Time Allowed: 3 Hours

Maximum Marks: 80

General Instructions

Read the following instructions carefully and follow them.

1. **This question paper contains 38 questions. All questions are compulsory.**

2. **This question paper is divided into 5 section A, B, C, D and E.**

3. **In Section A, question numbers 1-18 are Multiple Choice Questions (MCQs) and question number 19 and 20 are Assertion-Reason based questions of 1 mark each.**

4. **In Section B, question numbers 21-25 are Very Short Answer (VSA) type questions, carrying 02 marks each.**

5. **In Section C, question numbers 26-31 are Short Answer (SA) type questions, carrying o3 mark each.**

6. **In Section D, question numbers 32-35 are Long Answer (LA) type questions, carrying o5 marks each.**

7. **In Section E, question numbers 36-38 are Case Study Based questions carrying 4 marks each with sub parts of the values 1,1 and 2 marks each respectively.**

8. **There is no overall choice. However, an internal choice in 2 questions of section B, 2 questions of section C and 2 questions of section D has been provided. An internal choice has been provided in all the 2 marks questions of section E**

9. **Draw neat and clear figures wherever required. Take $\pi = 22/7$ wherever required if not stated.**

10. **Use of calculators is not allowed.**

Section A Multiple Choice Questions (Each Que. carries 1 M)

1. If α and β are the zeroes of polynomial $3x^2 + 6x + k$ such that $\alpha + \beta + \alpha\beta = -\frac{2}{3}$, then the value of k is :
   (A) -8
   (B) 8
   (C) -4
   (D) 4

2. If $x = 1$ and $y = 2$ is a solution of the pair of linear equations $2x - 3y + a = 0$ and $2x + 3y - b = 0$, then :
   (A) $a = 2b$
   (B) $2a = b$
   (C) $a + 2b = 0$
   (D) $2a + b = 0$

3. The mid-point of the line segment joining the points $P(-4,5)$ and $Q(4,6)$ lies on :
   (A) x -axis
   (B) y-axis
   (C) origin
   (D) neither x-axis nor y-axis

4. If θ is an acute angle and $7 + 4\sin\theta = 9$, then the value of θ is :
   (A) 90°
   (B) 30°
   (C) 45°
   (D) 60°

5. The value of $\tan^2 \theta - \left(\frac{1}{\cos \theta} \times \sec \theta\right)$ is :
   (A) 1   (B) 0   (C) -1   (D) 2

6. If $HCF(98,28) = m$ and $LCM(98,28) = n$, then the value of $n - 7m$ is :
   (A) 0
   (B) 28
   (C) 98
   (D) 198

7. The tangents drawn at the extremities of the diameter of a circle are always :
   (A) parallel
   (B) perpendicular
   (C) equal
   (D) intersecting

8. In triangles ABC and DEF, $\angle B = \angle E$, $\angle F = \angle C$ and $AB = 3DE$. Then, the two triangles are :
   (A) congruent but not similar
   (B) congruent as well as similar
   (C) neither congruent nor similar
   (D) similar but not congruent

9. If $(-1)^n + (-1)^8 = 0$, then n is :
   (A) any positive integer
   (B) any negative integer
   (C) any odd number
   (D) any even number

10. Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :
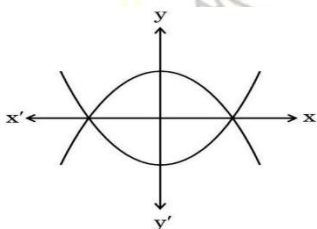
   (A) 3
   (B) 5
   (C) 2
   (D) 4

11. 30 th term of the AP 10,7,4, ….. , is
   (a) 97
   (b) 77
   (c) -77
   (d) -87

12. In a rectangle $ABCD$, $AB = 40$ cm, $\angle BAC = 30°$ then the side BC is
   (a) $\frac{40\sqrt{3}}{3}$ cm
   (b) $\frac{20\sqrt{3}}{3}$ cm
   (c) $\frac{20}{\sqrt{3}}$ cm
   (d) None of these

13. Point $A(-3,2)$ and point $B(4,-7)$ lie in quadrant
    (a) I, II
    (b) II, III
    (c) II, IV
    (d) III, IV

14. If $\cot^2 45° - \sin^2 30° = p \cdot \sin 30° \cos 60°$, then the value of p is
    (a) 4
    (b) $\frac{1}{2}$
    (c) 3
    (d) $\frac{1}{3}$

15. If the lines given by $3x + 2ky = 2$ and $2x + 5y + 1 = 0$ are not parallel then k has to be
    (a) $\frac{15}{4}$
    (b) $\neq \frac{15}{4}$
    (c) any rational number.
    (d) any rational number having 4 as denominator.

16. If the zeroes of the polynomial $ax^2 + bx + \frac{2a}{b}$ are reciprocal of each other then the value of b is
    (a) 2
    (b) $\frac{1}{2}$
    (c) -2
    (d) $-\frac{1}{2}$

17. For grouped data, if $\sum f_i = 18, \sum f_i x_i = 4p + 60$ and mean of distribution is 20 , then the value of p is
    (a) 75
    (b) 80
    (c) 100
    (d) 70

18. If $50\sqrt{3}$ m high tower makes angle of elevation at a point on ground which is 150 m away from it's foot then find the angle of elevation.
    (a) 30°
    (b) 90°
    (c) 60°
    (d) 0°

Assertion-Reason Based Questions
In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the arrect answer out of the following choices.
(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.

19. Assertion (A) The distance of a point $P(x, y)$ from the origin is $\sqrt{x^2 - y^2}$.
Reason (R) If $P(-1,1)$ is the mid-point of the line segment joining $A(-3, b)$ and $B(1, b + 4)$, then value of b is -1

20. Assertion (A) $3y^2 + 17y - 30 = 0$ have distinct roots.

Reason (R) The quadratic equation $ax^2 + bx + c = 0$ have distinct roots (real roots), if $D > 0$.

Section B Very Short Answer Type Questions (Each Que. carries 2 M)

21. (a) If $x\cos\ 60° + y\cos\ 0° + \sin\ 30° - \cot\ 45° = 5$, then find the value of x + 2y.

OR

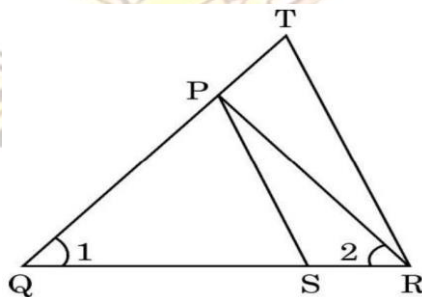(b) Evaluate : $\frac{\tan^2\ 60°}{\sin^2\ 60° + \cos^2\ 30°}$

22. Find the zeroes of the polynomial $p(x) = x^2 + \frac{4}{3}x - \frac{4}{3}$.

23. The coordinates of the centre of a circle are (2a, a - 7). Find the value(s) of ' a ' if the circle passes through the point $(11, -9)$ and has diameter $10\sqrt{2}$ units.

24. (a) If $\triangle ABC \sim \triangle PQR$ in which $AB = 6\ cm, BC = 4\ cm, AC = 8\ cm$ and $PR = 6\ cm$, then find the length of $(PQ + QR)$.

OR

(b) In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$, show that $\Delta PQS \sim \Delta TQR$.

25. A person is standing at P outside a circular ground at a distance of 26 m from the centre of the ground. He found that his distances from the points A and B on the ground are 10 m (PA and PB are tangents to the circle). Find the radius of the circular ground.
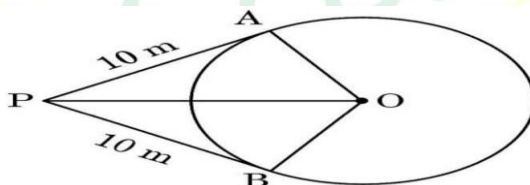
Section C Short Answer Type Questions (Each Que. carries 3 M)

26. (a) Prove that $\sin \theta(1 + \tan \theta) + \cos \theta(1 + \cot \theta) = \sec \theta + \operatorname{cosec}\theta$.

Or

(b) Prove that $\frac{1+\tan^2 \theta}{1+\cot^2 \theta} = \left(\frac{1-\tan \theta}{1-\cot \theta}\right)^2 = \tan^2 \theta$.

27. From a bus stand in Delhi, if we buy 2 tickets to Pitampura and 3 tickets to Dilshad Garden, the total cost is ₹ 46 but if we buy 3 tickets to Pitampura and 5 tickets to Dilshad Garden, the total cost is ₹ 74 . Then, find the fares from the bus stand to Pitampura and to Dilshad Garden.

28. Show that $7 - \sqrt{3}$ is irrational.

29. (a) Find a quadratic polynomial whose zeroes are reciprocals of the zeroes of the polynomial

$$f(x) = ax^2 + bx + c, a \neq 0, c \neq 0.$$

Or

(b) If α, β are the zeroes of the polynomial $p(x) = 2x^2 + 5x + k$ satisfying the relation $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$ then

find the value of k for this to be possible.

30. If the p th, q th and r th terms of an AP are a, b and c respectively then show that

$$a(q - r) + b(r - p) + c(p - q) = 0.$$

31. Find the coordinates of the points which divide the line segment joining $A(-3, -7)$ and $B(-7,8)$ into four equal parts.

Section D Long Answer Type Questions (Each Que. carries 5 M)

32. The following table shows the age distribution of cases of a certain disease admitted during a year in a particular hospital.

Age (in years)	$5 - 14$	$15 - 24$	$25 - 34$	$35 - 44$	$45 - 54$	$55 - 64$	Total
Number of cases	6	11	21	23	14	5	80

Find the modal age.

Or

(b) If the median of the distribution given below is 30 , then find the values of x and y.

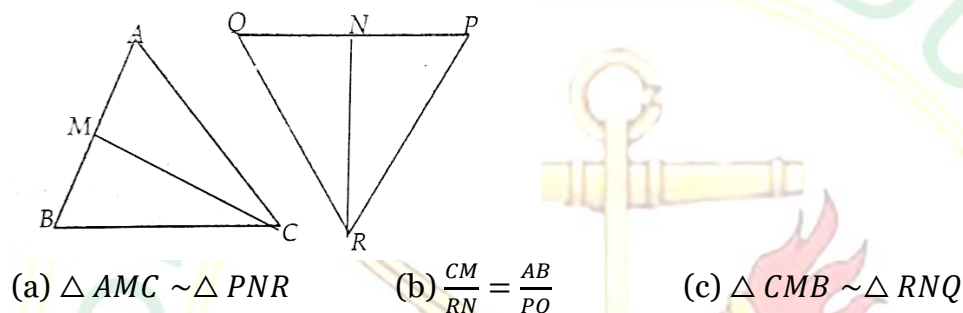| Class interval	$0 - 10$	$10 - 20$	$20 - 30$	$30 - 40$	$40 - 50$	$50 - 60$	Total
Number of students	5	x	20	15	y	5	60

33. From a solid cylinder whose height is 16 cm and diameter is 12 cm , two same conical cavity of height of 8 Ex and radius of 6 cm is hollowed out. Find the volume and total surface area of the remaining solid.

34. (a) If α, β are the zeroes of the polynomial $f(x) = 2x^2 + 5x + k$, and satisfying the relation $(\alpha + \beta)^2 - \alpha\beta = \frac{21}{4}$, then find the value of k. Also, find the zeroes of $f(x)$.

Or

(b) Find the zeroes of the polynomial $p(x) = 4\sqrt{3}x^2 + 5x - 2\sqrt{3}$ and verify the relationship between the zeroes and its coefficients.

35. In the given figure, CM and RN are respectively the medians of $\triangle ABC$ and $\triangle PQR$. If $\triangle ABC \sim \triangle PQR$, then prove that

(a) $\triangle AMC \sim \triangle PNR$ (b) $\frac{CM}{RN} = \frac{AB}{PQ}$ (c) $\triangle CMB \sim \triangle RNQ$

Section E Case-Study/Passage-Based [Each Que. carries 4 M]

36. The revenue (in ₹) of a firm is represented by the polynomial $R(x) = 5x^2 + 4x + 7$, and the expenditure (in ₹) by the firm is represented by the polynomial $E(x) = 3x^2 - 2$. Where x is the number of items produced by the firm in a year.
On the basis of above information, answer the following questions.

(i) Find the profit polynomial $p(x)$.   [1]

(ii) If the firm produces 1000 products in a year, find the revenue and profit (in ₹) for the firm using the

polynomials.   [1]

(iii) (a) If tax is calculated on the profit using the polynomial $T(y) = 0.3y + 100$, where y represents the profit

earned. Then, find the tax that firm paid.   [2]
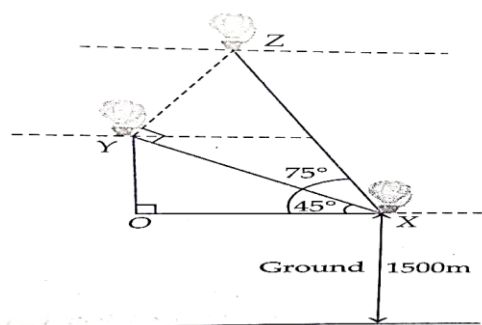
Or

(b) If tax is calculated on the profit using the polynomial $C(y) = 0.005y + 50$, where y represents the profit earned. Then, find the tax that firm paid.   [2]

37. At a local fair, three hot air balloons, X, Y, Z are flying along the same plane. At a particular instant, their positions and angle between them are as shown in the given diagram.

The horizontal distance between balloons X and Y is equal to X's altitude.
Balloons X, Y and Z are placed such that $\angle XYZ = 90°$.
On the basis of above information, answer the following questions.
(i) Find the altitude of balloon Y.   [1]
(ii) Find the distance between balloons X and Y.   [1]

(iii) (a) Find the shortest distance between balloons Y and Z.   [2]
                            Or
(b) Find the shortest distance between balloons X and Z [2]

38. Shruti wrote numbers from 2 to 7 on six papers such that the number on each paper was unique. She divided the even and odd numbered papers into two groups, X and Y, respectively.
She then choose a paper from each group at random, one after the other, without looking, and used the numbers written on them to form a 2 -digit number. The number chosen first is written at the tens place of the 2 -digit number.
On the basis of above information, answer the following questions.
(i) Find the probability that Shruti makes an even number less than 20.   [1]
 (ii) (a) Shruti thought she is more likely to form an even number greater than 40 as compared to an odd number less than 40 . Is she correct?   [2]
                            Or
(b) What is the probability that Shruti makes number more than 30 but less than 50 .

                                                                                                                                          [2]
(iii) Shruti redistributed the 6 papers evenly between two new groups, A and B making sure each group had a mix of even and odd numbered papers.

Write one possible distribution of the papers in the two groups, group A and group B such that the probability of forming an odd number is higher than that of formation of an even number, if the paper from group A is chosen first.