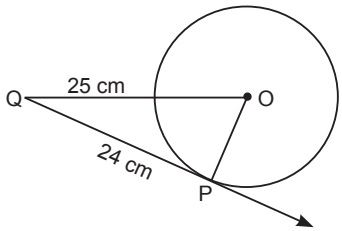
Ans. (*c*) Formulae.

5. From a point Q, the length of the tangent to a circle is 24 cm and the distance of Q from the centre is 25 cm. The radius of the circle is

(*a*) 7 cm (*b*) 12 cm (*c*) 15 cm (*d*) 24.5 cm

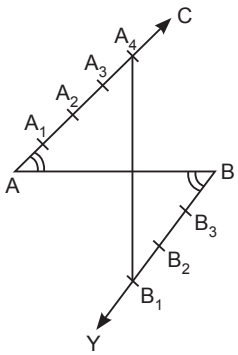
Sol. (*a*) From figure

$$OQ^2 = OP^2 + PQ^2$$
$$(25)^2 = OP^2 + (24)^2$$
$$\Rightarrow \quad 625 - 576 = OP^2$$
$$\Rightarrow \quad 49 = OP^2$$
$$\Rightarrow \quad OP = \sqrt{49}$$
$$OP = 7 \text{ cm}$$



Radius of the circle = 7 cm. Hence, correct option is (*a*).

6.



In the given figure, find the ratio, when X divides AB internally.

(*a*) 3 : 4 (*b*) 4 : 3 (*c*) 5 : 2 (*d*) 3 : 5

Ans. (*b*) 4 : 3

7. If α, β are roots of the equation $x^2 + 5x + 5 = 0$, then equation whose roots are $\alpha + 1$ and $\beta + 1$ is

(*a*) $x^2 + 5x - 5 = 0$ (*b*) $x^2 + 3x + 5 = 0$

(*c*) $x^2 + 3x + 1 = 0$ (*d*) none of these

Sol. (*c*) $\alpha + \beta = -5$, $\alpha\beta = 5$.

Required equation is $x^2 - (\alpha + 1 + \beta + 1)x + (\alpha + 1)(\beta + 1) = 0$

$\Rightarrow x^2 - (\alpha + \beta + 2)x + (\alpha\beta + \alpha + \beta + 1) = 0$

$\Rightarrow x^2 - (-5 + 2)x + (5 - 5 + 1) = 0$

$\Rightarrow x^2 + 3x + 1 = 0$

8. A car travels from city A to city B, 120 km apart at an average speed of 50 km/h. It then makes a return trip at an average speed of 60 km/h. It covers another 120 km distance at an average speed of 40 km/h. The average speed over the entire 360 km will be

(*a*) $\dfrac{50+60+40}{3}$ km/h (*b*) $\left(\dfrac{3}{\frac{1}{50}+\frac{1}{60}+\frac{1}{40}}\right)$ km/h

(*c*) $\dfrac{300}{50+60+40}$ km/h (*d*) none of these

Sol. $(b)\ T_1 = \frac{120}{50}$ hrs, $T_2 = \frac{120}{60}$ and $T_3 = \frac{120}{40}$

$$\text{Total time} = \left(\frac{120}{50} + \frac{120}{60} + \frac{120}{40}\right) \text{ hrs}$$

$$\text{Total distance} = 3 \times 120 \text{ km}$$

$$\text{Average speed} = \frac{3 \times 120}{\frac{120}{50} + \frac{120}{60} + \frac{120}{40}} = \left(\frac{3}{\frac{1}{50} + \frac{1}{60} + \frac{1}{40}}\right) \text{km/h}$$

9. A sphere of diameter 18 cm is dropped into a cylindrical vessel of diameter 36 cm, partly filled with water. If the sphere is completely submerged, then the water level rises (in cm) by

(*a*) 3 (*b*) 4 (*c*) 5 (*d*) 6

Sol. (*a*) 3 cm, Volume of sphere = Volume of water in cylindrical vessel

$$\frac{4}{3}\pi r^3 = \pi r^2 h$$

$$\Rightarrow \quad \frac{4}{3} \times 9 \times 9 \times 9 = 18 \times 18 \times h \qquad \left[\because r = \frac{d}{2}\right]$$

$$\Rightarrow \quad \frac{4 \times 9 \times 9 \times 9}{3 \times 18 \times 18} = h$$

$$\Rightarrow \quad h = 3 \text{ cm}$$

$\therefore$ Water level rises by 3 cm

10. Which of the following equations has two distinct real roots?

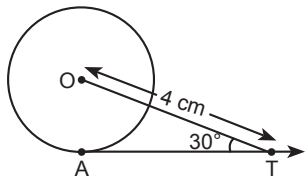
(*a*) $2x^2 - 3\sqrt{2}x + \frac{9}{4} = 0$ (*b*) $x^2 + x - 5 = 0$

(*c*) $x^2 + 3x + 2\sqrt{2} = 0$ (*d*) $5x^2 - 3x + 1 = 0$

Ans. (*b*) The equation which satisfies the condition $D > 0$ is having two distinct roots.

11. In figure AT is a tangent to the circle with centre O such that OT = 4 cm and $\angle OTA = 30°$. Then AT is equal to

(*a*) 4 cm (*b*) 2 cm (*c*) $2\sqrt{3}$ cm (*d*) $4\sqrt{3}$ cm



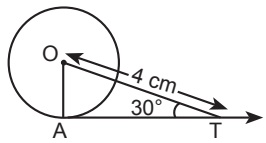
Sol. (*c*) $\angle OAT = 90^\circ$ [$\because$ Tangent and radius are $\perp$ to each other at the point of contact]

In right-angled ΔOAT,

$$\frac{AT}{OT} = \cos 30^\circ$$

$$\Rightarrow \quad \frac{AT}{4} = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \quad AT = 2\sqrt{3} \text{ cm.}$$



12. While computing mean of grouped data, we assume that the frequencies are

(*a*) evenly distributed over all the classes (*b*) centred at the classmarks of the classes

(*c*) centred at the upper limits of the classes (*d*) centred at the lower limits of the classes

Sol. (*b*) centred at the classmarks of the classes.

13. A right circular cylinder of radius r cm and height h cm ($h > 2r$) just encloses a sphere of diameter

(*a*) r cm (*b*) $2r$ cm (*c*) h cm (*d*) $2h$ cm

Sol. (*b*) $2r$ cm.

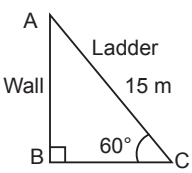
14. A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then the height of the wall is

(*a*) $15\sqrt{3}$ m (*b*) $\frac{15\sqrt{3}}{2}$ m (*c*) $\frac{15}{2}$ m (*d*) 15 m

Sol. (*b*) In ΔABC,

$$\frac{AB}{AC} = \sin 60^\circ$$

$$\Rightarrow \quad \frac{AB}{15} = \frac{\sqrt{3}}{2} \quad \Rightarrow \quad AB = \frac{15\sqrt{3}}{2} \text{ m}$$



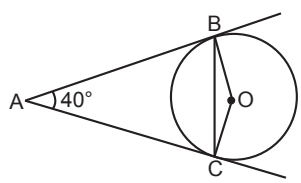
15. In the given figure, AB and AC are tangents to the circle with centre O such that $\angle BAC = 40^\circ$, then $\angle BOC$ is equal to

(*a*) 40°

(*b*) 50°

(*c*) 140°

(*d*) 150°



Sol. (*c*) In quadrilateral ABOC

$$\angle ABO + \angle BOC + \angle OCA + \angle BAC = 360^\circ$$

$$\Rightarrow \quad 90^\circ + \angle BOC + 90^\circ + 40^\circ = 360^\circ$$

$$\Rightarrow \quad \angle BOC = 360^\circ - 220^\circ = 140^\circ$$

16. The ratio of the volume of a cube to that of a sphere which will fit inside the cube is _____.

(*a*) 2 : π (*b*) 3 : π (*c*) 5 : π (*d*) 6 : π

Sol. (*d*) [6 : π] **Hint:**

Let side of cube = x ∴ Volume of cube = x^3

Diameter of sphere = x ⇒ radius = $\frac{x}{2}$

Volume of sphere = $\frac{4}{3}\pi\left(\frac{x}{2}\right)^3$

∴ Required ratio

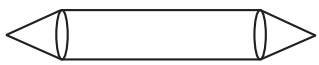
$x^3 : \frac{4}{3}\pi\left(\frac{x}{2}\right)^3 = 6 : \pi.$

17. To divide a line segment AB in the ratio 4 : 3, first a ray AX is drawn, so that ∠BAX is an acute angle and then at equal distances points are marked one the ray AX such that the maximum number of these points is:

(*a*) 4 (*b*) 3 (*c*) 6 (*d*) 7

Ans. (*d*) 7

18. The shape of a *gilli*, in the *gilli-danda* game (see Fig.), is a combination of



(*a*) two cylinders (*b*) a cone and a cylinder

(*c*) two cones and a cylinder (*d*) two cylinders and a cone

Sol. (*c*) Two cones and a cylinder.

19. If the roots of $ax^2 + bx + c = 0$ are equal in magnitude but opposite in sign, then

(*a*) $a = 0$ (*b*) $b = 0$ (*c*) $c = 0$ (*d*) none of these

Sol. (*b*) ∵ sum of roots = 0

⇒ $-\frac{b}{a} = 0$ ⇒ $b = 0$

20. The angle of elevation of the top of a tower from a point 20 metres away from its base is 45°. The height of the tower is

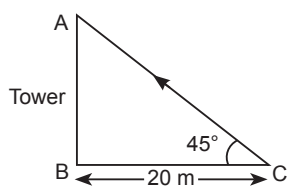
(*a*) 10 m (*b*) 20 m (*c*) 30 m (*d*) $20\sqrt{3}$ m

Sol. (*b*) 20 m,

$\frac{AB}{BC} = \tan 45°$

⇒ $\frac{AB}{20} = 1$

⇒ $AB = 20$ m.



Section B

Section B consists of 20 questions of 1 mark each. Any 16 questions are to be attempted

21. The line drawn from the eye of an observer to the point in the object viewed by the observer is known as

(*a*) horizontal line (*b*) vertical line (*c*) line of sight (*d*) transversal line

Sol. (*c*) line of sight

22. How many bags of grain can be stored in a cuboid granary 12 m × 6 m × 5 m. If each bag occupies a space of 0.48 m^3?

(*a*) 750 (*b*) 75 (*c*) 1500 (*d*) 375

Sol. (*a*) No. of bags $= \dfrac{\text{volume of granary}}{\text{volume of one bag}} = \dfrac{12 \times 6 \times 5}{0.48}$

$= 750.$

23. If the difference of the roots of the equation $x^2 - bx + c = 0$ be 1, then

(*a*) $b^2 - 4c + 1 = 0$ (*b*) $b^2 + 4c = 0$

(*c*) $b^2 - 4c - 1 = 0$ (*d*) $b^2 - 4c = 0$

Sol. (*c*) Let roots are α and β

$\Rightarrow \quad \alpha - \beta = 1$

$\because \quad (\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$

$\Rightarrow \quad 1 = b^2 - 4c \Rightarrow b^2 - 4c - 1 = 0$

24. Two poles are 25 m and 15 m high and the line joining their tops makes an angle of 45° with the horizontal. The distance between these poles is

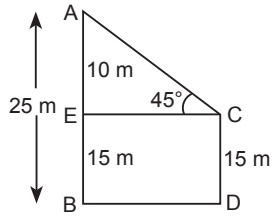
(*a*) 5 m (*b*) 8 m (*c*) 9 m (*d*) 10 m

Sol. (*d*) 10 m,

$$\frac{AE}{EC} = \tan 45°$$

$$\Rightarrow \quad \frac{10}{EC} = 1$$

$$\Rightarrow \quad EC = 10 \text{ m}.$$



25. Choose the correct answer from the given four options : In the formula

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

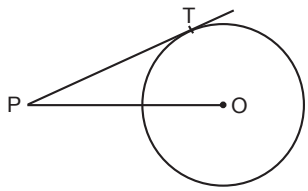
for finding the mean of grouped data d_i's are deviation from ***a*** of

(*a*) lower limits of the classes (*b*) upper limits of the classes

(*c*) mid-points of the classes (*d*) frequencies of the class marks

Sol. (*c*) mid-points of the classes.

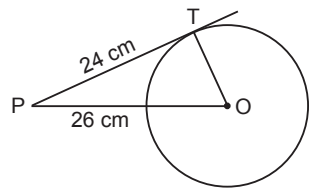
26. In the given figure, point P is 26 cm away from the centre O of a circle and the length PT of the tangent drawn from P to the circle is 24 cm. Then the radius of the circle is



(*a*) 25 cm (*b*) 26 cm (*c*) 24 cm (*d*) 10 cm

Sol. (*d*) $\because$ OT is radius and PT is tangent

$\therefore$ OT $\perp$ PT



Now, in ΔOTP,

$$OP^2 = PT^2 + OT^2$$

$$\Rightarrow \quad 26^2 = 24^2 + OT^2$$

$$\Rightarrow \quad 676 - 576 = OT^2$$

$$\Rightarrow \quad 100 = OT^2 \Rightarrow 10 \text{ cm} = OT$$

27. The radius (in cm) of the largest right circular cone that can be cut out from a cube of edge 4.2 cm is

(*a*) 4.2 (*b*) 2.1 (*c*) 8.1 (*d*) 1.05

Sol. (*b*) Edge of the cube = 4.2 cm

Diameter of base of largest possible cone = 4.2 cm

$\therefore$ Radius $= \frac{4.2}{2} = 2.1$ cm

28. If p, q and r are rational numbers and $p \neq q \neq r$, then roots of the equation $(p^2 - q^2)x^2 - (q^2 - r^2)x + (r^2 - p^2) = 0$ are

(*a*) $\frac{p}{q}, \frac{r}{p}$ (*b*) $\frac{p^2}{q^2}, \frac{r^2}{q^2}$ (*c*) $1, \frac{p^2 - q^2}{r^2 - p^2}$ (*d*) $-1, \frac{p^2 - r^2}{p^2 - q^2}$

Sol. (*d*) Putting $x = -1$, we have

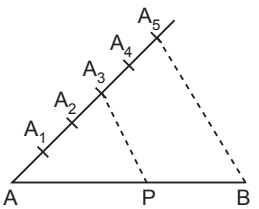
$(p^2 - q^2)(-1)^2 - (q^2 - r^2)(-1) + (r^2 - p^2)$

$\Rightarrow \quad p^2 - q^2 + q^2 - r^2 + r^2 - p^2 = 0$

$\therefore$ $x = -1$ is one root. Only option (*d*) has one root -1.

29. The ratio of division of the line segment AB by the point P from A in the following figure is:

(*a*) 2 : 3 (*b*) 3 : 2 (*c*) 3 : 5 (*d*) 2 : 5



Ans. (*d*)

30. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is

(*a*) 48 (*b*) 49 (*c*) 50 (*d*) 60

Sol. (*c*) Sum of 100 observations = $100 \times 49 = 4900$

Correct sum = $4900 - [40 + 20 + 50\ ] + [60 + 70 + 80] = 5000$

$\therefore$ Correct mean = $\dfrac{5000}{100} = 50.$

31. C(O, r_1) and C(O, r_2) are two concentric circles with $r_1 > r_2$. AB is a chord of C(O, r_1) touching C(O, r_2) at C then

(*a*) AB = r_1 (*b*) AB = r_2

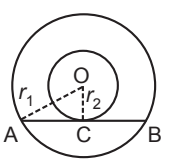
(*c*) AC = BC (*d*) AB = $r_1 + r_2$

Sol. (*c*) $\because$ AB touches C(O, r_2)

$\therefore$ OC $\perp$ AB

Also, perpendicular from the centre to a chord bisects the chord.

$\therefore$ AC = BC



32. A portion of a 60 m long tree is broken by tornado and the top struck up the ground making an angle of 30° with the ground level. The height of the point where the tree is broken is equal to

(*a*) 30 m (*b*) 35 m (*c*) 40 m (*d*) 20 m

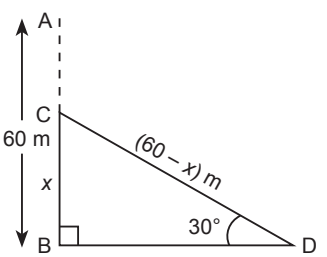
Sol. (*d*) Let AB is the tree which is broken at C.

$$\frac{BC}{DC} = \sin 30°$$

$$\Rightarrow \quad \frac{x}{60 - x} = \frac{1}{2}$$

$$\Rightarrow \quad 2x = 60 - x$$

$$\Rightarrow \quad x = 20 \text{ m}$$



33. A rectangular block 6 cm × 12 cm × 15 cm is cut into exact number of equal cubes. The least possible number of cubes will be

(*a*) 6 (*b*) 11 (*c*) 33 (*d*) 40

Sol. (*d*) Volume of rectangular block = $6 \times 12 \times 15 = 1080$ cm^3

Side of largest cube = HCF of 6, 12, 15 = 3

$\therefore$ Volume of 1 cube = $3^3 = 27$ cm^3

$$\text{Number of cubes} = \frac{6 \times 12 \times 15}{27} = 40$$

34. d_i is the deviation of $\boldsymbol{x}_i$ from assumed mean a. If mean = $\boldsymbol{x} + \dfrac{\sum f_i d_i}{\sum f_i}$, then $\boldsymbol{x}$ is

(*a*) class size (*b*) number of observations

(*c*) assumed mean (*d*) none of these

Sol. (c) $\because$ $\text{Mean} = \text{assumed mean} + \dfrac{\sum f_i d_i}{\sum f_i}$

$\therefore$ x = assumed mean.

35. If two solid hemispheres of the same base radius r are joined together along their bases, then curved surface area of this new solid is

(*a*) $4\pi r^2$ (*b*) $6\pi r^2$ (*c*) $3\pi r^2$ (*d*) $8\pi r^2$

Ans. (*a*) $4\pi r^2$

36. If p, q, r are in AP, then $p^3 + r^3 - 8q^3$ is equal to

(*a*) $4pqr$ (*b*) $-6pqr$ (*c*) $2pqr$ (*d*) $8pqr$

Sol. (*b*) $\because$ p, q, r are in AP.

$\therefore$ $2q = p + r$

$\Rightarrow$ $p + r - 2q = 0$

$\therefore$ $p^3 + r^3 + (-2q)^3 = 3 \times p \times r \times -2q$

[Using if $a + b + c = 0 \Rightarrow a^3 + b^3 + c^3 = 3abc$]

$\Rightarrow$ $p^3 + r^3 - 8q^3 = -6pqr$.

37. A circle touches x-axis at A and y-axis at B. If O is origin and OA = 5 units, then diameter of the circle is

(*a*) 8 units (*b*) 10 units (*c*) $10\sqrt{2}$ units (*d*) $8\sqrt{2}$ units

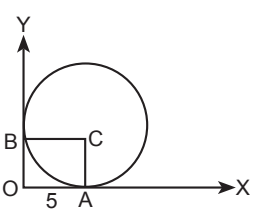
Sol. (*b*) OA = OB $\Rightarrow$ OB = 5

AC = BC [Radii]

$\Rightarrow$ OACB is a square.

$\Rightarrow$ AC = OA = 5

$\Rightarrow$ Diameter = 10 units.



38. A cube whose edge is 20 cm long, has circles on each of its faces painted black. What is the total area of the unpainted surface of the cube if the circles are of the largest possible areas?

(*a*) 90.72 cm^2 (*b*) 256.72 cm^2 (*c*) 330.3 cm^2 (*d*) 514.28 cm^2

Sol. (*d*) Diameter of largest circle = 20 cm.

$\therefore$ Area of circle = 100π cm^2

$\therefore$ Area of 6 circles = $6 \times 100\pi = 600\pi$ cm^2 ($\because$ there are six faces in a cube)

Also, Area of cube = $6 \times (20)^2 = 2400$ cm^2

Area of unpainted surface = $2400 - 600\pi$

$$= 2400 - 600 \times \frac{22}{7} = 514.28 \text{ cm}^2.$$

39. If at some time, the length of the shadow of a tower is $\sqrt{3}$ times its height, then the angle of elevation of the Sun, at that time, is

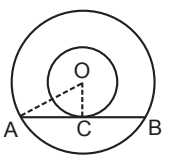
(*a*) 15° (*b*) 30° (*b*) 45° (*d*) 60°

Ans. (*b*)

40. Two concentric circles are of radii 13 cm and 5 cm. The length of the chord of larger circle which touches the smaller circle is _____.

Sol. 24 cm. Hint: $\because$ AB touches the smaller circle

$\therefore$ OC $\perp$ AB and hence AC = BC



In right ΔOCA,

$$OA^2 = OC^2 + AC^2$$

$\Rightarrow$ $AC^2 = 13^2 - 5^2$

$\Rightarrow$ $AC = 12$

$\therefore$ $AB = 2 \times 12 = 24$ cm.

Section C

Case study Questions

Section C consists of 10 questions of 1 mark each. Any 8 questions are to be attempted

Case study - 1

India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year.

Based on the above information, answer the following questions:

41. Find the production during first year.

(*a*) 5000 (*b*) 4000 (*c*) 6000 (*d*) 5500

Ans. (*a*) 5000

42. Find the production during 8th year.

(*a*) 10,400 (*b*) 20,600 (*c*) 20,400 (*d*) 20,000

Ans. (*c*) Production during 8th year is $(a + 7d) = 5000 + 2(2200) = 20400$

43. Find the production during first 3 years.

(*a*) 20,600 (*b*) 20,900 (*c*) 20,400 (*d*) 21,600

Ans. (*d*) Production during first 3 year = 5000 + 7200 + 9400 = 21600

44. In which year, the production is ₹ 29,200.

(*a*) N = 12 (*b*) N = 21 (*c*) N = 14 (*d*) N = 16

Ans. (*a*) N=12

45. Find the difference of the production during 7th year and 4th year.

(*a*) 6400 (*b*) 3200 (*c*) 3300 (*d*) 6600

Ans. (*d*) Difference = 18200 – 11600 = 6600

Case study - 2: (The modal value of a Mathematics test in a school)

In a school there are a total of 130 students studying in class X. In a mathematics test of maximum marks 60 the scoring pattern of the students is given in the following table.

Marks	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	Total
Frequency	12	35	45	25	13	130

Answer the following questions based on the above information:

46. Which is the modal class out of the following:

(*a*) 10 – 20 (*b*) 12 – 30 (*c*) 30 – 40 (*d*) 40 – 50

Ans. (*c*)

47. What is the lower limit of the modal class?

(*a*) 20 (*b*) 30 (*c*) 40 (*d*) 50

Ans. (*b*)

48. What is the modal frequency?

(*a*) 45 (*b*) 35 (*c*) 25 (*d*) 13

Ans. (*a*)

49. What is the mode of frequency distribution correct upto two places of decimal?

(*a*) 23.33 (*b*) 33.33 (*c*) 43.44 (*d*) 36.33

Ans. (*b*)

50. How many students scored more than 40?

(*a*) 45 (*b*) 37 (*c*) 83 (*d*) 38

Ans. (*d*)

2 | PRACTICE PAPER

[Time Allowed: 90 minutes] [Maximum Marks: 40]

General Instructions:

1. This question paper contains three parts A, B and C.
2. Section A consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.
3. Section B consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.
4. Section C consists of 10 questions based on two Case Studies. Attempt any 8 questions.
5. There is no negative marking.

Section – A

Section A consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.

1. If $(1 - b)$ is a root of quadratic equation $x^2 + bx + 1 - b = 0$, then its roots are

(*a*) 0, 1 (*b*) 0, –1 (*c*) –1, 1 (*d*) 0, 2

Ans. (*b*)

2. In an AP, if $a = 3.5$, $d = 0$, $n = 101$, then a_n will be

(*a*) 0 (*b*) 3.5 (*c*) 103.5 (*d*) 104.5

Sol. (*b*) $a_{101} = 3.5 + 0\ (100) = 3.5$

3. A pair of tangents can be constructed to a circle inclined at an angle of 130°

(*a*) False (*b*) True

(*c*) Can't determined (*d*) Insufficient information

Ans. (*b*)

4. Length of the shadow of a person is x when the angle of elevation of the Sun is 45°. If the length of the shadow increases by $(\sqrt{3} - 1)\,x$, then the angle of elevation of the Sun should become

(*a*) 60° (*b*) 45° (*c*) 30° (*d*) 20°

Ans. (*c*)

5. A right circular cylinder of radius r cm and height h cm ($h > 2r$) just encloses a sphere of diameter

(*a*) r cm (*b*) $2r$ cm (*c*) h cm (*d*) $2h$ cm

Ans. (*b*) $2r$ cm.

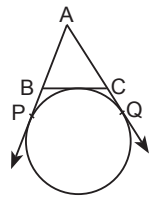
6. The list of numbers –10, –6, –2, 2, ... is

(*a*) an AP with $d = -16$ (*b*) an AP with $d = 4$

(*c*) an AP with $d = -4$ (*d*) not an AP

Sol. (*b*) An AP with $d = 4$.

7. In figure, AP, AQ and BC are tangents to the circle. If AB = 5 cm, AC = 6 cm and BC = 4 cm, then the length of AP (in cm) is



(*a*) 7.5 (*b*) 15

(*c*) 10 (*d*) 9

Sol. (*a*)

$$AP = AQ$$

$$\Rightarrow \quad AB + BP = AC + CQ$$

$$\Rightarrow \quad 5 + BP = 6 + CQ$$

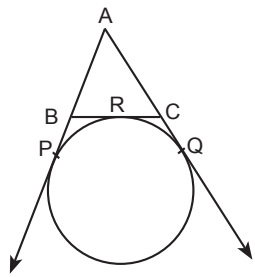
$$BP = 1 + CQ$$

$$BP = 1 + CR \ (\because \ CQ = CR)$$

$$BP = 1 + (BC - BR)$$

$$BP = 1 + (4 - BP) \ (\because \ BR = BP)$$

$$2BP = 5 \Rightarrow BP = \frac{5}{2} = 2.5 \text{ cm}$$



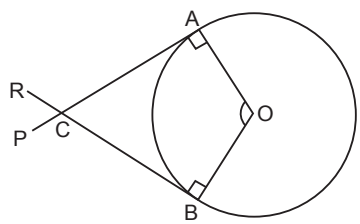
Now, $AP = AB + BP = 5 + 2.5 = 7.5$ cm

8. The roots of the equation $x^2 + x - p(p + 1) = 0$, where p is a constant, are

(*a*) $p, p + 1$ (*b*) $-p, p + 1$ (*c*) $p, -(p + 1)$ (*d*) $-p, -(p + 1)$

Ans. (*c*)

9. We draw pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 40°. Then, $\angle AOB =$



(*a*) 100° (*b*) 120° (*c*) 140° (*d*) 160°

Ans. (*c*)

10. A kite is flying at a height of 30 m from the ground. The length of string from the kite to the ground is 60 m. Assuming that here is no slack in the string, the angle of elevation of the kite at the ground is

(*a*) 45° (*b*) 30° (*c*) 60° (*d*) 90°

Ans. (*b*)

11. Which of the following is a solution of the equation $x^2 - 6x + 5 = 0$?

(*a*) 2 (*b*) 5 (*c*) 9 (*d*) 15

Sol. (*b*) Substituting $x = 5$, we have

$(5)^2 - 6(5) + 5 = 25 - 30 + 5 = 0$

$\therefore$ $x = 5$ is a solution of the given equation.

12. Two APs have the same common difference. The first term of one of these is –1 and that of the other is –8. Then the difference between their 4th terms is

(*a*) –1 (*b*) –8 (*c*) 7 (*d*) –9

Sol. (*c*) $a_4 - b_4 = (a_1 + 3d) - (b_1 + 3d)$

$= a_1 - b_1 = -1 - (-8) = 7$

13. During conversion of a solid from one shape to another, the volume of the new shape will

(*a*) increase (*b*) decrease

(*c*) remain unaltered (*d*) be doubled

Sol. (*c*) Remain unaltered.

14. At some time of the day, the length of the shadow of a tower is equal to its height. Then the Sun's altitude at that time is

(*a*) 30° (*b*) 60° (*c*) 90° (*d*) 45°

Ans. (*d*)

15. A pair of tangents can be constructed from a point P to a circle of radius 3.5 cm situated at a distance of _____ from the centre.

(*a*) 5 cm (*b*) 2 cm

(*c*) 3 cm (*d*) 3.5 cm

Ans. (*a*) 5 cm

16. The roots of the quadratic equation $x^2 + 5x - (\alpha + 1)(\alpha + 6) = 0$, where α is a constant, are

(*a*) $\alpha + 1, \alpha + 6$ (*b*) $(\alpha + 1), -(\alpha + 6)$

(*c*) $-(\alpha + 1), (\alpha + 6)$ (*d*) $-(\alpha + 1), -(\alpha + 6)$

Sol. (*b*) $x^2 + 5x - (\alpha + 1)(\alpha + 6) = 0$

$\Rightarrow x^2 + (\alpha + 6)x - (\alpha + 1)x - (\alpha + 1)(\alpha + 6) = 0$

$\Rightarrow x[x + (\alpha + 6)] - (\alpha + 1)[x + (\alpha + 6)] = 0$

$\Rightarrow [x + (\alpha + 6)][x - (\alpha + 1)] = 0$

$\Rightarrow x = -(\alpha + 6), x = (\alpha + 1)$

$\therefore$ Correct option (*b*)

17. In an AP, if $d = -2$, $n = 5$ and $a_n = 0$, the value of a is

(*a*) 10 (*b*) 5 (*c*) –8 (*d*) 8

Sol. (*d*) $d = -2$, $n = 5$, $a_n = 0$

$\because \quad a_n = 0$

$\Rightarrow \quad a + (n-1)d = 0$

$\Rightarrow \quad a + (5-1)(-2) = 0 \Rightarrow a = 8$

Correct option is (*d*).

18. In a quadratic equation with leading coefficient 1, Aseem reads the coefficient 16 of x wrongly as 19 and obtains the roots as –15 and – 4. The correct roots are

(*a*) 6, 10 (*b*) – 6, – 10 (*c*) 8, 8 (*d*) – 8, – 8

Ans. (*b*)

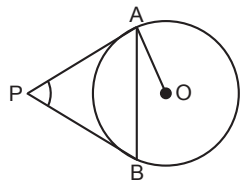
19. In the figure PA and PB are tangents to the circle with centre O. If $\angle APB = 60°$, then $\angle OAB$ is

(*a*) 30°

(*b*) 60°

(*c*) 90°

(*d*) 15°



Sol. (*a*) Given $\angle APB = 60°$

$\because \quad \angle APB + \angle PAB + \angle PBA = 180°$

$\Rightarrow \quad \angle APB + x + x = 180° \quad [\because PA = PB \therefore \angle PAB = \angle PBA = x \text{ (say)}]$

$\Rightarrow \quad 60° + 2x = 180° \Rightarrow 2x = 180° - 60°$

$\Rightarrow \quad 2x = 120° \Rightarrow x = \dfrac{120°}{2} = 60°$

Also, $\angle OAP = 90° \Rightarrow \angle OAB + \angle PAB = 90°$

$\Rightarrow \quad \angle OAB + 60° = 90° \Rightarrow \angle OAB = 30°$

20. If the elevation of the Sun is 30°, then the length of the shadow cast by a tower of 150 feet height is

(*a*) 150 feet (*b*) $50\sqrt{3}$ feet (*c*) $150\sqrt{3}$ feet (*d*) 200 feet

Sol. (*c*) $\tan 30° = \dfrac{150}{x} \Rightarrow x = 150\sqrt{3}$ feet, where x = length of shadow

Section B

Section B consists of 20 questions of 1 mark each. Any 16 questions are to be attempted

21. If the common difference of an AP is 3, then $a_{20} - a_{15}$ is

(*a*) 5 (*b*) 3 (*c*) 15 (*d*) 20

Sol. (*c*) Common difference, $d = 3$

$$a_{20} - a_{15} = (a + 19d) - (a + 14d)$$
$$= 5d = 5 \times 3 = 15$$

22. From the following ratios, a line segment cannot be divided into a ratio:

(*a*) $A \to \sqrt{2} : \frac{1}{\sqrt{2}}$ (*b*) $A \to \frac{1}{\sqrt{2}} : \frac{1}{\sqrt{2}}$

(*c*) $A \to \frac{3}{\sqrt{5}} : \frac{\sqrt{5}}{3}$ (*d*) $A \to \frac{1}{2} : 1$

Ans. (*c*)

23. When the length of the shadow of a pole of height 10 m is equal to 10 m, then the elevation of source of light is

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*b*)

24. If a non zero root of the equations $x^2 + 2x + 3\lambda = 0$ and $2x^2 + 3x + 5\lambda = 0$ is common, the value of λ will be

(*a*) 2 (*b*) 1 (*c*) –1 (*d*) 0

Sol. (*c*) Let common root is α

$$\Rightarrow \quad \alpha^2 + 2\alpha + 3\lambda = 0 \quad \ldots (i)$$

and $$2\alpha^2 + 3\alpha + 5\lambda = 0 \quad \ldots (ii)$$

Solving (*i*) and (*ii*), we get

$$\alpha = -\lambda.$$

Equation (*i*) becomes

$$\lambda^2 - 2\lambda + 3\lambda = 0 \Rightarrow \lambda(\lambda + 1) = 0$$

$$\Rightarrow \quad \lambda = 0 \quad \text{or} \quad \lambda = -1$$

$\because$ Common root is non-zero.

$$\therefore \quad \lambda = -1.$$

25. The next term of the AP $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots$ is

(*a*) $\sqrt{146}$ (*b*) $\sqrt{128}$ (*c*) $\sqrt{162}$ (*d*) $\sqrt{200}$

Sol. (*c*) $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots = 3\sqrt{2}, 5\sqrt{2}, 7\sqrt{2}, \ldots$

$\therefore$ Next term is $9\sqrt{2} = \sqrt{162}$

26. Three cubes of iron whose edges are 6 cm, 8 cm and 10 cm respectively are melted and formed into a single cube. The edge of the new cube formed is _____.

(*a*) 10 cm (*b*) 14 cm (*c*) 12 cm (*d*) 13 cm

Sol. $6^3 + 8^3 + 10^3 = l^3$

$\Rightarrow \quad 216 + 512 + 1000 = l^3$

$\Rightarrow \quad 1728 = l^3 \Rightarrow l = 12$ cm.

27. Let α, β be the roots of the equation $(x - a)(x - b) + c = 0, c \neq 0$.

The roots of the equation $(x - \alpha)(x - \beta) - c = 0$ are

(*a*) a, c (*b*) b, c (*c*) a, b (*d*) $a + c, b + c$

Sol. (*c*) $\because \alpha, \beta$ are roots of $(x - a)(x - b) + c = 0$

$\Rightarrow \quad (x - a)(x - b) + c = (x - \alpha)(x - \beta)$

$\Rightarrow \quad (x - a)(x - b) = (x - \alpha)(x - \beta) - c$

$\Rightarrow (x - a)(x - b)$ are the factors of $(x - \alpha)(x - \beta) - c$

$\therefore$ roots are a and b.

28. The number of real roots of the equation $(x - 1)^2 + (x - 2)^2 + (x - 3)^2 = 0$ is

(*a*) 2 (*b*) 1 (*c*) 0 (*d*) 3

Ans. (*c*)

29. A person standing on the bank of a river finds that the angle of elevation of the top of a tower on the opposite bank is 45°. Which of the following statements is correct?

(*a*) Breadth of the river is twice the height of the tower.

(*b*) Breadth of the river is half of the height of the tower.

(*c*) Breadth of the river is equal to the height of the tower.

(*d*) None of the above.

Ans. (*c*) Breadth of the river is equal to the height of the tower.

30. If α, β are the roots of the equation $x^2 - p(x + 1) - c = 0$, then $(\alpha + 1)(\beta + 1) =$

(*a*) c (*b*) $c - 1$ (*c*) $1 - c$ (*d*) $1 + c$

Sol. (*c*) $x^2 - p(x + 1) - c = 0$

$\Rightarrow \quad x^2 - px - p - c = 0$

$\therefore \quad \alpha + \beta = p$ and $\alpha\beta = -p - c$

Now $(\alpha + 1)(\beta + 1) = \alpha\beta + \alpha + \beta + 1$

$= -p - c + p + 1 = 1 - c.$

31. If $x^2 + px + q = 0$ is the quadratic equation whose roots are $a - 2$ and $b - 2$, where a, b are the roots of $x^2 - 3x + 1 = 0$, then

(*a*) $p = 1, q = 2$ (*b*) $p = 2, q = 1$ (*c*) $p = -1, q = 1$ (*d*) $p = 1, q = -1$

Sol. (*d*) $x^2 - 3x + 1 = 0$

a and b are roots $\therefore a + b = 3$ and $ab = 1$

Now $a - 2, b - 2$ are roots of $x^2 + px + q$

$\Rightarrow a - 2 + b - 2 = -p \Rightarrow 3 - 4 = -p \Rightarrow p = 1$

and $(a - 2)(b - 2) = q$

$\Rightarrow ab - 2a - 2b + 4 = q$

$\Rightarrow 1 - 2(a + b) + 4 = q$

$\Rightarrow 1 - 2(3) + 4 = q \Rightarrow q = -1.$

32. To draw a pair of tangents to a circle, which are inclined to each other at an angle of 60°, it is required to draw tangents at end points of those two radii of the circle, the angle between them should be

(*a*) 135° (*b*) 90° (*c*) 60° (*d*) 120°

Ans. (*d*)

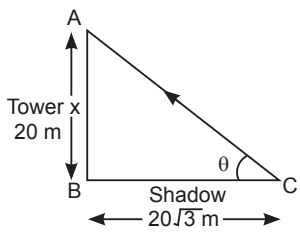
33. The angle of elevation of the Sun, if the length of the shadow of a tower of height 20 m is $20\sqrt{3}$ m is

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 75°

Sol. (*a*) $\tan\theta = \dfrac{20}{20\sqrt{3}}$

$\Rightarrow \tan\theta = \dfrac{1}{\sqrt{3}} = \tan 30°$

$\Rightarrow \theta = 30°$



34. The roots of the equation $x^2 + x - p(p + 1) = 0$, where p is a constant, are

(*a*) $p, p + 1$ (*b*) $-p, p + 1$ (*c*) $p, -(p + 1)$ (*d*) $-p, -(p + 1)$

Ans. (*c*)

35. If the equation $x^2 - (2 + m)x + (m^2 - 4m + 4) = 0$ has coincident roots, then

(*a*) $m = 0$ (*b*) $m = 0, 2$ (*c*) $m = 6, 2$ (*d*) none of these

Ans. (*d*)

36. If at some time, the length of the shadow of a tower is $\sqrt{3}$ times its height, then the angle of elevation of the Sun, at that time, is

(*a*) 15° (*b*) 30° (*b*) 45° (*d*) 60°

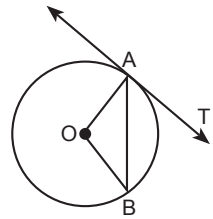
Sol. (*b*)

37. To divide a line segment AB in the ratio 4 : 5. First a ray AX is drawn, so that ∠BAX is an acute angle and then at equal distances points are marked on the ray AX such that the maximum number of these points are:

(*a*) 4 (*b*) 5 (*c*) 7 (*d*) 9

Ans. (*d*)

38. In figure, O is the centre of a circle, AB is a chord and AT is the tangent at A. If $\angle AOB = 100°$, then $\angle BAT$ is equal to



(*a*) 100°

(*b*) 40°

(*c*) 50°

(*d*) 90°

Sol. (*c*) $\angle AOB = 100°$

$\angle OAB = \angle OBA$ ($\because$ OA and OB are radii)

Now, in ΔAOB,

$\angle AOB + \angle OAB + \angle OBA = 180°$ (Angle sum property of Δ)

$\Rightarrow \quad 100° + x + x = 180°$ [Let $\angle OAB = \angle OBA = x$]

$\Rightarrow \quad 2x = 180° - 100° \Rightarrow 2x = 80° \Rightarrow x = 40°$

Also, $\angle OAB + \angle BAT = 90°$ [$\because$ OA is radius and TA is tangent at A]

$\Rightarrow \quad 40° + \angle BAT = 90° \Rightarrow \angle BAT = 50°$

39. The common difference of the AP $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}$, ... is

(*a*) p (*b*) $-p$ (*c*) -1 (*d*) 1

Sol. (*c*) Common difference $= a_2 - a_1 = \frac{1-p}{p} - \frac{1}{p} = \frac{1-p-1}{p} = -1$

40. The quadratic equation whose roots are twice the roots of $2x^2 - 5x + 2 = 0$ is

(*a*) $8x^2 - 10x + 2 = 0$ (*b*) $x^2 - 4x + 4 = 0$

(*c*) $x^2 - 5x + 4 = 0$ (*d*) $2x^2 - 5x + 2 = 0$

Sol. (*c*) Let roots of the equation

$2x^2 - 5x + 2 = 0$ are α and β

$\therefore \quad \alpha + \beta = \frac{5}{2}$ and $\alpha\beta = \frac{2}{2} = 1$

Equation whose roots are 2α and 2β is

$x^2 - (2\alpha + 2\beta)x + 2\alpha.2\beta = 0$

$\Rightarrow \quad x^2 - 2(\alpha + \beta)x + 4\alpha\beta = 0$

$\Rightarrow \quad x^2 - 2 \times \frac{5}{2}x + 4 \times 1 = 0$

$\Rightarrow \quad x^2 - 5x + 4 = 0$

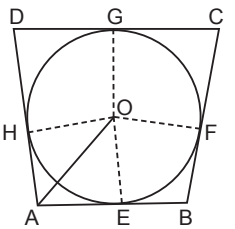
Section C

Case study Questions

Section C consists of 10 questions of 1 mark each. Any 8 questions are to be attempted

Case study - 1

A welfare society of birds constructed a circular tank to serve as a bird bath as shown in figure



Here ABCD is a quadrilateral sides AB, BC, CD, DA act as tangents to circle at E, F, G and H. Here AB = 5 m, CD = 6 m and BC = 7 m

Answer the questions based on above.

41. Distance BC =

(*a*) 11 m (*b*) 4 m (*c*) 7 m (*d*) 6 m

Ans. (*b*) 4 m

42. If O is centre of tank and AH and AE inclined to each other at angle 100°, then ∠HOE =

(*a*) 80° (*b*) 100° (*c*) 40° (*d*) 140°

Ans. (*a*) 80°

43. If ∠GOF = $(3x - 8)°$ and ∠GCF = $(2x + 3)°$ then x =

(*a*) 80° (*b*) 100° (*d*) 37° (*d*) 73°

Ans. (*c*) $x = 37°$

44. ΔOHA is an *a*

(*a*) right angled triangle (*b*) equilateral triangle

(*c*) both (*i*) and (*ii*) (*d*) None of these

Ans. (*a*) right-angled triangle

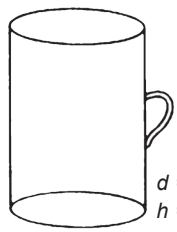
45. ∠HAO =

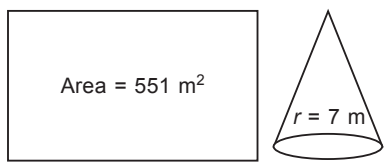
(*a*) ∠HOE (*b*) ∠AEO (*c*) ∠AEB (*d*) ∠OAE

Ans. (*d*) ∠HAO = ∠OAE

Case study - 2

Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a hemispherical cup whose dimensions are shown below. After that they went for a jungle trek. The jungle trek was enjoyable but tiring. As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area 551 m^2. Each group had to make a conical tent to accommodate all the four students. Assuming that all the stitching and wasting incurred while cutting, would amount to 1 m^2, the students put the tents. The radius of the tent is 7 m.





46. The volume of cylindrical cup is

(*a*) 295.75 cm^3 (*b*) 7415.5 cm^3 (*c*) 384.88 cm^3 (*iv*) 404.25 cm^3

Ans. (*d*) 404.25 cm^3

47. The volume of hemispherical cup is

(*a*) 179.67 cm^3 (*b*) 89.83 cm^3 (*c*) 172.25 cm^3 (*iv*) 210.60 cm^3

Ans. (*b*) 89.83 cm^3

48. Which container had more juice and by how much?

(*a*) Hemispherical cup, 195 cm^3 (*b*) Cylindrical glass, 207 cm^3

(*c*) Hemispherical cup, 280.85 cm^3 (*d*) Cylindrical glass, 314.42 cm^3

Ans. (*d*) Cylindrical glass, 314.42 cm^3

49. The height of the conical tent prepared to accommodate four students is

(*a*) 18 m (*b*) 10 m (*c*) 24 m (*d*) 14 m

Ans. (*c*) 24 m

50. How much space on the ground is occupied by each student in the conical tent

(*a*) 54 m^2 (*b*) 38.5 m^2 (*c*) 86 m^2 (*d*) 24 m^2

Ans. (*b*) 38.5 m^2