

Read the following instructions carefully and follow them:

- This question paper contains 38 questions.
 - This question paper is divided into 5 sections — A, B, C, D and E.
 - In Section A, Question numbers 1–18 are multiple choice questions MCQs and Q19–20 are Assertion-Reason questions of 1 mark each.
 - In Section B, Question numbers 21–25 are very short answer VSA type questions, carrying 2 marks each.
 - In Section C, Question numbers 26–31 are short answer SA type questions, carrying 3 marks each.
 - In Section D, Question numbers 32–35 are long answer LA type questions, carrying 5 marks each.
 - In Section E, Question numbers 36–38 are case-study questions carrying 4 marks each with sub parts of 1, 1 and 2 marks respectively.
 - All questions are compulsory. However, an internal choice in 2 questions Sections 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.
 - Draw neat diagrams wherever required.
 - Take $\pi = \frac{22}{7}$ wherever required, if not stated.
- Use of calculators is NOT allowed.

SECTION A

Section A consists of 20 questions of 1 mark each

1. Which of the following is an irrational number?

- (a) $\sqrt{16}$ (b) $\sqrt{25}$
(c) $\sqrt{72}$ (d) 0.75

2. The decimal expansion of $\frac{7}{12}$ is:

- (a) 0.5833 (terminating)
(b) 0.5833... (non-terminating, repeating)
(c) 0.5833... (non-terminating, non-repeating)
(d) 0.583 (terminates after 3 decimal places)

3. Which of the following statements is true?

- (a) The sum of two irrational numbers is always irrational
(b) The product of two irrational numbers is always irrational
(c) The sum of a rational and an irrational number is irrational
(d) The product of a rational and an irrational number is always rational

4. A polynomial $p(x) = x^3 - kx + 3$ has $(x-1)$ as a factor. The value of k is:

- (a) 1 (b) 2
(c) 4 (d) 3

5. The zero of the linear polynomial $p(x) = 4x - 12$ is:

- (a) -3 (b) 3
(c) 4 (d) 12

6. Using the identity $(a-b)^2 = a^2 - 2ab + b^2$, the value of $(96)^2$ is:

- (a) 9216 (b) 9024
(c) 9600 (d) 9261

7. In an AP, the first term is 22 and the common difference is 7. Which of the following is the 5th term?

- (a) 62 (b) 57
(c) 43 (d) 50

8. The number of zeroes of the polynomial $p(x) = x^2 - 4x + 3$ is:

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

9. The graph of the equation $2x + 3y = 12$ cuts the y -axis at point P. What are the coordinates of P?

- (a) (0, 4) (b) (6, 0)
(c) (0, 6) (d) (4, 0)

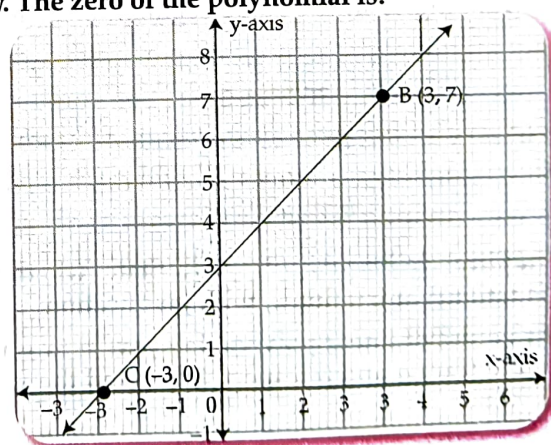
10. Point A is in Quadrant II. Which of the following correctly describes its coordinates?

- (a) (+, +) (b) (-, +)
(c) (-, -) (d) (+, -)

11. The distance of the point (0, -8) from the origin is:

- (a) 0 (b) 8
(c) -8 (d) 64

12. The graph of a linear polynomial $p(x)$ is shown below. The zero of the polynomial is:



- (a) $x = 3$ (b) $x = -2$
 (c) $x = 7$ (d) $x = -3$

13. If the 3rd term of a GP is 12 and the 6th term is 96, then the common ratio is:

- (a) 2 (b) 3
 (c) 4 (d) 6

14. The sides of a triangle are 13 cm, 14 cm and 15 cm. Using Heron's formula, its area is:

- (a) 42 cm^2 (b) 72 cm^2
 (c) 84 cm^2 (d) 96 cm^2

15. A chord of a circle is 5 cm from the centre. If the radius is 13 cm, the length of the chord is:

- (a) 10 cm (b) 12 cm
 (c) 24 cm (d) 26 cm

16. Two lines AB and CD intersect at point O. If $\angle AOC = 70^\circ$, what is the measure of $\angle BOD$?

- (a) 20° (b) 70°
 (c) 110° (d) 140°

17. The total surface area of a cube with side 6 cm is:

- (a) 36 cm^2 (b) 144 cm^2
 (c) 180 cm^2 (d) 216 cm^2

18. A bag has 4 red, 6 green and 5 blue marbles. A marble is drawn at random. The probability that it is NOT green is:

- (a) $\frac{1}{5}$ (b) $\frac{2}{5}$
 (c) $\frac{3}{5}$ (d) $\frac{6}{15}$

Direction: In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:

- (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): $\sqrt{3} + \sqrt{5}$ is an irrational number.

Reason (R): The sum of any two irrational numbers is always irrational.

20. Assertion (A): The angle subtended by a semicircle (diameter as chord) at any point on the remaining arc is always 90° .

Reason (R): Angles in the same segment of a circle are equal.

SECTION-B

Section B consists of 5 questions of 2 mark each

Very Short Answer type questions. Internal choice is provided in 2 questions.

21. Simplify: $(\sqrt{5} + \sqrt{3})(\sqrt{5} - \sqrt{3})$. State whether the result is rational or irrational, with justification.

22. The zeroes of linear polynomials $p(x) = 5x - 15$ and $q(x) = 3x + 9$ are α and β respectively. Find the value of $\alpha + \beta$.

OR

Find the zero of the polynomial $p(x) = 3x - 12$. Also find the zero of $q(x) = 5x + 25$. If α and β are the respective zeroes, find the value of $3\alpha - \beta$.

23. In an AP, the first term is 5 and the common difference is 3. Find the 8th term. Write the general formula used.

24. The vertices of a triangle are $A(1, 2)$, $B(5, 2)$ and $C(3, 6)$.

- (i) Find the length of each side using the distance formula.
 (ii) What type of triangle is it? Justify using the computed side lengths.

OR

Plot the points $A(3, 0)$, $B(0, 4)$ and $C(-3, 0)$ on a Cartesian plane. What type of triangle is formed by joining these three points?

25. In triangles ABC and PQR, $AB = PQ$, $\angle B = \angle Q$ and $BC = QR$.

(i) State the congruence condition that applies and write the congruence statement in correct correspondence order.

(ii) If $\angle A = 55^\circ$ and $\angle B = 65^\circ$, find $\angle R$. Justify your answer using the congruence established above.

SECTION-C

Section C consists of 6 questions of 3 marks each

Short Answer type questions. Internal choice is provided in 2 questions.

26. Explain the concept of slope and y-intercept using the graphs of

$$y = -3x + 2, y = -3x - 1 \text{ and } y = -3x + 5.$$

What do you conclude when:

- (i) the slope remains the same but the y-intercept changes?
 (ii) the y-intercept remains fixed but the slope changes?

27. Rohan arranged 1 square tile of side x units, 6 rectangular strips each of dimensions x units and 1 unit and 8 unit squares to form a larger rectangle.

Find the possible length and breadth of the rectangle in terms of x . Also find the algebraic expression for its area.

OR

Evaluate: $(\sqrt{3} + \sqrt{2})^3$ using the identity $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$. Simplify.

28. For triangle PQR with vertices $P(2, 5)$, $Q(6, 2)$, $R(8, 7)$ find the lengths of all three sides.

The triangle is then reflected in the y-axis to obtain the image points:

$$P'(-2, 5), Q'(-6, 2), R'(-8, 7)$$

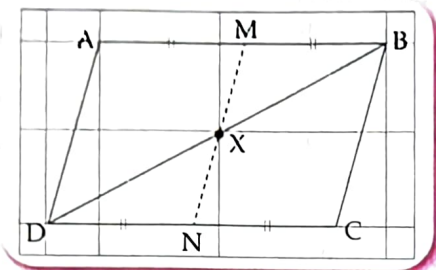
Find the lengths of $P'Q'$, $Q'R'$, and $R'P'$. Hence verify whether reflection in the y-axis preserves distances.

29. A circular park has several equal-length decorative ropes stretched across it as chords. Two such ropes AB and CD are equal in length. If O is the centre of the park and OM and ON are the perpendicular distances from the centre to the ropes AB and CD respectively, prove that: $OM = ON$

State the theorem used and provide a complete proof.

OR

$ABCD$ is a parallelogram. M and N are the midpoints of sides AB and CD respectively. Prove that MN bisects the diagonal BD .



30. A farmer has a circular field of radius 14 m. He installs a sprinkler at the centre that irrigates a sector of angle 60° . Find:

- The total circumference of the circular field.
- The area irrigated by the sprinkler.
- What percentage of the total field area does the sprinkler irrigate? (Use $\pi = \frac{22}{7}$)

31. A shopkeeper randomly checks 40 balloons from a large packet and records their colours as follows:

14 Red, 10 Blue, 9 Green, 7 Yellow

Based on this sample, answer the following:

- Find the probability that a randomly selected balloon is Blue.
- If the packet contains 800 balloons in total, estimate how many are Green.
- Estimate the number of balloons of each colour in the packet.

SECTION-D

Section D consists of 4 questions of 5 marks each

Long Answer type questions. Internal choice is provided in 2 questions.

32. The number of bacteria in a culture doubles every hour. At the start of the experiment ($n = 1$), there are 3 bacteria.

- Write the first 5 terms of the sequence of bacteria counts. Show that this is a GP and find the common ratio.
- Using the n th term formula for a GP ($t_n = an^{n-1}$), find the number of bacteria at the end of the 8th hour.
- A second culture follows an AP where the first term is 5 and the 6th term is 30. Find the common difference and determine which term of this AP equals 80.
- Both cultures are observed from hour 1 to hour 6. At which hour does the GP culture first exceed the AP culture? Show your working for each hour.

OR

In an AP, the 4th term is 22 and the 8th term is 42.

- Set up two equations using the n th term formula $t_n = a + (n-1)d$ and find a and d .
- Find the 15th term and the 25th term of this AP.
- Determine whether 152 is a term of this AP. If yes, find its position. If no, justify with proof.

(iv) A GP has its 2nd term equal to 6 and its 4th term equal to 54. Find the first term and common ratio. Write the first 5 terms of this GP.

33. (i) Prove that equal chords of a circle subtend equal angles at the centre. Draw the required figure and provide a complete proof.

(ii) Using the theorem proved above, show that if two equal chords AB and CD of a circle intersect at a point P inside the circle, then $\triangle APD \cong \triangle CPB$.

OR

Prove that the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle. Draw the required figure. Using this theorem, find the angle subtended at the centre if the angle at the circumference is 35° .

34. A municipal corporation is developing a community space. The space consists of a triangular garden with sides 26 m, 28 m and 30 m, surrounded by a circular boundary wall of radius 21 m. A sprinkler system is installed at the centre of the circle, which waters a sector of angle 120° .

Find:

- The area of the triangular garden using Heron's formula.
- The total area enclosed by the circular boundary.
- The area of the remaining open space
- The area watered by the sprinkler and the length of the arc it covers. (Use $\pi = \frac{22}{7}$)

OR

A farmer owns a land piece in the shape of a quadrilateral $ABCD$. He divides it into two triangles by drawing a diagonal $AC = 48$ m. The perpendicular from B to AC measures 20 m and the perpendicular from D to AC measures 13 m and both B and D lie on opposite sides of AC .

Find:

- The area of $\triangle ABC$ and $\triangle ACD$ separately. [1]
- The total area of the quadrilateral plot $ABCD$. [1]
- The farmer fences only the triangular portion ABC , whose sides are 30 m, 40 m and 50 m. Find the perimeter and use Heron's formula to find the area of $\triangle ABC$. Do both methods (part i and Heron's) give the same area? Comment. [2]
- If the cost of fencing is ₹65 per metre, find the total cost of fencing $\triangle ABC$. [1]

35. Prove the following theorem completely, with a proper figure and step-by-step logical deduction:

"The sum of either pair of opposite angles of a cyclic quadrilateral is 180° ."

Use the above theorem to answer the following:

- In a cyclic quadrilateral $ABCD$, $\angle A = 3x$ and $\angle C = x$. Find the values of $\angle A$ and $\angle C$.
- In the same cyclic quadrilateral, $\angle B = (2y + 10)^\circ$ and $\angle D = (y + 20)^\circ$. Find $\angle B$ and $\angle D$.
- A quadrilateral $PQRS$ has $\angle P = 85^\circ$, $\angle Q = 95^\circ$, $\angle R = 95^\circ$ and $\angle S = 85^\circ$. Is $PQRS$ cyclic? Justify using the converse of the theorem proved above.

SECTION-E

Section E consists of 3 case study based questions of 4 marks each

Each question has sub-parts of 1, 1 and 2 marks respectively.
Internal choice is provided in the 2-mark sub-part.

36. Priya is a landscape architect designing a rectangular community garden with length $(2x+5)$ metres and width $(x+3)$ metres. She plans to lay a concrete path of uniform width 1 m around the outer boundary. The bottom-left corner of the garden is taken as origin $O(0, 0)$.

Based on the above information, answer the following:

- Write the polynomial expression for the area of the garden (without the concrete path). [1]
- If the area of the garden is 45 m^2 , form a quadratic equation in x and solve it by factorisation to find the value of x . [1]
- Using the value of x found in (b), calculate the area of the concrete path alone. Also verify that:
Path Area = Perimeter of garden $\times 1 + 4$
Show complete working for both. [2]

OR

Using $x = 2$, the four corners of the garden are $O(0, 0)$, $A(9, 0)$, $B(9, 5)$ and $C(0, 5)$. Priya places a water fountain at point F , the intersection of the diagonals OB and AC . Find the coordinates of F . Verify that F is equidistant from all four corners of the garden. [2]

37. A mobile battery company tested the backup time of 800 batteries before releasing them in the market. The observations are given below:

Backup Time	Number of Batteries
Less than 5 hours	40
5–10 hours	220
10–15 hours	310
More than 15 hours	230

Based on the above information, answer the following:

- Find the probability that a randomly selected battery lasts less than 5 hours. [1]
- Find the probability that a randomly selected battery lasts more than 15 hours. [1]
- Find the probability that a randomly selected battery lasts at least 10 hours. [2]

OR

Find the probability that a randomly selected battery lasts less than 15 hours. [2]

38. A circular park has a jogging track along its boundary. Two straight paths AB and CD are chords of the circle with centre O . It is given that $AB = CD = 24 \text{ m}$ and the radius of the park is 13 m. A lamp-post is to be installed at the midpoint M of chord AB . A triangular rest area PQR is also marked inside the park such that $PQ = PR = 15 \text{ m}$ and $QR = 18 \text{ m}$.

Based on the above information, answer the following:

- The park manager claims that the perpendicular from vertex P to side QR in triangle PQR bisects QR exactly at point M . Prove this claim using triangle congruence. State the congruence condition used and write the congruence statement in correct correspondence. Hence find PM . [2]

OR

(i) A cyclic quadrilateral $PQRS$ is inscribed in the circular park (radius 13 m) with sides $PQ = 10 \text{ m}$, $QR = 10 \text{ m}$, $RS = 12 \text{ m}$ and $SP = 12 \text{ m}$. Using Brahmagupta's formula $A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$, find the area of quadrilateral $PQRS$. [2]

(ii) Find the perpendicular distance from the centre O to chord AB . (Show full working.) [1]

(iii) What is the perpendicular distance from O to chord CD ? State the theorem used. [1]

