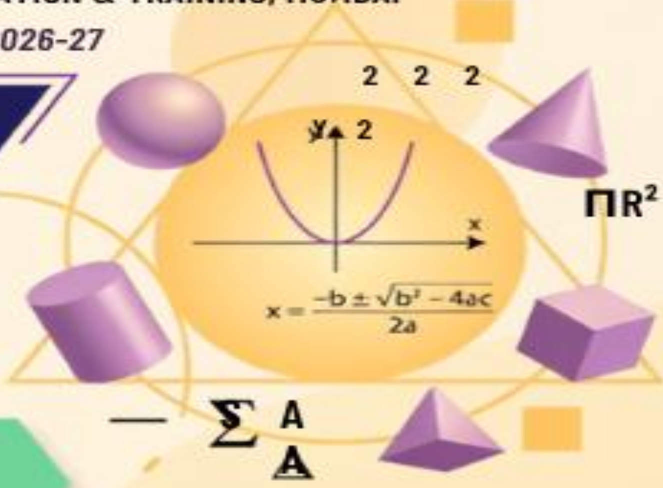
आंचलिक शिक्षा एवं प्रशिक्षण संस्थान, मुंबई

KVS ZONAL INSTITUTE OF EDUCATION & TRAINING, MUMBAI

SESSION 2026-27

COMPETENCY BASED QUESTIONS IN MATHEMATICS FOR CLASS IX



GEOMETRY & SPATIAL REASONING
Focus on properties & relations of points, lines, surfaces, and higher-dimensional solids.

DATA REPRESENTATION & GRAPHS
Interpreting & constructing visual representations to identify trends.

THINK • APPLY • SOLVE • EXCEL
Four-step cognitive cycle to guide students through complex mathematical challenges.

FOUNDATIONAL ARITHMETIC & CALCULATION
Utilizing tools and mental strategies for speed and accuracy in numerical operations.

INSTITUTIONAL IDENTITY & FRAMEWORK ALIGNMENT

KVS Zonal Institute of Education & Training, Mumbai:Lead Institution for this Cutting-edge Mathematics Resource

SESSION 2026-2027
For Implementation of Competency-Based Assessments

Aligned with NEP 2020 | NCF 2023 | CBSE Competency Framework 2025-26

CLASS IX MATHEMATICS: COMPETENCY-BASED LEARNING FRAMEWORK (2026-27)

THINK CRITICALLY
Encourage students to evaluate mathematical problems from multiple perspectives.

ANALYZE DEEPER
Investigate underlying patterns & structures.

APPLY KNOWLEDGE
Transition from abstract formulas to practical applications.

SOLVE PROBLEMS
Systematic problem-solving strategies for complex challenges.

MAKE CONNECTIONS
Link different mathematical concepts to real-world scenarios.

PERFORM BETTER
Drive overall academic excellence.

Inspire • Empower • Transform

केन्द्रीय विद्यालय संगठन
आंचलिक शिक्षा एवं प्रशिक्षण संस्थान,
मुम्बई

Kendriya Vidyalaya Sangathan
Zonal Institute of Educational and
Training, Mumbai

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KENDRIYA VIDYALAYA SANGATHAN

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PM SHRI KV DEOGARH

Programme Overview

The four-day Offline Capacity Building Programme for TGT (Mathematics) was conducted from 17 to 20 August 2026 at KVS Zonal Institute of Education & Training (ZIET), Mumbai. The programme theme was “From Concept to Clarity: Creating Meaningful Mathematics Teaching Experiences”. The programme aimed to strengthen teachers’ conceptual understanding, pedagogical practices, assessment strategies, use of digital tools, and ability to connect mathematical ideas with meaningful classroom experiences.

The programme brought together academic sessions, interactive discussions, problem-solving, visualization, digital technology, educational research, classroom activities, competency-based assessment and collaborative group work. Across the four days, participants were encouraged to move beyond routine procedures and focus on reasoning, conceptual clarity, application, problem solving, learner engagement and reflective teaching.

Objectives of the Programme

- Deepen conceptual understanding of important mathematical ideas and their interconnections.
- Develop reasoning, critical thinking, problem-solving and generalization skills in mathematics teaching.
- Strengthen competency-based assessment practices and question-design skills.
- Promote purposeful integration of ICT, AI and digital resources in mathematics classrooms.
- Encourage learner-centred, activity-based, visual and experiential approaches to mathematics teaching.
- Provide opportunities for collaborative professional learning, reflection and sharing of classroom practices.


आंचलिक शिक्षा एवं प्रशिक्षण संस्थान, मुंबई
एन. सी. एच. कॉलोनी कांजुरमार्ग (प.) मुंबई - 400078
ZONAL INSTITUTE
NCH COLONY,

LIST OF PARTICIPANTS

क्र. सं.	प्रतिभागी का नाम हिन्दी में	MALE/ FEMALE	संभाग	केन्द्रीय विद्यालय का नाम हिन्दी में
1	राजेंद्र कुमार साहू	Male	रायपुर	पीएम श्री केन्द्रीय विद्यालय अम्बिकापुर
2	रणदीप अधिकारी	Male	रायपुर	केन्द्रीय विद्यालय बचेली
3	दिनेश कुमार ठाकुर	Male	रायपुर	केन्द्रीय विद्यालय सीआईएसएफ भिलाई
4	हरेन्द्र कुमार साहू	Male	रायपुर	पीएम श्री केन्द्रीय विद्यालय धमतरी
5	सोनू अय्यर	Female	रायपुर	केन्द्रीय विद्यालय किरन्दुल
6	तुलसीराम चंद्राकर	Male	रायपुर	पीएम श्री केन्द्रीय विद्यालय महासमुन्द
7	मनोज कुमार वासनिक	Male	रायपुर	पीएम श्री केन्द्रीय विद्यालय मनेन्द्रगढ़
8	वर्षा रानी विश्वकर्मा	Female	रायपुर	केन्द्रीय विद्यालय बिलासपुर
9	श्रीमती रुचिका अग्रवाल	Female	अहमदाबाद	पीएम श्री केंद्रीय विद्यालय अहमदाबाद-छावनी
10	पूजा जुनेजा	Female	अहमदाबाद	केंद्रीय विद्यालय अन्तरिक्ष उपयोग केंद्र अहमदाबाद
11	यतिन भुपतराय कलाथिया	Male	अहमदाबाद	पीएम श्री केंद्रीय विद्यालय भावनगर परा
12	मिलनदीप शर्मा	Male	अहमदाबाद	केंद्रीय विद्यालय इफको गांधीधाम
13	सुश्री निकिता	Female	अहमदाबाद	पीएम श्री केंद्रीय विद्यालय क्र-1 सेक्टर 30 गांधीनगर
14	कुमुद प्रकाशचंद्र भट्ट	Female	अहमदाबाद	केन्द्रीय विद्यालय वल्लभ विद्यानगर
15	मधुबाला	Male	अहमदाबाद	केंद्रीय विद्यालय मधुबाला
16	श्री जगदीप कुमार सिंह	Male	पटना	पीएम श्री केंद्रीय विद्यालय दानापुर कैंट प्र.पाली
17	बिपिन कुमर सिन्हा	Male	पटना	पीएम श्री केंद्रीय विद्यालय जमालपुर
18	मृत्युंजय कुमार	Male	पटना	पी एम श्री के वि खगड़िया
19	श्री मनमोहन सिंह	Male	पटना	पीएम श्री के वि खगौल
20	श्रीमति कृतिका वर्मा	Female	पटना	पीएम श्री के. वि. कंकड़बाग (द्वि. पा.)
21	श्री गुरमीत सिंह	Male	पटना	पीएम श्री के. वि. आरपीसीएयू पूसा
22	श्री सुभाष कुमार	Male	पटना	पीएम श्री केंद्रीय विद्यालय, सहरसा
23	प्रमोद कुमार	Male	पटना	केंद्रीय विद्यालय सासाराम
24	श्रीमती ममता	Female	जयपुर	पीएम श्री केन्द्रीय विद्यालय क्रमांक 01 वायुसेना स्थल जोधपुर
25	मनोज कुमार	Male	जयपुर	श्री केन्द्रीय विद्यालय खेतड़ीनगर
26	श्री दीनदयाल महावर	Male	जयपुर	पीएम श्री केन्द्रीय विद्यालय क्र 1 कोटा
27	विजय कुमार	Male	जयपुर	पीएम श्री केवी एकलिंगगढ़ उदयपुर

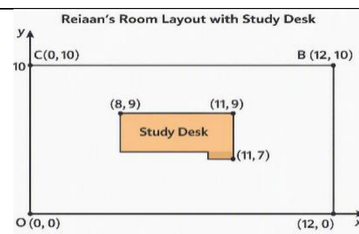
28	श्री अशोक कुमार चाहर	Male	जयपुर	पीएम श्री के.वि.(वा.से)उत्तरलाई
29	सतेंद्र कुमार शर्मा	Male	जयपुर	केंद्रीय विद्यालय बी एस एफ रामगढ़
30	रजनी रमेश दाभाडे	Female	मुंबई	पीएम् श्री केंद्रीय विद्यालय वायुसेना स्थल
31	ऋतु यादव	Female	मुंबई	केन्द्रीय विद्यालय ओएनजीसी पनवेल (केवी.1218)
32	श्री शैलेश गायकवाड़	Male	मुंबई	पीएम श्री केंद्रीय विद्यालय नासिक रोड कैंप
33	प्रीती मुखर्जी	Female	मुंबई	पीएम श्री केंद्रीय विद्यालय आर्मी एरिया पुणे
34	सोनम	Female	मुंबई	पीएम श्री केंद्रीय विद्यालय गणेशखिंड पुणे
35	मंजु लोकरस	Female	मुंबई	पीएम श्री केंद्रीय विद्यालय कोलिवाडा
36	जयशंकर यादव	Male	मुंबई	पीएम श्री केंद्रीय विद्यालय क्र 2 कुलाबा
37	विभा शर्मा	Female	मुंबई	पीएम श्री केंद्रीय विद्यालय क्रमांक 1 कुलाबा

एकत्रीकरण एवं संपादन:

1. कुमुद प्रकाशचंद्र भट्ट
केन्द्रीय विद्यालय वल्लभ विद्यानगर

2. सुश्री निकिता
पीएम श्री केंद्रीय विद्यालय क्र-1 सेक्टर 30 गांधीनगर

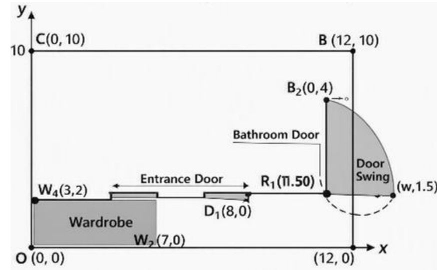
CHAPTER: 1 ORIENTING YOURSELF: THE USE OF COORDINATES

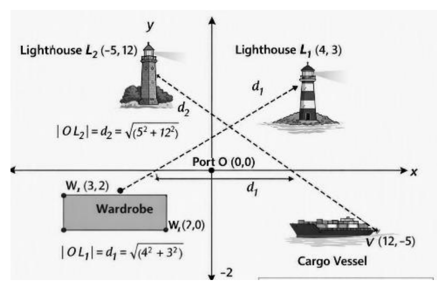
Q. No.	MULTIPLE CHOICE QUESTIONS
1	In ancient Indian mathematics, Baudhāyana (c. 800 BCE) used mutually perpendicular East-West and North-South lines for geometric altar constructions, establishing early grid-based coordinate principles. If a ceremonial altar base is mapped on a Cartesian plane such that its vertices are located at (a, b), (-a, b), (-a, -b), and (a, -b) where a > 0 and b > 0, what geometric figure is formed, and in which quadrant does the vertex with both negative coordinates lie? A) Parallelogram; Quadrant II B) Rectangle; Quadrant III C) Rhombus; Quadrant IV D) Square; Quadrant II
2	Historical geographical records state that Ujjayinī was regarded as the prime meridian (zero longitude reference) in early Indian astronomy (Siddhāntas), later transcribed as 'Arin' in Arabic maps. If Ujjayinī is mapped as the origin (0,0) on a celestial grid, and city A has coordinates (-d, k) while city B has coordinates (d, -k) with d > 0, k > 0, which statement correctly describes the spatial relationship between city A and city B? A) City B is the reflection of City A in the x-axis. B) City B is the reflection of City A in the y-axis. C) City B is the reflection of City A through the origin (0,0). D) City A and City B lie in the same quadrant
3	In Reiaan's room floor layout, the room boundaries form a rectangle with vertices O(0,0), A(12,0), B(12,10), and C(0,10). A study desk is positioned such that three of its foot corners are at (8,9), (11,9), and (11,7). A student analyses the position of the desk. Which of the following spatial deductions is INCORRECT?  A) The fourth foot of the table is at (8,7). B) The area covered by the table on the floor is 6 square feet. C) The desk extends 2 units parallel to the y-axis and 3 units parallel to the x-axis. D) The desk is positioned completely inside the bathroom space.
4	Point P lies in Quadrant II of the Cartesian plane such that its perpendicular distance from the x-axis is 7 units and its perpendicular distance from the y-axis is 4 units. What are the coordinates of point P? A) (-7, 4) B) (-4, 7) C) (4, -7) D) (7, -4)
5	Consider a point Q(x, y) located in the Cartesian plane. Under what precise condition will the point Q(x, y) coincide with the point R(y, x)? A) Only when x = -y B) Only when both x and y are positive C) If and only if x = y D) Points (x, y) and (y, x) can never coincide
6	A point lies on the y-axis and is at a distance of 6.5 units below the x-axis. What are its coordinates, and what is its distance from the origin? A) (-6.5, 0) and distance is 6.5 units B) (0, -6.5) and distance is 6.5 units C) (0, 6.5) and distance is -6.5 units D) (-6.5, -6.5) and distance is 13 units
7	An architectural layout maps a room's door frame on the x-axis between points D1(8, 0) and R1(11.5, 0). If an accessibility guideline requires doors to be at least 3.2 feet wide to allow easy wheelchair passage, does this door comply with the guideline? A) No, because the door width is 2.5 feet. B) Yes, because the door width is 3.5 feet. C) No, because the door width is 11.5 feet. D) Yes, because the door width is 8 feet.

8	Triangle ADM has vertices at A(3, 4), D(7, 1), and M(9, 6). Using the Baudhāyana-Pythagoras theorem on the grid, what is the exact perimeter of triangle ADM? A) $5 + \sqrt{29} + \sqrt{40} units$ B) $12 + \sqrt{20}\ units$ $C)\ 15\ units$ D)$\sqrt{25} + \sqrt{25} + \sqrt{25}\ units$
9	If triangle ADM with vertices A(3, 4), D(7, 1), and M(9, 6) is reflected across the y-axis to form triangle A'D'M', which property of the triangle is altered? A) Lengths of the side segments AD, DM, and MA B) The overall perimeter of the triangle C) The signs of the x-coordinates of its vertices D) The area enclosed by the triangle
10	A line segment ST has endpoints S(-3, 0) and T(3, 0). Point M is the midpoint of ST. If the line segment is shifted upwards parallel to the y-axis by 4 units to form S'T', what are the new coordinates of the midpoint M'? A) (0, 0) B) (0, 4) C) (3, 4) D) (-3, 4)
11	Let P(-5, -2) and Q(5, -2) be two points in a coordinate plane. The distance between points P and Q is calculated using which formula derivation? A) $\|-5 - 5\| = 10\ units\ along\ the\ x-axis\ since\ y-coordinates\ are\ equal$ B) $\|-2 - (-2)\| = 4\ units\ along\ the\ y-axis$ C) $\sqrt{(-5)^2 + (-2)^2} = \sqrt{29}\ units$ D) $D)\ 5 + 2 = 7\ units$
12	In a town planning software, two main avenues cross at the origin O(0,0). Avenue East-West is the x-axis, and Avenue North-South is the y-axis. A delivery hub is located at (-6, -8). In which quadrant is the delivery hub, and what is its direct shortest distance (crow-fly distance) from the origin? A) Quadrant II; 14 units B) Quadrant III; 10 units C) Quadrant IV; 10 units D) Quadrant III; 14 units
13	Points A(1, -8), B(-4, 7), and C(-7, -4) all lie on a circle centred at the origin O(0,0). What is the exact radius of this circle? A) √65 units B) 8 units C) √55 units D) 65 units
14	A computer screen grid has origin (0,0) at the bottom-left corner. A circular icon of radius 80 pixels is centred at A(100, 150). What are the minimum and maximum x-coordinates occupied by the edges of this circular icon? A) x_min = 100, x_max = 180 B) x_min = 20, x_max = 180 C) x_min = 70, x_max = 230 D) x_min = 0, x_max = 200
15	Four points are plotted on a graph: A(2, 1), B(-1, 2), C(-2, -1), and D(1, -2). What shape is formed by connecting A-B-C-D-A, and what is its area? A) Rectangle of area 10 sq units B) Square of area 10 sq units C) Square of area 5 sq units D) Rhombus of area 20 sq units
16	A bedroom floor plan is bounded by x = 0, x = 12, y = 0, and y = 10. A rug is laid out such that every boundary point of the rug is exactly 2 units away from the room's boundary walls. The area of the rug is: A) 48 sq units B) 60 sq units C) 32 sq units D) 80 sq units
17	A point K lies in Quadrant IV. If its distance from the x-axis is 5 units and its distance from the y-axis is 3 units, what are the coordinates of K? A) (-5, 3) B) (3, -5) C) (-3, 5) D) (5, -3)
18	If a system of coordinates were constructed without using negative numbers (using only non-negative real numbers [0, ∞), which of the following best describes the limitation of such a system? A) It can only represent points lying in Quadrant I and on the positive axes.

	B) It cannot measure distances between any two points. C) It cannot define the origin (0,0). D) It can only represent 3D objects, not 2D shapes.
	Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.
19	Assertion (A): The point P(-4, 0) lies on the negative x-axis at a perpendicular distance of 4 units from the y-axis. Reason (R): For any point lying on the x-axis, its y-coordinate (ordinate) is always 0, and its x-coordinate (abscissa) represents its directed perpendicular distance from the y-axis.
20	Assertion (A): Point P(0, -5) lies in Quadrant IV of the Cartesian plane. Reason (R): Any point whose x-coordinate is 0 lies directly on the y-axis and does not belong to any of the four quadrants.
	2 MARK QUESTIONS
21	A point A is located on the x-axis at a distance of 7 units to the left of the origin, and point B is located on the y-axis at a distance of 24 units above the origin. Write the coordinates of A and B, and find the straight-line distance AB.
22	Explain why Brahmagupta's formalization of zero and negative numbers was a necessary prerequisite for the development of the modern four-quadrant Cartesian coordinate system.
23	Point M(x, y) is the midpoint of a line segment joining S(-8, 7) and T(6, -3). Calculate the values of x and y using coordinate principles.
24	A rectangular room floor has corner coordinates O(0,0), A(12,0), B(12,10), and C(0,10). A circular rug of radius 3 feet is placed with its centre at (6, 5). Determine whether any part of the rug extends outside the room boundaries.
25	Without plotting on graph paper, determine whether the point P(-4.5, 0) and point Q(0, 3.8) lie in any quadrant or on coordinate axes. Justify your reasoning.
	3 MARK QUESTIONS
26	Three points are given as M(-3, -4), A(0, 0), and G(6, 8). (i) Suggest and derive a mathematical method using distances to check if M, A, and G lie on the same straight line (are collinear) without plotting them. (ii) Execute your method to conclude whether they are collinear.
27	In Reiaan's bathroom layout, the bathroom occupies a rectangular region with vertices P(-6, 0), O(0, 0), F(0, 10), and R(-6, 10). (i)A washbasin area of size 3 ft × 2 ft is placed against the left wall (x = -6) in the bottom corner starting from y = 0. Write the coordinates of its four corners. (ii)A toilet space of size 2 ft × 3 ft is placed along the y-axis starting above the door hinge B2(0, 4) up to y = 7. Write the coordinates of its four corners.
28	Points P and Q are points of trisection of the line segment AB, where P is closer to A and Q is closer to B. Given A(4, 7) and B(16, -2): (i)Find the midpoint of AB (call it M). (ii)Using midpoint concepts , calculate the precise coordinates of trisection points P and Q.

29	The points R(3, 0), A(0, -2), M(-5, -2), and P(-5, 2) are joined in order to form quadrilateral RAMP. (i) Identify two sides that are perpendicular to each other. (ii) Identify one side that is parallel to the x-axis. (iii) Identify two vertices that are mirror images of each other across an axis, and name the axis.
30	(i)Given two circular computer icons: Icon 1 is centred at A(100, 150) with radius 80 pixels, and Icon 2 is centred at B(250, 230) with radius 100 pixels. (ii)Calculate the exact distance between centres A and B. (iii)Determine analytically whether the two circular icons overlap/intersect each other.
31	Construct an isosceles triangle on a Cartesian plane such that one vertex is at the origin O(0,0), the second vertex lies in Quadrant III, and the third vertex lies in Quadrant IV. Provide explicit coordinates for all three vertices and prove analytically that two side lengths are equal.
5 MARK QUESTIONS	
32	The midpoints of the sides of triangle ABC are D(5, 1), E(6, 5), and F(0, 3). (i) Let the unknown vertices be A(x1, y1), B(x2, y2), and C(x3, y3). Set up a system of linear equations relating the vertex coordinates to the given midpoints D, E, and F. (ii) Solve the system step-by-step to determine the exact coordinates of vertices A, B, and C. (iii) Verify your result by calculating the midpoint of segment AB and matching it with the given midpoint
33	A city layout is designed as a square grid centred at origin O(0,0). Two main perpendicular avenues run along the axes: East-West Avenue (x-axis) and North-South Avenue (y-axis). Parallel streets are built at uniform intervals of 200 meters (1 unit on grid = 200 m). (a) A cyclist starts at intersection C(-4, 3) and travels along grid lines to D(5, -9). (i) Calculate the Manhattan distance (distance travelled strictly along grid lines) in meters. (ii) Calculate the Euclidean (direct shortest crow-fly) distance in meters between C and D. (iii) Explain how this urban grid system reflects the historical urban planning of the ancient Sindhu-Sarasvatī Civilisation.
34	Consider circle K centred at the origin O(0,0) passing through point A(1, -8). (i) Prove that points B(-4, 7) and C(-7, -4) also lie on circle K. (ii) Check whether point D(-5, 6) lies inside, on, or outside circle K. (iii) Check whether point E(0, 9) lies inside, on, or outside circle K. (iv) Calculate the exact area of the circle K in square units (leave answer in terms of π).
35	Given quadrilateral ABCD with vertices A(2, 1), B(-1, 2), C(-2, -1), and D(1, -2): Using the Baudhāyana-Pythagoras distance formula. (i) Calculate the lengths of all four sides AB, BC, CD, and DA (ii) Calculate the lengths of both diagonals AC and BD. (iii) Justify whether ABCD is a square. (iv) Compute the exact area of quadrilateral ABCD.
CASE STUDY BASED QUESTIONS	
36	Reiaan and Shalini's family recently moved into a new home. Shalini, having studied *Coordinate Geometry* in Grade 9, designed a tactile grid floor map of Reiaan's bedroom and bathroom to help him navigate independently. The floor plan is modelled on a 2D Cartesian plane,where 1 grid unit = 1 foot. Room Layout: Bedroom vertices: $O(0,0)$, $A(12,0)$, $B(12,10)$, $C(0,10)$ Main entrance door spans segment D_1R_1along the x-axis:$D_1(8,0)$, $R_1(11.5,0)$

<table>
<tr><td></td><td>Bathroom door spans segment B_1B_2 along the y-axis: $B_1(0, 1.5)$, $B_2(0, 4)$
Wardrobe occupies space between: $W_1(3, 0)$, $W_2(7, 0)$, $W_4(3, 2)$


Questions
(i) Calculate the width of the main entrance door D_1R_1 and the bathroom door B_1B_2.
(ii) Standard wheelchair accessibility guidelines require interior doors to have a minimum clearance width of 3.0 ft. Evaluate whether both doors meet accessibility standards for a person using a wheelchair.
(iii) If the bathroom door hinges at $B_1(0, 1.5)$ and swings 90° outward into the bedroom along a circular arc of radius equal to the door width, determine: the coordinates of the door's outer edge when fully opened into the room. Check if it collides with the wardrobe located between $W_1(3,0)$ and $W_2(7,0)$ extending up to $W_4(3,2)$.</td></tr>
<tr><td>37</td><td>Throughout history, coordinate systems developed across cultures for sky mapping and terrestrial navigation. In 5th-century India, Āryabhaṭa used Celestial Coordinates based on the ecliptic and introduced sine functions. Later, Islamic scholar Al-Bīrūnī (c. 1000 CE) perfected the handheld 'astrolabe' to calculate city coordinates using Indian trigonometric methods. Modern navigation systems rely on similar Cartesian coordinates overlaying geographical zones.
Suppose a regional navigation grid places a coastal port at origin O(0,0). Lighthouse L_1 is at (4, 3), Lighthouse L_2 is at (-5, 12), and a cargo vessel V is at (12, -5).


Questions:
(i)Calculate the direct distance of Lighthouse L_1 and Lighthouse L_2 from the port origin O(0,0).
(ii)In which quadrants do Lighthouse L_2 and Vessel V lie?
(iii)The cargo vessel V(12, -5) sends a distress signal.
(iv)Determine which lighthouse (L_1 or L_2) is closer to vessel V in direct line-of-sight distance. Support your answer with full calculations.</td></tr>
<tr><td>38</td><td>A computer graphics application renders a graphical user interface (GUI) on a display screen of size 800 × 600 pixels. The origin (0,0) is located at the bottom-left corner of the screen. x increases horizontally to the right (up to 800), and y increases vertically upward (up to 600).
Two circular interactive icons are rendered on the screen:
• Icon A (Settings): Centre at A(100, 150), Radius $R_1 = 80$ pixels.
• Icon B (Profile): Centre at B(250, 230), Radius $R_2 = 100$ pixels.
Questions:
(i)Determine whether any part of Icon A or Icon B extends outside the visible boundary of the screen $[0 \le x \le 800, 0 \le y \le 600]$. Show analytical proof.
(ii)Calculate the straight-line distance between the centres A and B of the two icons.
(iii)Determine whether Icon A and Icon B overlap each other on the screen.
(iv)If a software engineer wants to move Icon B horizontally to the right along y = 230 so that it is exactly tangent to Icon A (touching externally at one point), what should be the new x-coordinate of Icon B's centre?</td></tr>
</table>

CHAPTER 2: INTRODUCTION TO LINEAR POLYNOMIALS

Q. No.	MULTIPLE CHOICE QUESTIONS
1	The expression $9x + 7$ is evaluated for $x=3$. A student obtains 34. Which statement is correct? (a) The student is correct. (b) The student should get 27. (c) The student should get 34. (d) The expression cannot be evaluated.
2	A linear polynomial is represented by $p(x) = ax+b$, where $a\neq0$. What happens to its degree if $a = 0$? (a) It becomes 2. (b) It remains 1. (c) It becomes a constant polynomial. (d) It is no longer an expression.
3	A student writes the expression $7x-4$. Which statement correctly describes it – (a) It is a quadratic polynomial. (b) It is a constant polynomial. (c) It is a linear polynomial with degree 1. (d) It is not a polynomial.
4	The cost of a notebook is ₹ x, and the cost of a pen is ₹15. If a student buys 4 notebooks and 2 pens, the total cost is represented by: (a) $4x+15$ (b) $4x+30$ (c) $6x+30$ (d) $4(x+15)$
5	Riju wants to express the perimeter of his carrom board in terms of a linear polynomial. Which of the following polynomials can be used by him? (a) $4x+16$ (b) $4x^2+16$ (c) $4x^2+2x$ (d) $4x^3+16x^2$
6	A taxi charges ₹50 as a fixed charge and ₹12 per kilometre. Which expression represents the fare for a travel for x kilometres – (a) $6x+30$ (b) $50x+12$ (c) $62x$ (d) $50+12x$
7	Ihana puts 4 ball pens in each of the ‘x’ red boxes and 5 ball pens in ‘y’ blue boxes with 3 extra pens left. The number of pens Ihana has – (a) $4x+5y$ (b) $4x+5y+3$ (c) $5x+4y+3$ (d) $4x+5y-3$
8	A rectangular garden has length $(x+5)$ m and breadth 3 m. The length of wire required to fence this garden is – (a) $2x+16$ (b) $2x+8$ (c) $3x+5$ (d) $2x+10$
9	Two students classify the polynomial $p(x) = 5 - 2x$. Student A: “Its degree is 1.” Student B: “Its coefficient of x is 5.” Who is correct? (a) Only Student A (b) Only Student B (c) Both students (d) Neither student
10	The temperature at 6 a.m. is x°C. During the day, it rises by 8°C. Which expression represents the temperature later in the day? (a) $8x$ (b) $x-8$ (c) $x+8$ (d) $8-x$
11	Which of the following situations can be represented by a linear polynomial in x? (a) Area of a square of side x. (b) Cost of x pens at ₹10 each plus a fixed ₹20 charge. (c) Volume of a cube of side x. (d) Product of two numbers x and $x+2$
12	A student simplifies $(5x+8) - (2x+3)$ as $3x+11$. What is the error? (a) The coefficients of x cannot be subtracted.

	(b) The constant terms should be subtracted as 8−3. (c) The expression is not a polynomial. (d) The x-terms should be multiplied.
13	Observe the following table: <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>P(x)</td><td>4</td><td>7</td><td>10</td><td>13</td></tr></table>Which expression represents p(x) (a) x+4 (b) 2x+4 (c) 4x+3 (d) 3x+4
14	A shopkeeper's billing rule is represented by B(x) = 25x + 100, where x is the number of items purchased. What does the constant term 100 represent? (a) Cost of one item (b) Number of items (c) Fixed charge in the bill (d) Total cost of x items
15	Riya says, "Every polynomial containing x is a linear polynomial." Which example disproves her statement? (a) $4x^2+2x$ (b) 2x+4 (c) 7x-1 (d) 9x
16	A linear polynomial p(x) = 2x - 6 is represented graphically. At which point does its graph meet the x-axis? (a) (0,−6) (b) (3,0) (c) (0,3) (d) (−3,0)
17	Two students simplify the expression: 6x + 5 − (2x − 3); Student A gets 4x + 2, while Student B gets 4x + 8. Who is correct? (a) Student A (b) Student B (c) Both (d) Neither
18	A parking area charges ₹30 as a fixed fee and ₹10 per hour. If a vehicle stays for x hours, its parking charge is represented by p(x) = 10x + 30. What will be the charge for 5 hours? (a) ₹50 (b) ₹70 (c) ₹80 (d) ₹100
	Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.
19	Assertion (A): A student says that 7-3x is a linear polynomial. Reason (R): The highest power of variable in a linear polynomial is 1.
20	Assertion (A): The zero of the linear polynomial p(x) = 3x - 12 is –4. Reason (R): A zero of a polynomial is the value of x for which the value of the polynomial is zero.
2 MARK QUESTIONS	
21	A student says 4x+9 is a quadratic polynomial because it has two terms. Is the statement correct? Give reason.
22	Two polynomials are p(x) = 2x - 10 and q(x) = 5x - 25. Do they have the same zero? Justify.
23	A polynomial has p(0) = -4 and increases by 3 for every unit increase in x. Write p(x).
24	A machine follows M(n) = 8n - 3 for n = 1, 2, 3, ... A student says the constant term -3 means the first output is -3. Is this correct?

25	A line y = 2x - 6 crosses the x-axis at a point. Find that point without drawing the graph.
	3 MARK QUESTIONS
26	A delivery app uses the rule P(x) = 15x + 40 to calculate a packaging score for x items. (a) Find P(6). (b) State the coefficient of x and the constant term. (c) Explain what the number multiplying the coefficient of $x$and the constant term in the rule $P(x) = 15x + 40$ might represent in the delivery app's packaging context.
27	A student says 7x - 5 is not a polynomial because one term is negative. (a) Justify whether his claim correct? (b) State its degree. (c) Name its constant term.
28	The values of a quantity follow the pattern 11, 16, 21, 26, ... for x = 0, 1, 2, 3, ... (a) Write a linear polynomial P(x). (b) Find P(8). (c) Explain how you identified the coefficient of x.
29	For P(x) = 4x - 20: (a) Find its zero, (b) Verify it by substitution, and (c) Explain what the zero means graphically.
30	A polynomial P(x) = ax + 8 has zero x = -4. (a) Find a. (b) Write P(x). (c) Check the zero.
31	Observe the following table: <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>P(x)</td><td>4</td><td>7</td><td>10</td><td>13</td></tr></table>(a) Find a rule of the form ax + b. (b) Find P(0). (c) Compute P(10).
	5 MARK QUESTIONS
32	A taxi service charges a fixed amount of ₹50 and ₹15 per km travelled. Let the distance travelled be x km and the total fare be represented by F(x). (a) Form a polynomial F(x) representing the total fare. (b) State its degree, coefficient of x, and constant term. (c) For what distance will the fare be ₹200? (d) Explain why the polynomial obtained in this situation is a linear polynomial.
33	Two linear polynomials are given by: p(x) = 3x + 5 and q(x) = 5x - 7. (a) Find p(2) and q(2).

	(b) Find the value of x for which $p(x) = q(x)$. (c) Determine the zero of each polynomial.
34	A linear polynomial is of the form $p(x) = ax + b$, where a and b are real numbers. It is known that $p(2) = 7$ and $p(5) = 16$. (a) Form two equations in a and b using the given information. (b) Find the values of a and b. (c) Hence, find the polynomial $p(x)$. (d) Find the zero of $p(x)$.
35	A student claims: "If $p(x) = ax + b$ is a linear polynomial and $p(3) = p(7)$, then $a = 0$." Consider the statement carefully. (a) Determine whether the student's claim is correct or incorrect. (b) Give a mathematical justification for your answer. (c) Is such a polynomial a linear polynomial? Give a reason based on the definition of the degree of a polynomial. (d) What condition on a is necessary for $ax + b$ to be a linear polynomial?
CASE STUDY BASED QUESTIONS	
36	The Robot That Refuses Stage 0 A robot builds towers according to $H(n) = 5n - 2$ centimetres, where $n = 1, 2, 3, ...$ is the tower number. A student says the constant term -2 means the first tower has negative height. (a) Explain the error in the student's interpretation. (b) Find $H(1)$, $H(2)$ and $H(10)$. (c) Algebraically $H(0) = -2$. Why need this not describe a real tower? (d) Can a tower in this sequence have height 48 cm?
37	The Reverse Barcode A barcode machine prints a value $B(x) = ax + 9$. It prints 29 when $x = 4$. (a) Find a. (b) Find the zero of $B(x)$. (c) A worker says the zero must be positive because all printed values seen so far were positive. Is that valid? (d) If x is restricted to whole-number package counts, does the zero necessarily correspond to a real package count?
38	The Discount That Becomes Impossible A coupon model gives final price $F(n) = 500 - 35n$, where n is the number of discount tokens used. (a) Is $F(n)$ increasing or decreasing? Why? (b) The algebraic rule eventually gives negative prices. Does that mean a shop would pay the customer? (c) Find the greatest whole number n for which $F(n)$ is still non-negative.

CHAPTER 3: THE WORLD OF NUMBERS

Q. No.	MULTIPLE CHOICE QUESTIONS
1	. teacher asks students to arrange the following numbers in increasing order: -3/4, -0.6, 0, 2/3. Riya says that -0.6 should come before -3/4 because 0.6 < 0.75. Which statement best evaluates her reasoning? A. Riya is correct because smaller absolute value always means a smaller number. B. Riya is correct because both numbers are negative. C. Riya is incorrect because on the number line -3/4 lies to the left of -0.6. D. Riya is incorrect because negative rational numbers cannot be compared.
2	A student claims that only one number exist between 2 and 3 because (2+3)/2 = 2.5. Identify the flaw in the reasoning. A. The formula used is incorrect B. Only integers exist between numbers C. Infinitely many rational numbers exist between two numbers D. 2.5 is irrational
3	Three students are asked whether the natural numbers are closed under subtraction. P: 'Yes, because subtracting two natural numbers always gives a natural number.' Q: 'No, because 3-5 is not a natural number.' R: 'Yes, because 5-3 is a natural number.' Which student gives the best evidence for the correct conclusion? A. P B. Q C. R D. P and R together
4	Neha is searching irrational numbers. From the variables x, y, z and u. Her right answer will be: A. $x^2 = 5$ B. $y^2 = 9$ C. $z^2 = 0.04$ D. $u^2 = 16/4$
5	. Every p/q type number, where p and q are integer and q is not equal to zero, can be converted into decimal form. The decimal expansion of 11/16 is: A. Non-terminating recurring B. Irrational C. Terminating D. Undefined
6	Ghanshyam is inserting numbers which lies between 2/5 and 3/5. According to you, he should select: A. ½ B. 5/6 C. 4/5 D. 1/5
7	A Mathematician wants to construct a number that is certainly irrational using only the information that 2 and 3 are not perfect squares. Which choice gives the strongest justification? A. 2+3 B. 2×3 C. $\sqrt{2}$ D. 2^3
8	Geeta wants to convert $0.\overline{18}$ into p/q form. According to you she will select: A. 18/100 B. 17/99 C. 18/5 D. 2/11
9	A digital display shows the value 0.27272727... A student wants to decide whether the number is rational without converting it into a fraction. Which observation is sufficient? A. The decimal has infinitely many digits. B. The decimal digits repeat in a fixed pattern. C. The first digit after the decimal is 2. D. The number is less than 1.
10	A diver is at -6m below sea level and rises to 2 m above the sea level. Total change in his position is: A. -8 B. -4 C. 8 D. 4
11	Decimal numbers are also showing rational and irrational numbers. Choose odd one from the followings: A. 0.01001000100001........ B. 23.56018561223987479012O....... C. 0.11222333344055......... D. 0.123451234512345.........

12	During a class activity, students have to place $\sqrt{2}$ and 1.5 on a number line. Four students make these claims: a. '$\sqrt{2}$ must be greater because it contains a square root.' b. '$\sqrt{2} = 2$, so it should be placed at 2.' c. 'Since $1.4 < \sqrt{2} < 1.5$, it should lie between 1.4 and 1.5.' d. '$\sqrt{2}$ cannot be placed on a number line because it is irrational.' Which claim provides the most appropriate mathematical reasoning? A. a B. b C. c D. d
13	Anamika Convert $0.\overline{5}$ into p/q form. Her correct answer will be: A. ½ B. 5/9 C. 2/3 D. 1/3
14	A student uses a calculator and obtains 7/8 = 0.875. She then says, 'Every rational number must have a terminating decimal expansion.' Which example would be the best evidence to challenge her conclusion? A. ¾ B. 11/20 C. 2/3 D. 9/10
15	Four students are discussing numbers between 2/5 and 3/5. Aman: 'There is no rational number between them.' Bhavna: 'There is exactly one rational number between them.' Chitra: 'There are infinitely many rational numbers between them.' Deepak: 'There are rational numbers between them only if their denominators are different.' Which student's conclusion is mathematically defensible? A. Aman B. Bhavna C. Chitra D. Deepak
16	A student argues that counting can begin from 0 because we can count 'zero objects'. Which statement correctly explain this concept? A. Natural numbers include 0 B. counting begins from 1 C. 0 is negative D. 0 is irrational
17	Radha asked, which of the following situation demonstrates that natural numbers are not closed under subtraction? A. 15 - 10 = 5 B. 8 - 3 = 5 C. 4 - 9 = -5 D. 6 - 2 = 4
18	If a number x satisfies $x + 0 = x$ and $x \times 0 = 0$, which property is illustrated? A. Closure B. Identity and zero property C. Density D. irrationality
	Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.
19	Assertion: Rational numbers are closed under division. Reason: division by zero is not defined.
20	Assertion: Zero is not a natural number but is an integer. Reason: Natural numbers begin from 1, while integers include negative numbers, zero, and positive number.
	2 MARK QUESTIONS
21	Virat live in a residential flat. He park his car and through lift, he moves from floor No. -2 to floor No. 5. He says that his total movement is 8 floors. By calculation show that, whether, he is correct or not.

22	A trader records the following transactions: Rs.200 earned, Rs. 350 lost and Rs. 150 earned again. Determine the final balance and state its implication.
23	Using the number 35, illustrate how zero behaves differently under addition and multiplication.
24	Goutam is converting 0.125 into p/q form. Show his steps and get answer.
25	A right triangle has both perpendicular sides of length 1 unit. Find the length of the hypotenuse and explain how this result is connected to irrational numbers.
	3 MARK QUESTIONS
26	A person moves on a number line from -3 to 5 and then back to 1. (a) Calculate the total distance covered (b) Determine the net displacement. (c) Explain the difference between distance and displacement.
27	A container holds 9/10 litres of water. If 2/5 litres of water is removed (a) determine the remaining quantity (b) express in simplest form
28	Examine whether the decimal expansion of 7/40 is terminating or non-terminating (a) Express the denominator in its prime factorised form (b) Verify whether it satisfies the condition for a terminating decimal. (c) State the final conclusion regarding the nature of its decimal expansion.
29	Convert the mixed recurring decimal $0.\overline{23}$ into the form p/q. Show the complete method used to obtain the fractional form.
30	Alexa try to simplify the expression (3/4) × (2/5) + (1/2). She claims that the result is irrational number. Is she correct? Show the steps of solution.
31	A number is $\sqrt{49}$ and another number is $\sqrt{10}$ (a) Evaluate the expression (b) classify each number as rational or irrational (c) compare the nature of these numbers with appropriate justification
	5 MARK QUESTIONS
32	A square park has side 5m. A diagonal path is constructed across it. (a) Find the length of diagonal (b) Simplify (c) Identify number type (d) Explain representation on number line (e) Compare with rational value
33	A city planner is designing a smart park. The park includes walking tracks, water pipelines and digital sensors. The measurements involve numbers like 3/4, $\sqrt{2}$, 0.666... and -5 (representing underground depth). The planner must classify numbers correctly to ensure accurate calculations and avoid errors in design. While measuring pathways, the planner notes that some values repeat in pattern, while others continue infinitely without repletion. During calculations, distances are also measured on a number line to track underground and above ground levels. (i) Which number represents an irrational value?

	(a) 3/4 (b) 0.666... (c) $\sqrt{2}$ (d) -5 (ii) Which number has recurring decimal form? (a) 3/4 (b) 0.666... (c) $\sqrt{2}$ (d) -5 (iii) Which number represents underground depth? (a) 3/4 (b) 0.666... (c) $\sqrt{2}$ (d) -5 (iv) Which number is terminating decimal? (a) 3/4 (b) 0.666... (c) $\sqrt{2}$ (d) -5 (v) write 0.666.... in p/q form
34	A delivery vehicle moves along a straight road, starting from -5 km, then travelling to 3 km, moving back to -2 km and finally reaching 4 km. Determine the total distance travelled and the net displacement of the vehicle. Also interpret the result by comparing the two values.
35	A student considers the numbers $\sqrt{5}$, $\sqrt{25}$, $\sqrt{3}$, $\sqrt{36}$. (a) Evaluate the expression wherever possible. (b) Classify each number as rational or irrational (c) There are how many irrational numbers in the group (d) Provide a clear explanation for your classification (rational / irrational) (e) Out of $\sqrt{5}$, $\sqrt{25}$, $\sqrt{3}$ and $\sqrt{36}$, whose decimal expansion is non-terminating non-repeating decimal
	CASE STUDY BASED QUESTIONS
36	A school is constructing a square playground of side 2 m for a model. The diagonals is calculated for placing a rope across it. (i) Find the length of the diagonal (ii) State whether the diagonal is rational or irrational (iii) Justify your answer using appropriate reasoning OR Write the decimal expansion of the diagonal correct up to 3 decimal places. State whether the decimal expansion is terminating or non-terminating.
37	A construction engineer uses different types of numbers while designing a structure. He uses $\sqrt{5}$ for diagonal measurements, 0.75 for material ratio and -3 to represent underground depth. (i) Which of the following is irrational?(a) 0.75 (b) -3 (c) $\sqrt{5}$ (d) 1 (ii) The decimal 0.75 is :(a) Irrational (b) Terminating (c) Recurring (d) Undefined (iii) The number -3 represents : (a) Natural number (b) Whole number (c) Integer (d) Irrational (iv) Which of the following statement is correct? (a) All integers are irrational (b) All rational numbers are integers (c) Some rational numbers are integer (d) Irrational numbers are finite
38	A weather station records temperature changes throughout the day. In the morning, the temperature is -3°C. By afternoon, it rises to 5/2 °C. The system tracks the change using number line concepts and also calculates differences to predict weather patterns. Scientists also use decimal forms of numbers to improve accuracy in reporting. (a) Find the change in temperature. (b) Identify type of 5/2. (c) Convert 5/2 into decimal and classify the decimal. OR (d) Represent both temperatures on the number line and determine which temperature is closer to 0°C.

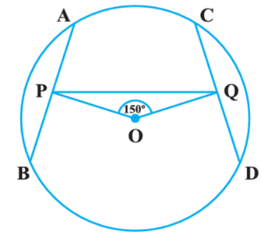
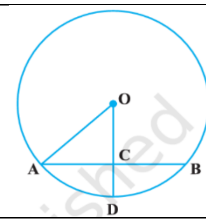
CHAPTER 4: EXPLORING ALGEBRAIC IDENTITIES

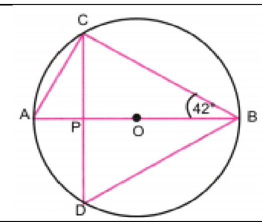
Q. No.	MULTIPLE CHOICE QUESTIONS
1	A square courtyard has side $(x+3)$ m. A student writes its area as x^2+9. Which reasoning best identifies the error? (A) The term $6x$is missing (B) The term $3x$is missing (C) The constant should be 6 (D) No error
2	A rectangular notice board has dimensions $(x+5)$ cmand $(x-5)$ cm. Without multiplying term by term, its area is: (A) x^2+25 (B) x^2-25 (C) $x^2-10x+25$ (D) $x^2+10x+25$
3	A learner wants to calculate 102^2mentally. Which identity gives the quickest route? (A) $(a+b)^2$ (B) $(a-b)^2$ (C) $(a+b)(a-b)$ (D) a^2+b^2
4	A cube has side length $(x+2)$ cm. Its volume is: $(A) x^3+8$ (B) $x^3+6x^2+12x+8$ (C) x^3+4x^2+4x+8 (D) x^3+8x^2+8
5	A square tile has side $(2p-1)$ cm. Which expression represents its area? (A) $4p^2-1$ (B) $4p^2-4p+1$ (C) $4p^2+4p+1$ (D) $2p^2-2p+1$
6	The expression $49m^2-64n^2$occurs in a design calculation. Which factorisation is most useful? (A) $(7m-8n)^2$ (B) $(7m+8n)^2$ (C) $(7m-8n)(7m+8n)$ (D) $(49m-64n)(m+n)$
7	For $a=3$and $b=-2$, which statement is correct? (A) $(a+b)^2=a^2+b^2$ (B) $(a-b)^2=a^2-b^2$ (C) $(a+b)^2=a^2+2ab+b^2$ (D) $(a-b)^2=a^2-2ab+b^2$only when $b$is positive
8	A rectangle has sides $(y+4)$and $(y+7)$. A student obtains y^2+28as its area. The missing part is: (A) $11y+28$ (B) $11y$ (C) $4y+7$ (D) $7y+4$
9	If $x+\frac{1}{x}=5,\ x\neq 0$, then $x^2+\frac{1}{x^2}=?$ (A) 23 (B) 25 (C) 27 (D) 15
10	A pattern produces the expression $(3x+2)^2-(3x-2)^2$. Its simplified form is: (A) $12x$ (B) $24x$ (C) $9x^2-4$ (D) $36x^2-16$
11	A square has area 144 cm^2. If its side is increased by 2 cm, the new area is: (A) 164 cm^2 (B) 196 cm^2 (C) 148 cm^2 (D) 192 cm^2
12	Which expression is always a perfect square for every real x? (A) x^2+6x+7 (B) $x^2-10x+25$ (C) $x^2+5x+10$ (D) x^2-4x-4
13	A student simplifies $(p-q)^2$as p^2-q^2. Which numerical check disproves the result most directly? (A) $p=1,\ q=0$ (B) $p=2,\ q=1$ (C) $p=0,\ q=0$ (D) $p=5,\ q=0$
14	If $(x+7)(x-7)=51$, then $x^2=$ (A) 44 (B) 51 (C) 100 (D) 58
15	The value of 98×102can be found using: (A) $(100-2)(100+2)$ (B) $(100-2)^2$ (C) $(100+2)^2$ (D) 100^2-2
16	A rectangular field has length $(x+8)$ mand breadth $(x-3)$ m. Compared with x^2, its area differs by: (A) $5x-24$ (B) $11x+24$ (C) $5x+24$ (D) $x-24$

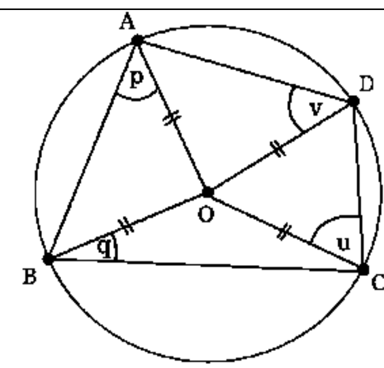
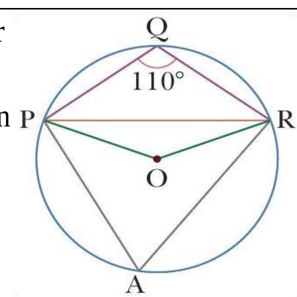
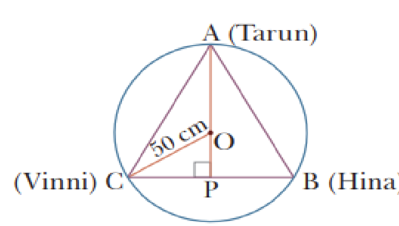
17	If $(m+n)^2 = 169$and $m^2+n^2 = 89$, then $mn =$: (A) 20 (B) 40 (C) 80 (D) 129
18	Which transformation is valid and useful for factorising $x^2+10x+25$? (A) $x^2+2(x)(5)+5^2$(B) $x^2-2(x)(5)+5^2$ (C) x^2-25(D) x^2+25
Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.	
19	Assertion (A):$(x+4)^2-(x-4)^2 = 16x$ for every real number x Reason (R):$(a+b)^2-(a-b)^2 = 4ab$.
20	Assertion (A): $a^2+b^2 = 50,\ ab = 7 \implies (a-b)^2 = 36$ Reason (R):$(a-b)^2 = a^2+b^2-2ab$
2 MARK QUESTIONS	
21	A square photo frame has side $(x+2)$ cm. Its outer area is 100 cm^2. Find x, and hence the side length.
22	Without direct long multiplication, using an algebraic identity evaluate:49^2.
23	The expression:$9a^2-24ab+16b^2$appears in a worksheet. Recognize it as a square and write its factorised form. Briefly justify.
24	A student claims:$(2x+3)(2x-3) = 4x^2+9$ Test the claim by choosing $x = 2$ and state the correct expression
25	If sum of the two sides of a rectangular park is 12 m and area is 20 m^2, then find the sum of squares of its two sides.
3 MARK QUESTIONS	
26	A school wants a square-shaped display board whose side is $(3x-2)$ cm. (i) Express its area in expanded form. (ii) Find the area when $x = 4$.
27	A rectangular garden has dimensions $(2x+5)$ mand $(2x-5)$ m. (i) Express its area using an identity. (ii) Find the area when $x = 6$.
28	A mental-maths activity asks students to calculate:1003^2Use an algebraic identity and explain why your method is efficient.
29	A student claims that 123×73 is difficult without a calculator. Use an identity to find the value.
30	A designer compares two square panels of sides $(n+3)$ cm and $(n-3)$ cm. Show that the difference in their areas is $12n\text{ cm}^2$.
31	Simplify and factorise:$4a^2-12ab+9b^2-25$. Interpret the result as a difference of two squares.
5 MARK QUESTIONS	
32	A rectangular school stage is $(x+6)$ mlong and $(x+2)$ mwide. (a) Obtain its area in expanded form. (b) A second stage has side $(x+4)$ mand is square. Compare the two areas and simplify the difference. (c) For $x = 10$, find both areas and verify the simplified difference.
33	A square park has side $(2x+5)$ m. A smaller square lawn of side $(2x-5)$ mis removed from one corner. (a) Find the remaining area using an identity. (b) For $x = 8$, calculate the remaining area. (c) Explain why the difference-of-squares identity is appropriate.

34	During a number game, a student is given:$x + \frac{1}{x} = 6,\ x \neq 0$ (a) Find $x^2 + \frac{1}{x^2}$. (b) Find $x^3 + \frac{1}{x^3}$. (c) State the identities used and show the key steps.
35	A rectangular sheet has length $(y + 9)$ cm and breadth $(y - 9)$ cm. Its area is $319\ \text{cm}^2$. (a) Find y. (b) If the length is increased by 2 cm while the breadth is unchanged, find the new area. (c) Find the increase in area and verify it algebraically.
35	A rectangular sheet has length $(y + 9)$ cm and breadth $(y - 9)$ cm. Its area is $319\ \text{cm}^2$. (a) Find y. (b) If the length is increased by 2 cm while the breadth is unchanged, find the new area. (c) Find the increase in area and verify it algebraically.
CASE STUDY BASED QUESTIONS	
36	A school is laying square tiles in a corridor. The side of each tile is $(x + 1)$ cm. (i) Write the area of one tile in expanded form. (ii) For $x = 9$, find the area. (iii) The same tile is compared with a square of side $(x - 1)$ cm. Find the difference between their areas.
37	A science exhibition model uses a rectangular panel of dimensions $(p + 6)$ cm by $(p - 6)$ cm. (i) Write the area using a suitable identity. (ii) Find the area for $p = 10$. (iii) If another panel has area $p^2 + 36\ \text{cm}^2$, state whether it is always equal to the first panel's area and justify.
38	A shopkeeper uses mental calculation to find the cost of 99×101items at ₹1 each. He rewrites the product as:$(100 - 1)(100 + 1)$ (i) Find the value quickly using an identity. (ii) Explain the identity used. (iii) If the price per item is ₹5, find the total cost.

CHAPTER 5: I'm UP AND DOWN, AND ROUND AND ROUND

Q. No.	MULTIPLE CHOICE QUESTIONS
1	In Fig. AB and CD are two equal chords of a circle with centre O. OP and OQ are perpendiculars on chords AB and CD, respectively. If ∠POQ = 150º, then ∠APQ is equal to (a) 30º (b) 75º (c) 15º (d) 60º 
2	AD is a diameter of a circle and AB is a chord. If AD = 34 cm, AB = 30 cm, the distance of AB from the centre of the circle is : (a) 17 cm (b) 15 cm (c) 4 cm (d) 8 cm
3	In Fig. 10.3, if OA = 5 cm, AB = 8 cm and OD is perpendicular to AB,  then CD is equal to: (a) 2 cm (b) 3 cm (c) 4 cm (d) 5 cm
4	If AB = 12 cm, BC = 16 cm and AB is perpendicular to BC, then the radius of the circle passing through the points A, B and C is : (a) 6 cm (b) 8 cm (c) 10 cm (d) 12 cm
5	Two circles are congruent if they have equal ___. (a) Angles (b) Radii (c) Chords (d) Diameters only
6	Diagonals of a cyclic quadrilateral are the diameters of that circle, then quadrilateral is a (a) parallelogram (b) square (c) rectangle (d) trapezium
7	Given a circle of radius r and with centre O. A point P lies in a plane such that OP > r, then point P lies (a) in the interior of the circle (b) on the circle (c) in the exterior of the circle (d) cannot say
8	3 boys A, B, C stand on the boundary of a circular ground. How many circles can be drawn passing through all three boys? (a) 0 (b) 1 (c) 2 (d) Infinite
9	Two wires are tied in the same circle. Wire 1 is 3cm from center and Wire 2 is 4cm from center. Which wire is longer? (a) First (b) Second (c) Both equal (d) Can't say
10	If the radius of a circle is doubled, its circumference increases by: (a) 2 times (b) 4 times (c) 8 times (d) Same
11	Two circles intersect each other. The line joining their centers: (a) Perpendicular Bisector the common chord (b) Doubles the common chord (c) Is parallel to common chord (d) Is not perpendicular to common chord
12	In a circle with centre O chords AB = CD. If ∠AOB = 70°, then ∠COD = ? (a) 35º (b) 70º (c) 140º (d) 210º
13	In a circle AB = CD. If ∠AOB = 70°, then ∠COD = ? (a) 35º (b) 70º (c) 140º (d) 210º

14	A string is bent to form a circle and then a square. Relation between radius r and side of square a: (a) $r = a$ (b) $r = a\sqrt{2}$ (c) $2r = a\sqrt{2}$ (d) $r = 2a$
15	A string is bent to form a circle and then a square. Relation between radius r and side of square a: (a) $r = a$ (b) $r = a\sqrt{2}$ (c) $2r = a\sqrt{2}$ (d) $r = 2a$
16	A string is bent to form a circle and then a square. Relation between radius r and side of square a: (a) $r = a$ (b) $r = a\sqrt{2}$ (c) $2r = a\sqrt{2}$ (d) $r = 2a$
17	In the given figure, if O is the centre of the circle, then $\angle BDC$ = (a) 48° (b) 52° (c) 51° (d) 42° 
18	AB, CD and EF are chords of a circle with centre O. Also $OL \perp AB$, $OM \perp CD$ and $ON \perp EF$. If OL = OM = ON, then which of the following is true? (a) AB, BC and CD are unequal (b) AB, BC and CD may be or may not be equal (c) AB = BC = CD (d) None of these
	ASSERTION REASONING QUESTIONS
19	Assertion (A): All the diameters of a circle are of the same length. Reason (R): Diameter is half of the radius. (A) Both A and R are true, and R is the correct explanation of A. (B) Both true, but R is not the correct explanation. (C) A true, R false. (D) A false, R true.
20	Assertion (A): A square is always a cyclic quadrilateral. Reason (R): The sum of the measures of a pair of opposite angles is 180°. (A) Both A and R are true, and R is the correct explanation of A. (B) Both true, but R is not the correct explanation. (C) A true, R false. (D) A false, R true.
	2 MARK QUESTIONS
21	What is the least possible radius of a circle through two points A and B?
22	Prove that "Equal chords of a circle subtend equal angles at the centre of the circle".
23	ABCD is a cyclic quadrilateral. If $\angle B = 75^\circ$, $\angle D = 3X+15^\circ$,find x
24	A chord of a circle is 16 cm long and its perpendicular distance from the centre is 6 cm. Find the radius of the circle.
25	If two chords of a circle are equally inclined to the diameter passing through their point of intersection, prove that the chords are equal.
	3 MARK QUESTIONS
26	Prove that the perpendicular bisector of a chord passes through the centre of the circle.
27	Quadrilateral PQRS is inscribed in a circle. If $\angle P = (2x + 10)^\circ$ and $\angle R = (3x - 20)^\circ$, find the value of x and the measures of $\angle P$ and $\angle R$.

28	In a circle with centre O, the central angle AOB is 60°. If the radius of the circle is 12 cm, what is the length of the chord AB?
29	Explain why the following statement is true: If the perpendicular distance of a chord from the centre is d and the radius is r, then the chord length is $2\sqrt{r^2 - d^2}$
30	In a circle with centre O, chords AB and AC are congruent. Explain why this statement is true: "The centre of the circle lies on the angle bisector of ∠BAC".
31	Distance of a chord AB of a circle from the centre is 12 cm and length of the chord AB is 10 cm. Find the diameter of the circle.
5 MARK QUESTIONS	
32	Two parallel chords of lengths 6 cm and 8 cm are on opposite sides of the centre of a circle. If the radius of the circle is 5 cm, find the distance between the midpoints of the chords.
33	Prove that "The angle subtended by an arc at the centre of the circle is double the angle subtended by the arc at any point on the circle outside the arc."
34	How would you use the following figure to justify the statement that the sum of the opposite angles of a cyclic quadrilateral is 180°? 
35	A quadrilateral MNOP is inscribed in a circle. If MN is a diameter, what can you say about ∠MOP and ∠MNP? Explain your reasoning.
CASE STUDY BASED QUESTIONS	
36	Four friends Rima, Sita, Mohan and Sohan are sitting on the circumference of a circular park. Their locations are marked by points A, P, Q and R. Rohit joins them and sits at the centre of the circular park, so he is equidistant from all the other friends. His position is marked as O. They are sitting in such a way that ∠PQR = 110°.  Based on above information, answer the following questions (i) What is the measure of reflex ∠POR? Give reason. (ii) What is the measure of ∠PAR ? Give reason. (iii) Find ∠OPR. Give reason.
37	Hina and Vinni are best friends. They usually go to the park in the evening to play. One day in the evening, they were sitting on a Merry-go-round at A, B and C Tarun respectively (say) and passing a ball to each other. The seats on it was at equal distances and radius of its base circle is 50 cm. Based on the above information, answer the following questions:  

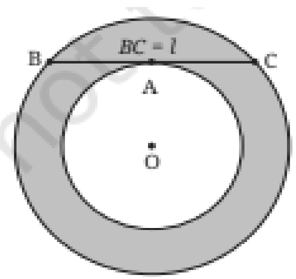
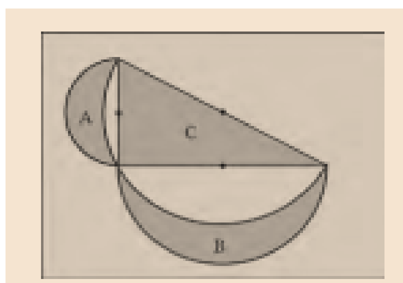
	a) Which type of the triangle is formed by them? b) If distance between Vinni and Hina is $2x$ cm, then find the value of CP. c) Find distance between A and P in terms of x. d) Find the value of x. e) If the distances between any two of them is $m\sqrt{3}$ cm, then find m.
38	A newly constructed sports stadium has a perfectly circular running track with its central hub located at point O. The radius of this circular setup is 17 metres. During a regional athletic meet training session, four athletes A, B, C, and D are stationed at different strategic positions directly on the track boundary line, forming a layout that can be modeled mathematically as a cyclic quadrilateral ABCD. The sports coach notes down the angular relationships of their tracking positions: the opposite angles are recorded as angle DAB = $(2x + 15)°$ and angle BCD = $(3x - 10)°$. Additionally, two underground linear water pipe segments, EF and GH, cross beneath the field. Pipe EF has an exact length of 16 metres and lies at a perpendicular distance of 6 metres from the central hub O. Pipe GH is laid out at a perpendicular distance of 8 m from the central hub O. An internal tracking arc AB subtends an angle AOB = 80° at the central hub O. *Based on the information above, answer the following questions.* (i)What is the numerical value of x determined from the positions of athletes A and C? (ii)Find the length of the underground water pipe line GH. (iii)If another athlete, E, stands at a random single point on the major arc AB along the boundary line, what would be the measure of the subtended angle AEB? (iv)Which of the following fundamental geometric theorems explains why the distance of pipe EF from the center is shorter than that of pipe GH? (a) Equal chords of a circle subtend equal angles at the center. (b) The longer chord is closer to the center than the smaller chord. (c) Chords equidistant from the center are equal in length. (d) The perpendicular from the center to a chord bisects the chord.

CHAPTER 6: MEASURING SPACE: PERIMETER AND AREA

Q. No.	MULTIPLE CHOICE QUESTIONS
1	A school wants to put a boundary rope around a rectangular playground of length 45 m and breadth 30 m. The rope is to be fixed along the boundary only. How much rope is required? A. 75 m B. 120 m C. 150 m D. 1350 m
2	Two rectangular gardens have the same perimeter of 40 m. Garden A measures 12 m × 8 m. Garden B has a length of 15 m. Which statement is correct? A. Garden A has greater area B. Garden B has greater area C. Both have equal area D. Their areas cannot be compared
3	A circular running track has radius 35 m. A runner completes one round. Using $\pi = \frac{22}{7}$, the distance covered is: A. 110 m B. 220 m C. 440 m D. 770 m
4	A circular flower bed has circumference 44 m. A student claims that its radius is 14 m. Which reasoning correctly evaluates the claim? A. Correct, because 44=2×14 B. Correct, because 44= $\frac{22}{7} \times 14$ C. Incorrect, because the radius is 7 m D. Incorrect, because the radius is 22 m
5	A semicircular path has radius 14 m. A student calculates its boundary length as 14π m. What has the student missed? A. The diameter of the semicircle B. The radius of the semicircle C. The area of the semicircle D. Nothing; the answer is complete
6	A sector of a circle has radius 14 cm and central angle 90°. What is the length of its curved arc? A. 11 cm B. 22 cm C. 44 cm D. 88 cm
7	A clock's minute hand is 7 cm long. The area swept by it in 15 minutes is: A. $\frac{49\pi}{4}$cm² B. $\frac{49\pi}{2}$cm² C. 49πcm² D. 196πcm²
8	A parallelogram has base 18 cm and perpendicular height 7 cm. If its slant side is changed while the base and perpendicular height remain unchanged, what happens to its area? A. It increases B. It decreases C. It remains unchanged D. It becomes zero
9	A parallelogram and a rectangle have the same base of 12 cm and the same perpendicular height of 8 cm. Which conclusion is valid? A. Rectangle has greater area B. Parallelogram has greater area C. Both have area 96 cm² D. Their areas cannot be compared
10	A triangular park has base 40 m and perpendicular height 25 m. A contractor calculates its area as 40×25=1000 m². What is the error? A. Base should be squared B. Height should be squared C. The product should be divided by 2 D. The product should be multiplied by 2
11	A triangular field has sides 8 m, 11 m and 13 m. Before applying Heron's formula, a student calculates the semi-perimeter as 32 m. What should the student have calculated? A. 8 m B. 16 m C. 32 m D. 64 m
12	A square and a rectangle each have an area of 64 cm². The square has side 8 cm, while the rectangle measures 16 cm × 4 cm. Which statement is correct? A. Square has greater perimeter B. Rectangle has greater perimeter C. Both have equal perimeter D. Both have equal area and perimeter

13	A farmer has a rectangular field of area 600 m^2. He wants to increase the area without changing the length. If the length is 30 m, which new breadth would give an area of 750 m^2? A. 20 m B. 25 m C. 30 m D. 35 m
14	A car tyre has a diameter of 56 cm. Approximately how far will the car travel when the tyre makes 100 complete revolutions? A. 17.6 m B. 176 m C. 1760 m D. 5600 m
15	Two circles have circumferences in the ratio 5:4. What is the ratio of their radii? A. 25 : 16 B. 5 : 4 C. 4 : 5 D. 10 : 8 only
16	A designer wants to make a circular logo with radius r. If the radius is doubled, what happens to its area? A. It becomes 2 times B. It becomes 3 times C. It becomes 4 times D. It remains the same
17	A cyclic quadrilateral has sides 5 cm, 6 cm, 7 cm and 8 cm. A student says that its area can always be found from these four side lengths alone. Which is the best response? A. Yes, because every quadrilateral has a unique area for given sides B. No, additional information such as its cyclic nature is needed for the relevant formula C. Yes, by using $l \times b$ D. No quadrilateral can have its area calculated
18	A 400 m athletics track has curved portions. To ensure that every runner covers the same total distance, the starting points are staggered. Which mathematical idea is primarily used to determine the required stagger? A. Area of a triangle B. Circumference/arc length of circles C. Heron's formula D. Area of a rectangle
	Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.
19	Assertion (A): If an urban planner scales up the dimensions of a triangular park by increasing every boundary wall to exactly three times its original length, the new park will cover exactly nine times the area of the original park. Reason (R): According to Heron's formula, scaling all side lengths of a triangle by a factor of k scales the semi-perimeter s by k, resulting in the total area being scaled by the square of the factor(k^2).
20	Assertion (A): A geometric designer inscribes both a regular hexagon and an equilateral triangle inside the same circle of radius r. The ratio of the area of the hexagon to the area of the circle is exactly double the ratio of the equilateral triangle to the circle. Reason (R): An inscribed equilateral triangle has a side length equal to the radius of the circle (r), while a regular hexagon is formed by six smaller equilateral triangles.
	2 MARK QUESTIONS
21	A circular school garden has a radius of 7 m. The school has ₹1,500 for edging. A contractor charges ₹28 per metre. Is the budget sufficient? Show your reasoning and state one assumption.
22	A circular flower bed around a school flagpole has radius 3.5 m. The school wants a decorative border at ₹40 per metre. Will ₹500 be sufficient?
23	A school wants to paint a circular logo of radius 14 cm on a wall. Find the area that needs painting.

24	A car tyre has a diameter of 56 cm. How many complete rotations are needed to travel 1 km?
25	Garden A has radius 7 m and Garden B has radius 14 m. A student says Garden B has twice the area of Garden A. Is the student correct?
	3 MARK QUESTIONS
26	A student makes rectangles with a perimeter of 24 cm and records their dimensions: 1×11, 2×10, 3×9, 4×8, 5×7, 6×6 What pattern do you observe in their areas? Which rectangle gives the maximum area? Explain what this suggests about rectangles having a fixed perimeter.
27	A rectangular classroom floor is 8 m long and 6 m wide. Square tiles of side 40 cm are used to cover the floor completely. Find: (a) the area of the floor. (b) the area of one tile. (c) the number of tiles required.
28	A student wants to make a square having the same area as a given rectangle. Instead of calculating the area and then finding the square root, the student uses a geometric construction. Why is it possible to construct such a square? What property must the square and rectangle have in common?
29	A trapezium has parallel sides of lengths 18 cm and 32 cm. Another trapezium has parallel sides 25 cm and 25 cm. Both have the same height. Without finding their areas separately, determine which one has the greater area. Give a reason.
30	A square has side 'a'. Four semicircles are drawn inside it, one on each side, with the side of the square as the diameter. A student claims that the total area of the four semicircles is equal to the area of the square.Do you agree? Show your reasoning.
31	A triangular piece of land has a perimeter of 36 m. The owner wants to divide it into two regions having equal areas. Suggest a mathematical construction that can achieve this. You do not need to calculate the areas.
	5 MARK QUESTIONS
32	A farmer has a rectangular field measuring 45 m × 32 m. He wants to divide it into two equal parts by drawing a line along its length. Determine the perimeter and area of each part. Also suggest the total length of fencing required if the farmer fences the outer boundary and the dividing line.
33	A rectangular sheet of paper is 30 cm long and 20 cm wide. A square of side 8 cm is cut from one corner. Find the area of the remaining sheet. Explain whether the perimeter of the remaining sheet is equal to, greater than, or less than the original perimeter, with reasons.
34	Riya has 40 m of fencing. She wants to make a rectangular garden using all the fencing. Find at least three different pairs of length and breadth possible. Determine the area of each garden. Which dimensions give the greatest area? What do you notice?
35	You have a rectangular piece of land with a perimeter of 60 m. Design a garden that has maximum possible area. (a) What will be its dimensions?

	(b) What will be its area? (c) Explain why you think your design gives the maximum area.
CASE STUDY BASED QUESTIONS	
37	An architect is designing a circular plaza consisting of two concentric circles sharing a common central point O. A straight pathway is built across the outer edge of the plaza. On the blueprint, this pathway forms a chord BC of the larger circle, and it perfectly grazes (is tangent to) the smaller circle at a single point, A. The total length of the pathway segment BC is given as l.  1. Based on the visual representation, a contractor assumes that point A perfectly bisects the pathway BC. Evaluate this geometric assumption and state the specific circle theorem that proves whether it is correct or incorrect. 2. Let the radius of the larger circle be R and the radius of the smaller circle be r. Analyze the right-angled triangle formed by the radii and the chord to express R^2 purely in terms of r and l. 3. The architect claims that the area of the annular region (the green space strictly between the two circles) does not require knowing the individual values of R or r, but can be calculated using *only* the pathway length l. Is the claim of the architect valid?.
38	A mathematics club is building a wooden model to demonstrate the relationship between geometric shapes. The base of the model is a right-angled triangle. Attached to the outer edge of each side of this triangle is a perfect solid semicircle. The semicircles attached to the two perpendicular legs are labeled with Area A and Area B, while the largest semicircle attached to the hypotenuse is labeled with Area C.  1. Let the diameter of a given semicircle be *d.* Formulate a mathematical expression that represents the area of any semicircle strictly as a in terms of its diameter d. 2. A club member hypothesizes that the sum of the curved perimeter arcs of the two smaller semicircles A and B is exactly equal to the curved perimeter arc of the largest semicircle C. Is this hypothesis true or false? Show your work 3.Using the Baudhāyana-Pythagoras theorem with your area formula from part (i) to construct a formal proof demonstrating that Area A + Area B= Area C.

CHAPTER 7: THE MATHEMATICS OF MAY BE: INRODUCTION TO PROBABILITY

Q. No.	MULTIPLE CHOICE QUESTIONS
1	A library has 100 books: 40 novels, 30 science, 20 history, 10 magazines. If one book is chosen, what is the probability that it is not a magazine? (a) 9/10 (b) 1/10 (c) 3/10 (d) 1/5
2	Bag of Marbles A bag has 5 red and 3 blue marbles. A student says the chance of picking red is more than half. Which option is correct? (a) Yes, probability = 5/8 (b) No, probability = 3/8 (c) Yes, probability = 1/2 (d) No, probability = 2/3
3	A die is rolled once. Which statement is correct? (a) P(number greater than 4) = 1/3 (b) P(number greater than 4) = 1/2 (c) P(number greater than 4) = 2/3 (d) P(number greater than 4) = 1/6
4	A box of 20 bulbs has 4 defective ones. If one bulb is chosen, what is the probability that it is not defective? (a) 1/5 (b) 4/20 (c) 4/5 (d) ¼
5	A spinner has 4 equal parts A, B, C, D. If spun once, what is the probability of landing on C? (a) 1/2 (b) 1/4 (c) 1/3 (d) 1
6	A card is drawn from a deck. A student says probability of getting king is 1/26. Is this correct? (a) Yes, because 2 kings in each colour. (b) No, probability = 1/13 (c) Yes, probability = 2/26 (d) No, probability = 4/52
7	A bag has marbles numbered 1–10. If one is drawn, what is the probability that the number is prime? (a) 4/10 (b) 5/10 (c) 6/10 (d) 7/10
8	A teacher writes roll numbers 1 to 40 on slips and puts them in a box. If one slip is drawn, what is the probability that the number is divisible by 4? (a) 1/4 (b) 1/5 (c) 1/10 (d) 1/2
9	A bag has 6 white and 4 black balls. Which statement is correct? (a) Probability of black = 2/5 (b) Probability of black = 1/2 (c) Probability of black = 3/5 (d) Probability of black = 4/10
10	A bag has 6 white and 4 black balls. Which statement is correct? (a)Probability of black < probability of white (b)Probability of black = probability of white (c)Probability of black > probability of white (d)Cannot be determined without drawing
11	A die is rolled once. Which statement is correct? (a) Probability of composite = probability of prime (b) Probability of composite > probability of prime (c) Probability of composite < probability of prime (d) Probability of composite = 0
12	In a class of 40 students: 18 study Maths, 12 Science, 10 both. If one student is chosen, what is the probability that the student studies only Maths? (a) 1/5 (b) 9/20 (c) ¼ (d) 7/10
13	During a sports day, 100 medals were awarded: 35 for running, 25 for swimming, 20 for football, and 20 for basketball. If one medal is chosen at random, what is the probability that it is not a basketball medal? (a) 1/4 (b) 1/5 (c) 7/10 (d) 4/5

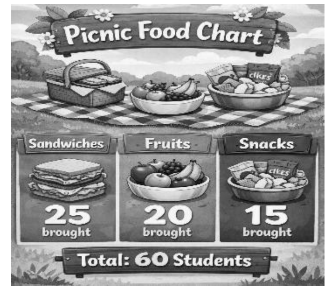
14	Library has 240 books: 100 novels, 70 science, 50 history, and 20 magazines. If one book is chosen, what is the probability that it is either a novel or a science book? (a) 17/24 (b) 5/12 (c) 7/24 (d) 1/12
15	In a school election, 120 votes were cast: 70 for A, 40 for B, 10 NOTA. If one vote is chosen, what is the probability that it is valid? (a) 11/12 (b) 7/12 (c) 1/3 (d) 1/12
16	A coin is tossed once. A student claims the probability of getting a head is more than the probability of getting a tail. Is the student correct? (a) Yes, because probability of head = ½ (b) No, because probability of tail =½ (c) Yes, because probability of head = 1 (d) No, because probability of tail = 0
17	A coin is tossed twice. What is the probability of getting exactly one head? (a) 1/4 (b) 1/2 (c) 3/4 (d) 1
18	A bag has tickets numbered 1 to 50. If one is drawn, what is the probability that the number is a perfect square? (a) 7/50 (b) 1/10 (c) 3/25 (d) 4/25
	Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.
19	A bag contains 5 red and 3 blue marbles. Assertion (A): The probability of drawing a red marble is greater than that of drawing a blue marble. Reason (R): Probability increases with the number of favorable outcomes.
20	In a school election, 120 votes were cast: 70 for A, 40 for B, 10 invalid. Assertion (A): The probability of selecting a valid vote is 11/12. Reason (R): Probability of an event = 1 – Probability of its complement.
	2 MARK QUESTIONS
21	A fruit seller has 100 fruits: 40 apples, 30 bananas, 20 oranges, 10 mangoes. If one fruit is chosen, is the probability of selecting a banana or orange greater than that of selecting an apple?
22	A cinema hall has 300 seats: 120 balcony, 100 middle, 80 front. If one seat is chosen, is the probability of selecting a balcony seat greater than 1/3?
23	During a shopping festival, 80 coupons were distributed: 30 for clothes, 25 for electronics, 15 for groceries, and 10 for toys. If one coupon is picked at random: (i) Identify which category has the lowest probability of being selected after computation of probability of each category being selected. (ii) Is the probability of selecting a clothes coupon greater than 1/3? Justify
24	Compare the probability of getting a prime number and the probability of getting a composite number when a die is thrown
25	In a test, 40 students appeared: 10 full marks, 15 above average, 10 below average, 5 failed. Is the probability of selecting a student who did not fail greater than 0.85?
	3 MARK QUESTIONS
26	A cricket team played 12 matches: won 7, lost 4, draw 1. (i) Find the probability of selecting a match they won. (ii) Compare the probability of losing with drawing. (iii) State whether the probability of winning is greater than 1/2.

27	A die is rolled once.(i) Find the probability of getting a prime number. (ii) Compare the probability of getting a composite number with a prime number. (iii) State whether the probability of getting an odd number is equal to the probability of getting an even number.
28	A factory produces 500 toys: 450 good and 50 defective. (i)Find the probability of selecting a defective toy. (ii)Compare the probability of selecting a good toy with a defective toy. (iii)State whether the probability of selecting a good toy is more than 4/5.
29	In a class of 40 students: 18 study Mathematics, 12 study Science, 10 study both. (i)Find the probability of selecting a student who studies only Mathematics. (ii)Compare the probability of studying Science with studying both subjects. (iii)Justify: the probability of studying Maths is greater than 1/3.
30	In a school election, 150 votes were cast 90 for Candidate A, 50 for Candidate B, 10 NOTA (i)Find the probability of selecting a valid vote. (ii)Compare the probability of voting for A with voting for B. (iii)Explain: the chance of picking NOTA at random from the 150 cast is smaller than one-twelfth.
31	A hospital has 120 patients: 50 children, 40 adults, and 30 senior citizens. If one patient is chosen at random: (i) Identify which group has the highest probability of being selected (ii) Compare the probability of selecting an adult with that of selecting a senior citizen. (iii) State which group has the highest probability of being selected if one patient is chosen at random.
	5 MARK QUESTIONS
32	At an airport, 200 passengers are checked: 90 carry handbags, 70 carry backpacks, and 40 carry suitcases. If one passenger is chosen at random, find the probability that the passenger is: (i) carrying a handbag (ii) (ii) carrying a backpack (iii) (iii) carrying a suitcase (iv) (iv) not carrying a suitcase (v) (v) either a handbag or a backpack
33	A restaurant served 150 meals in a day: 60 vegetarian, 50 non-vegetarian, and 40 vegan. If one meal order is chosen at random, find the probability that it is: (i) vegetarian (ii) non-vegetarian (iii)vegan (iv)not vegan (v) either vegetarian or vegan.
34	A bus company issues 100 tickets: 25 window, 35 aisle, and 40 middle seats. If one ticket is chosen at random, find the probability that it is: (i) a window seat (ii) an aisle seat (iii) a middle seat (iv) not a window seat (v) either aisle or middle seat
35	In a shopping mall, 250 customers bought items: 100 bought clothes, 80 bought electronics, 50 bought groceries, and 20 bought books. If one customer is chosen at random, find the probability that the customer bought: (i) clothes (ii) electronics (iii) groceries (iv) not books (v) either clothes or electronics

CASE STUDY BASED QUESTIONS

36

A school is organizing a picnic for 60 students. Out of them, 25 chose sandwiches, 20 chose fruits, and 15 chose snacks.

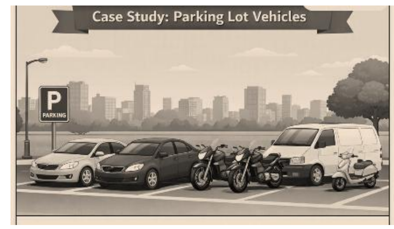


(i) Find the probability most chosen food item

(ii) State whether the probability of choosing fruits is less than 1/3.
(iii) If one student is chosen at random, find the probability that the student chose either sandwiches or snacks.

37

A parking lot has 80 vehicles: 30 cars, 25 bikes, 15 scooters, and 10 vans.



(i)Which vehicle type has the lowest probability of being selected?
(ii) Is the probability of selecting a car greater than 1/3?

(iii) If one vehicle is chosen at random, find the probability that it is either a bike or scooter.

38

An online store sold 100 items in a day: 40 clothes, 30 electronics, 20 books, and 10 toys.

(i) Which category has a probability of exactly 1/5 of being selected?
(ii) Is the probability of selecting electronics equal to the probability of selecting books plus toys together?

(iii) If one item is chosen at random, find the probability that it is not clothes.

CHAPTER 8 PREDICTING WHAT COMES NEXT: EXPLORING SEQUENCES AND PROGRESSIONS

Q. No.	MULTIPLE CHOICE QUESTIONS
1	A theatre arranges seats in rows with 12 seats in the first row, 15 in the second, 18 in the third, and so on. If the pattern continues, how many seats will be in the 8th row? A) 30 B) 33 C) 36 D) 39
2	A student records the number of pages read each day as 8, 13, 18, 23, … . Which expression gives the number of pages read on the nth day? A) 5n+3 B) 5n−3 C) 8n+5 D) 3n+5
3	A staircase has 5 tiles in the first step, 8 in the second, 11 in the third and so on. Which statement best explains the pattern? A) Each step has 2 more tiles than the previous one B) Each step has 3 more tiles than the previous one C) The number of tiles doubles D) The number of tiles increases by 5
4	The sequence 4, 9, 14, 19, … is used to model a growing design. Which term is 44? A) 8^{th} B) 9^{th} C) 10^{th} D) 11^{th}
5	A savings plan gives ₹100 in the first week and increases the weekly amount by ₹50. Which amount is saved in the 7th week? A) ₹350 B) ₹400 C) ₹450 D) ₹500
6	A sequence is 3, 6, 12, 24, … . A student says its 10th term is 30. Which is the best reason the student is wrong? A) The sequence is arithmetic B) Each term is obtained by adding 3 C) Each term is doubled, so the terms grow much faster D) The first term should be 6
7	A pattern has 2, 5, 10, 17, 26, … objects in successive figures. Which rule fits the sequence? A) n^2+1 B) n^2-1 C) 2n+1 D) 3n−1
8	The nth term of a sequence is 7n−2. What is the difference between its 12th and 9th terms? A) 14 B) 21 C) 28 D) 35
9	A bus route has stops numbered 4, 9, 14, 19, … according to a design rule. Which number cannot occur in this sequence? A) 24 B) 29 C) 34 D) 36
10	A sequence has first term 20 and common difference −3. Which term is 2? A) 5^{th} B) 6^{th} C) 7^{th} D) 8th
11	The first four terms of an arithmetic progression are x, 11, 17, 23. What is x? A) 3 B) 5 C) 6 D) 7
12	A pattern follows 1, 4, 9, 16, 25, … . If the pattern is used for square tiles, how many tiles are needed in the 12th figure? A) 121 B) 132 C) 144 D) 169
13	In an AP, the 5th term is 18 and the 9th term is 34. What is the common difference? A) 2 B) 3 C) 4 D) 5
14	A sequence has nth term 3n+7. Which pair of consecutive terms is correct? A) 13,16 B) 16,19 C) 19,23 D) 22,26

15	A student wants the sum 2+5+8+…+29. Which method is most efficient? A) Add all terms individually B) Use the AP sum formula after finding the number of terms C) Multiply 2 by 29 D) Find only the common difference
16	The sequence 50, 45, 40, 35, … represents a decreasing quantity. Which term is the first term less than 10? A) 8^{th} B) 9^{th} C) 10th D) 11th
17	A school plants 6 trees in the first row, 10 in the second, 14 in the third and so on. How many trees are planted in the first 10 rows? A) 220 B) 230 C) 240 D) 250
18	Two APs have the same common difference 4. Their first terms are 3 and 8. What is always true? A) Their corresponding terms differ by 5 B) Their corresponding terms differ by 4 C) Their sums are equal D) They eventually become identical
	Assertion–Reason Based MCQs Directions: (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true, but R is false. (d) A is false, but R is true.
19	Assertion (A): In an AP, the difference between any two consecutive terms is constant. Reason (R): An AP is generated by adding the same number to each term.
20	Assertion (A): The sequence 2, 6, 12, 20, 30 is an AP. Reason (R): Its consecutive differences are 4, 6, 8 and 10.
	2 MARK QUESTIONS
21	A pattern begins 14, 19, 24, 29, … . Find the 15th term and explain the step used to obtain it.
22	The 7th term of an AP is 31 and its common difference is 4. Find its first term.
23	A delivery service charges ₹60 on day 1 and increases the charge by ₹15 each day. Find the charge on day 12.
24	For the AP 7, 12, 17, …, which term is 92? Show your reasoning.
25	A sequence has nth term 5n−1. Find the 20th term and the difference between two consecutive terms.
	3 MARK QUESTIONS
26	A school auditorium has 18 seats in the first row, 22 in the second, 26 in the third, and so on. Find the number of seats in the 15th row and the total seats in the first 15 rows.
27	A student saves ₹200 in the first month and increases the saving by ₹75 every month. How much is saved in the 12th month? Also find the total saving in 12 months.
28	The 4th term of an AP is 17 and the 10th term is 41. Find the first term, common difference, and 20th term.
29	A sequence has first term 35 and common difference −4. Determine whether 3 is a term of the sequence. Give a reason.
30	The numbers of books read by five students form the AP 3, 7, 11, 15, … . How many books would the 20th student have read according to the pattern? What is the total for the first 20 students?
31	A designer makes triangular arrangements using 1, 3, 6, 10, 15, … tiles. The differences are 2, 3, 4, 5, … . Is this sequence an AP? Explain, and predict the next two terms.

5 MARK QUESTIONS

32	A stadium has 25 seats in the first row and each next row has 6 more seats than the previous row. There are 18 rows. Find (i) seats in the last row, (ii) total seats, and (iii) whether the stadium can seat 1,000 people if every seat is occupied.
33	A charity collects ₹500 in week 1 and increases the collection by ₹125 each week for 16 weeks. Find the collection in week 16 and the total collection. If the target is ₹25,000, determine whether the target is met and by how much.
34	In an AP, the sum of the first 10 terms is 230 and the 10th term is 41. Find the first term and common difference. Then find the 20th term.
35	A game awards points in levels according to 7, 12, 17, … . A player completes 25 levels. Find the total points earned. If the player needs at least 2,000 points, how many additional complete levels are needed?

CASE STUDY BASED QUESTIONS

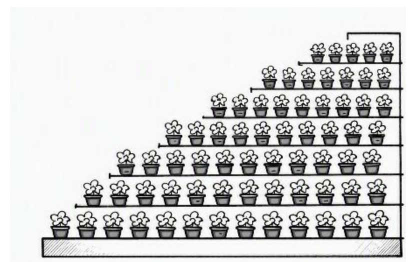
36 A school creates a stepped flower bed. The first row contains

9 plants, the second 13, the third 17, and so on.

(a) Identify the first term and common difference.

(b) Find the number of plants in the 12th row.

(c) Find the total number of plants in the first 12 rows.



37 A mobile learning app awards 20 points on the first day of a challenge and increases the daily award by 10 points. A learner completes 15 days.

(a) Find the points on day 15.

(b) Find the total points earned in 15 days.

(c) The learner needs 1,500 points. Does the learner reach the target? If not, how many more points are needed?

38 A theatre has 30 seats in the first row, 34 in the second, 38 in the third, and the pattern continues for 20 rows.

(a) Find the number of seats in the 20th row.

(b) Find the total number of seats.

(c) If 750 people arrive, can everyone be seated? Justify using the total.

SOLUTIONS

CHAPTER 1 :- Orienting Yourself: The Use of Coordinates
Solution Q1: Correct Option: B) Rectangle; Quadrant III
Explanation: • Vertices are (a,b) in Q I, (-a,b) in Q II, (-a,-b) in Q III, and (a,-b) in Q IV. • Horizontal lengths: |a - (-a)| = 2a. Vertical lengths: |b - (-b)| = 2b. Opposites are equal and adjacent angles are 90°, forming a rectangle. • The vertex with both negative coordinates (-a, -b) lies strictly in Quadrant III.
Solution Q2: Correct Option: C) City B is the reflection of City A through the origin (0,0).
Explanation: • City A = (-d, k) where -d < 0 and k > 0 (Quadrant II). • City B = (d, -k) where d > 0 and -k < 0 (Quadrant IV). • Switching signs of both x and y coordinates (x -> -x, y -> -y) corresponds to a central reflection through the origin (0,0).
Solution Q3: Correct Option: D) The desk is positioned completely inside the bathroom space.
Explanation: • Given 3 feet at (8,9), (11,9), and (11,7). Since it is rectangular, the 4th foot is at (8,7). • Width along x = 11 - 8 = 3 ft; Length along y = 9 - 7 = 2 ft. Area = 3 × 2 = 6 sq ft. • Option D is false because x = 8 to 11 lies inside the bedroom (x = 0 to 12), whereas the bathroom lies in x < 0 (x = -6 to 0).
Solution Q4: Correct Option: B) (-4, 7)
Explanation: • Perpendicular distance from x-axis = |y| = 7. In Quadrant II, y is positive, so y = +7. • Perpendicular distance from y-axis = |x| = 4. In Quadrant II, x is negative, so x = -4. • Coordinates = (-4, 7).
Solution Q5: Correct Option: C) If and only if x = y
Explanation: • Two ordered pairs (a, b) and (c, d) are equal if and only if a = c and b = d. • For (x, y) = (y, x), we must have x = y and y = x, which reduces strictly to x = y.
Solution Q6: Correct Option: B) (0, -6.5) and distance is 6.5 units
Explanation: • Any point on the y-axis has x-coordinate = 0. • Being 6.5 units below the x-axis means y = -6.5. Coordinates = (0, -6.5). • Distance from origin = √(0^2 + (-6.5)^2) = 6.5 units (distance is non-negative).
Solution Q7: Correct Option: B) Yes, because the door width is 3.5 feet.
Explanation: • Door spans D1(8, 0) to R1(11.5, 0) on the x-axis. • Width = |11.5 - 8| = 3.5 feet. • Since 3.5 feet ≥ 3.2 feet required width, it complies with accessibility guidelines.

Solution Q8: Correct Option: A) 5 + √29 + √40 units

Explanation:
- Side AD: $\sqrt{(7-3)^2 + (1-4)^2} = \sqrt{16 + 9} = \sqrt{25} = 5$ units.
- Side DM: $\sqrt{(9-7)^2 + (6-1)^2} = \sqrt{4 + 25} = \sqrt{29}$ units.
- Side MA: $\sqrt{(9-3)^2 + (6-4)^2} = \sqrt{36 + 4} = \sqrt{40}$ units.
- Perimeter = AD + DM + MA = $5 + \sqrt{29} + \sqrt{40}$ units.

Solution Q9: Correct Option: C) The signs of the x-coordinates of its vertices

Explanation:
- Reflection across the y-axis transforms point (x, y) into (-x, y).
- x-coordinates change signs (A'(-3, 4), D'(-7, 1), M'(-9, 6)).
- Reflection is a rigid transformation (isometry), so side lengths, perimeter, and area remain invariant.

Solution Q10: Correct Option: B) (0, 4)

Explanation:
- Midpoint M of S(-3,0) and T(3,0) is ((-3+3)/2, (0+0)/2) = (0,0).
- Shifting the segment up by 4 units adds +4 to the y-coordinates: S'(-3, 4), T'(3, 4).
- New midpoint M' = ((-3+3)/2, (4+4)/2) = (0, 4).

Solution Q11: Correct Option: A) |-5 - 5| = 10 units along the x-axis since y-coordinates are equal

Explanation:
- Since both points have y = -2, the segment is parallel to the x-axis.
- Distance = $|x_2 - x_1| = |5 - (-5)| = 10$ units.

Solution Q12: Correct Option: B) Quadrant III; 10 units

Explanation:• Both x = -6 and y = -8 are negative, placing the hub in Quadrant III.
- Distance from origin O(0,0) = $\sqrt{(-6)^2 + (-8)^2} = \sqrt{36 + 64} = \sqrt{100} = 10$ units.

Solution Q13: Correct Option: A) √65 units

Explanation:
- Radius r = distance from origin (0,0) to A(1, -8).
- $r = \sqrt{(1 - 0)^2 + (-8 - 0)^2} = \sqrt{1 + 64} = \sqrt{65}$ units (≈ 8.06 units).

Solution Q14: Correct Option: B) x_{min} = 20, x_{max} = 180

Explanation:
- Center x-coordinate = 100, radius = 80.
- Minimum x-extent = 100 - 80 = 20 pixels.
- Maximum x-extent = 100 + 80 = 180 pixels.

Solution Q15: Correct Option: B) Square of area 10 sq units

Explanation:
- $AB^2 = (-1-2)^2 + (2-1)^2 = 9 + 1 = 10 \Rightarrow AB = \sqrt{10}$.
- $BC^2 = (-2 - (-1))^2 + (-1-2)^2 = 1 + 9 = 10 \Rightarrow BC = \sqrt{10}$.
- $CD^2 = (1 - (-2))^2 + (-2 - (-1))^2 = 9 + 1 = 10 \Rightarrow CD = \sqrt{10}$.
- $DA^2 = (2-1)^2 + (1 - (-2))^2 = 1 + 9 = 10 \Rightarrow DA = \sqrt{10}$.
- Diagonal $AC^2 = (-2-2)^2 + (-1-1)^2 = 16 + 4 = 20 \Rightarrow AC = \sqrt{20}$.
- Diagonal $BD^2 = (1 - (-1))^2 + (-2-2)^2 = 4 + 16 = 20 \Rightarrow BD = \sqrt{20}$.
- All sides equal (√10) and diagonals equal (√20), so ABCD is a square.
- Area = $side^2 = (\sqrt{10})^2 = 10$ sq units.

Solution Q16: Correct Option: B) Because squaring any real number yields a non-negative result.
Explanation: • For any real number k, $(k)^2 = (-k)^2 \geq 0$. • Thus $(x2 - x1)^2 = (x1 - x2)^2$, making distance directional-independent (AB = BA).
Solution Q17: Correct Option: B) (3, -5)
Explanation: • In Quadrant IV, $x > 0$ and $y < 0$. • Distance from y-axis = $\|x\| = 3 \Rightarrow x = +3$. • Distance from x-axis = $\|y\| = 5 \Rightarrow y = -5$. • Point K = (3, -5).
Solution Q18: Correct Option: A) It can only represent points lying in Quadrant I and on the positive axes.
Explanation: • Quadrants II, III, and IV require negative x or y coordinates. • Without negative numbers, points with negative coordinates cannot be assigned unique numerical pairs, restricting grid coverage to Quadrant I.
Solution Q19: Correct Option: A) Both (A) and (R) are true, and (R) is the correct explanation of (A).
Step-by-step verification: • Assertion calculation: $d = \sqrt{(3 - (-3))^2 + (-4 - 4)^2} = \sqrt{6^2 + (-8)^2} = \sqrt{36 + 64} = \sqrt{100} = 10$ units. Assertion is TRUE. • Reason statement gives the exact Baudhāyana-Pythagoras distance formula used to calculate this distance. Reason is TRUE and correctly explains Assertion.
Solution Q20: Correct Option: D) (A) is false, but (R) is true.
Step-by-step verification: • Point P(0, -5) has x = 0, which means it lies directly on the negative y-axis. It does NOT lie in Quadrant IV. Thus, Assertion (A) is FALSE. • Reason (R) correctly states that any point with x = 0 lies on the y-axis and does not belong to any quadrant. Reason (R) is TRUE.
Solution Q21: Coordinates and Distance of Points A and B
1. Point A is on the x-axis, 7 units left of origin => A(-7, 0). 2. Point B is on the y-axis, 24 units above origin => B(0, 24). 3. Distance $AB = \sqrt{(0 - (-7))^2 + (24 - 0)^2} = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25$ units.
Solution Q22: Historical Necessity of Zero and Negative Numbers
• A 2D Cartesian coordinate plane is divided into four quadrants by two perpendicular axes intersecting at an origin. • The origin represents zero (0,0). Values to the left of origin on the x-axis and below origin on the y-axis represent negative quantities. • Brahmagupta formalised zero and negative numbers as algebraic entities. Without negative numbers, locations in Quadrants II, III, and IV could not be represented with unique numerical coordinates.
Solution Q23: Midpoint Calculation
• Midpoint formula: $M(x, y) = ((x1 + x2)/2, (y1 + y2)/2)$. • Given S(-8, 7) and T(6, -3): $x = (-8 + 6) / 2 = -2 / 2 = -1$.

$y = (7 + (-3)) / 2 = 4 / 2 = 2$.
• Therefore, the coordinates of midpoint M are (-1, 2).

Solution Q24: Circular Rug Boundary Check

• Center of rug = (6, 5), Radius r = 3 feet.
• x-extent of rug: from 6 - 3 = 3 to 6 + 3 = 9. Room x-boundary is 0 to 12. ($3 \geq 0$ and $9 \leq 12$ - OK)
• y-extent of rug: from 5 - 3 = 2 to 5 + 3 = 8. Room y-boundary is 0 to 10. ($2 \geq 0$ and $8 \leq 10$ - OK)
• Conclusion: All edge points of the rug lie strictly within the room boundaries $[3, 9] \times [2, 8]$. No part extends outside.

Solution Q25: Location Analysis without Plotting

• Point P(-4.5, 0): The y-coordinate is 0, while $x = -4.5 \neq 0$. By rule, any point with y = 0 lies directly on the x-axis (specifically on the negative x-axis). It does NOT lie in any quadrant.
• Point Q(0, 3.8): The x-coordinate is 0, while $y = 3.8 \neq 0$. By rule, any point with x = 0 lies directly on the y-axis (specifically on the positive y-axis). It does NOT lie in any quadrant.

Solution Q26: Collinearity Test for M(-3,-4), A(0,0), G(6,8)

(i) Method: Calculate pairwise distances MA, AG, and MG using the distance formula. Three points are collinear if the sum of the two shorter segment lengths equals the total length of the longest segment (MA + AG = MG).
(ii) Execution:
• MA = √((0 - (-3))^2 + (0 - (-4))^2) = √(3^2 + 4^2) = √25 = 5 units.
• AG = √((6 - 0)^2 + (8 - 0)^2) = √(6^2 + 8^2) = √100 = 10 units.
• MG = √((6 - (-3))^2 + (8 - (-4))^2) = √(9^2 + 12^2) = √(81 + 144) = √225 = 15 units.
• Check: MA + AG = 5 + 10 = 15 = MG.
• Conclusion: Since MA + AG = MG, points M, A, and G lie strictly on the same straight line.

Solution Q27: Bathroom Layout Coordinates

(i) Washbasin space (3 ft × 2 ft): Placed against left wall x = -6, starting from y = 0 up to y = 2, and extending right from x = -6 by 3 ft to x = -3.
Corners: (-6, 0), (-3, 0), (-3, 2), (-6, 2).
(ii) Toilet space (2 ft × 3 ft): Placed along y-axis from y = 4 to y = 7, extending left from x = 0 by 2 ft to x = -2.
Corners: (0, 4), (-2, 4), (-2, 7), (0, 7).

Solution Q28: Trisection Points of Segment AB

Given A(4, 7) and B(16, -2).
(i) Midpoint M of AB = ((4 + 16)/2, (7 + (-2))/2) = (20/2, 5/2) = (10, 2.5).
(ii) Trisection point P is the midpoint of segment AM:
P = ((4 + 10)/2, (7 + 2.5)/2) = (14/2, 9.5/2) = (8, 4.25).
Trisection point Q is the midpoint of segment MB:
Q = ((10 + 16)/2, (2.5 + (-2))/2) = (26/2, 0.5/2) = (12, 0.25).
• Final Trisection Coordinates: P(8, 4.25) and Q(12, 0.25).

Solution Q29: Properties of Quadrilateral RAMP

Vertices: R(3,0), A(0,-2), M(-5,-2), P(-5,2).
(i) Side AM lies on line y = -2 (horizontal). Side MP lies on line x = -5 (vertical).
Since horizontal and vertical lines intersect at 90°, sides AM and MP are perpendicular.
(ii) Side AM connects (0,-2) and (-5,-2). Both points have y = -2, so side AM is parallel to the x-axis.
(iii) Mirror image vertices: Point M(-5, -2) and Point P(-5, 2) have identical x-coordinates (-5) and opposite y-

coordinates (-2 and +2).
Therefore, M and P are mirror images of each other across the x-axis.

Solution Q30: Icon Center Distance and Intersection Test

Given A(100, 150), R1 = 80 and B(250, 230), R2 = 100.
(i) Distance between centers AB = $\sqrt{(250 - 100)^2 + (230 - 150)^2} = \sqrt{150^2 + 80^2} = \sqrt{22500 + 6400} = \sqrt{28900} = 170$ pixels.
(ii) Sum of radii R1 + R2 = 80 + 100 = 180 pixels.
Condition for intersection: If distance between centers < sum of radii, the circles intersect.
Since 170 < 180, the two circular icons overlap/intersect each other by 10 pixels.

Solution Q31: Isosceles Triangle Construction Across Quadrants III and IV

- Choose origin O(0,0) as vertex 1.
- Choose vertex P in Quadrant III: P(-4, -3).
- Choose vertex Q in Quadrant IV: Q(4, -3).
- Analytical Proof of equal side lengths:
  Length OP = $\sqrt{(-4 - 0)^2 + (-3 - 0)^2} = \sqrt{16 + 9} = \sqrt{25} = 5$ units.
  Length OQ = $\sqrt{(4 - 0)^2 + (-3 - 0)^2} = \sqrt{16 + 9} = \sqrt{25} = 5$ units.
  Length PQ = $|4 - (-4)| = 8$ units.
- Since OP = OQ = 5 units ≠ PQ, triangle OPQ is an isosceles triangle with equal sides OP and OQ.

Solution Q32: Determining Triangle Vertices from Midpoints D(5,1), E(6,5), F(0,3)

(i) Midpoint equations:
D is midpoint of BC: $(x_2 + x_3)/2 = 5 \Rightarrow x_2 + x_3 = 10$ --- (1)
$(y_2 + y_3)/2 = 1 \Rightarrow y_2 + y_3 = 2$ --- (2)
E is midpoint of AC: $(x_1 + x_3)/2 = 6 \Rightarrow x_1 + x_3 = 12$ --- (3)
$(y_1 + y_3)/2 = 5 \Rightarrow y_1 + y_3 = 10$ --- (4)
F is midpoint of AB: $(x_1 + x_2)/2 = 0 \Rightarrow x_1 + x_2 = 0$ --- (5)
$(y_1 + y_2)/2 = 3 \Rightarrow y_1 + y_2 = 6$ --- (6)

(ii) Solving x-coordinates:
Sum of (1), (3), (5): $2(x_1 + x_2 + x_3) = 10 + 12 + 0 = 22 \Rightarrow x_1 + x_2 + x_3 = 11$ --- (7)
Subtracting (1) from (7): $x_1 = 11 - 10 = 1$.
Subtracting (3) from (7): $x_2 = 11 - 12 = -1$.
Subtracting (5) from (7): $x_3 = 11 - 0 = 11$.
Solving y-coordinates:
Sum of (2), (4), (6): $2(y_1 + y_2 + y_3) = 2 + 10 + 6 = 18 \Rightarrow y_1 + y_2 + y_3 = 9$ --- (8)
Subtracting (2) from (8): $y_1 = 9 - 2 = 7$.
Subtracting (4) from (8): $y_2 = 9 - 10 = -1$.
Subtracting (6) from (8): $y_3 = 9 - 6 = 3$.
- Vertices: A(1, 7), B(-1, -1), C(11, 3).

(iii) Verification:
Midpoint of AB = ((1 + (-1))/2, (7 + (-1))/2) = (0, 6/2) = (0, 3) = F. Correct!

Solution Q33: City Grid Distance Calculations and Historical Context

(a) Given C(-4, 3) and D(5, -9) on grid (1 unit = 200 m):
(i) Horizontal grid shift = $|5 - (-4)| = 9$ units.
Vertical grid shift = $|-9 - 3| = 12$ units. Total Manhattan grid units = 9 + 12 = 21 units.
Distance in meters = 21 × 200 m = 4,200 meters (4.2 km).

(ii) Direct Euclidean distance in grid units = $\sqrt{(9^2 + 12^2)} = \sqrt{(81 + 144)} = \sqrt{225} = 15$ units.
Distance in meters = 15×200 m = 3,000 meters (3.0 km).

(b) Historical Connection:
This grid system directly mirrors the urban planning of the ancient Sindhu-Sarasvatī Civilisation (Harappan cities like Mohenjo-daro and Harappa). City streets were laid out in precise North-South and East-West grid lines separated by uniform distances (≈ 10 meters apart), allowing merchants and residents to navigate and specify locations by counting orthogonal units from a city center.

Solution Q34: Circle Equation and Point Position Analysis

Circle K is centered at O(0,0) and passes through A(1, -8).
Radius squared $r^2 = 1^2 + (-8)^2 = 1 + 64 = 65$ units.

(i) Check B(-4, 7) and C(-7, -4):
Distance $OB^2 = (-4)^2 + 7^2 = 16 + 49 = 65 = r^2$. Thus, B lies ON circle K.
Distance $OC^2 = (-7)^2 + (-4)^2 = 49 + 16 = 65 = r^2$. Thus, C lies ON circle K.

(ii) Check D(-5, 6):
Distance $OD^2 = (-5)^2 + 6^2 = 25 + 36 = 61$.
Since OD^2 (61) < r^2 (65), point D lies strictly INSIDE circle K.

(iii) Check E(0, 9):
Distance $OE^2 = 0^2 + 9^2 = 81$.
Since OE^2 (81) > r^2 (65), point E lies strictly OUTSIDE circle K.

(iv) Area of circle K = $\pi \times r^2 = 65\pi$ square units (≈ 204.2 square units).

Solution Q35: Geometric Proof of Square ABCD and Area Calculation

Given A(2, 1), B(-1, 2), C(-2, -1), D(1, -2).
(i) Side lengths:
$AB = \sqrt{((-1 - 2)^2 + (2 - 1)^2)} = \sqrt{((-3)^2 + 1^2)} = \sqrt{(9 + 1)} = \sqrt{10}$.
$BC = \sqrt{((-2 - (-1))^2 + (-1 - 2)^2)} = \sqrt{((-1)^2 + (-3)^2)} = \sqrt{(1 + 9)} = \sqrt{10}$.
$CD = \sqrt{((1 - (-2))^2 + (-2 - (-1))^2)} = \sqrt{(3^2 + (-1)^2)} = \sqrt{(9 + 1)} = \sqrt{10}$.
$DA = \sqrt{((2 - 1)^2 + (1 - (-2))^2)} = \sqrt{(1^2 + 3^2)} = \sqrt{(1 + 9)} = \sqrt{10}$.
All four sides are equal ($AB = BC = CD = DA = \sqrt{10}$).

(ii) Diagonal lengths:
$AC = \sqrt{((-2 - 2)^2 + (-1 - 1)^2)} = \sqrt{((-4)^2 + (-2)^2)} = \sqrt{(16 + 4)} = \sqrt{20}$.
$BD = \sqrt{((1 - (-1))^2 + (-2 - 2)^2)} = \sqrt{(2^2 + (-4)^2)} = \sqrt{(4 + 16)} = \sqrt{20}$.
Diagonals are equal ($AC = BD = \sqrt{20}$).

(iii) Conclusion:
Since a quadrilateral with four equal sides and equal diagonals is a square, ABCD is proven to be a square.

(iv) Area = (side length)$^2 = (\sqrt{10})^2 = 10$ square units.

Solution Q36: Solution to Case Study 1 (Accessibility Design)

1. Entrance door width D1R1 = $|11.5 - 8| = 3.5$ feet.
Bathroom door width B1B2 = $|4 - 1.5| = 2.5$ feet.

2. Guideline evaluation:
- Entrance door (3.5 ft) $\geq$ 3.0 ft requirement → Fully Accessible.
- Bathroom door (2.5 ft) < 3.0 ft requirement → Not Accessible (Too narrow for standard wheelchairs).

3. Door swing analysis:
- Hinge is at B1(0, 1.5). Radius of door swing = 2.5 ft.
- Swinging 90° outward into bedroom (rightward parallel to x-axis) places the edge at (0 + 2.5, 1.5) = (2.5, 1.5).
- Wardrobe extends along x from x = 3 to x = 7, and along y from y = 0 to y = 2.
- Since the door edge reaches x = 2.5, it stops 0.5 feet SHORT of the wardrobe at x = 3.
- Therefore, the bathroom door will NOT hit the wardrobe when opened.

Solution Q37: Solution to Case Study 2 (Navigation Grid)

1. Distances from Port O(0,0):
- Light L1(4, 3): OL1 = √(4^2 + 3^2) = √25 = 5 units.
- Light L2(-5, 12): OL2 = √((-5)^2 + 12^2) = √(25 + 144) = √169 = 13 units.

2. Quadrants:
- L2(-5, 12) lies in Quadrant II (x < 0, y > 0).
- Vessel V(12, -5) lies in Quadrant IV (x > 0, y < 0).

3. Distance from Vessel V(12, -5) to both lighthouses:
- Distance V to L1(4, 3) = √((12 - 4)^2 + (-5 - 3)^2) = √(8^2 + (-8)^2) = √(64 + 64) = √128 ≈ 11.31 units.
- Distance V to L2(-5, 12) = √((12 - (-5))^2 + (-5 - 12)^2) = √(17^2 + (-17)^2) = √(289 + 289) = √578 ≈ 24.04 units.
- Conclusion: Lighthouse L1 is significantly closer to Vessel V (√128 ≈ 11.31 units vs √578 ≈ 24.04 units).

Solution Q38: Solution to Case Study 3 (Display Technology)

1. Screen boundary check [0 ≤ x ≤ 800, 0 ≤ y ≤ 600]:
- Icon A: Center (100, 150), R = 80 → x in [20, 180], y in [70, 230]. Entirely inside screen.
- Icon B: Center (250, 230), R = 100 → x in [150, 350], y in [130, 330]. Entirely inside screen.
- Neither circle lies outside the screen boundary.

2. Distance between centers A(100, 150) and B(250, 230):
- AB = √((250 - 100)^2 + (230 - 150)^2) = √(150^2 + 80^2) = √(22500 + 6400) = √28900 = 170 pixels.

3. Overlap check and new position calculation:
- Sum of radii R1 + R2 = 80 + 100 = 180 pixels.
- Since AB (170) < R1 + R2 (180), the two icons currently overlap.
- For Icon B to be externally tangent to Icon A at y = 230, the new distance between centers AB_new must equal R1 + R2 = 180 pixels.
- Let new center of Icon B be (x_new, 230).
- Distance formula: √((x_new - 100)^2 + (230 - 150)^2) = 180
  → (x_new - 100)^2 + 80^2 = 180^2 = 32,400
  → (x_new - 100)^2 = 32,400 - 6,400 = 26,000
  → x_new - 100 = √26,000 ≈ 161.25
  → x_new ≈ 100 + 161.25 = 261.25 pixels.
- Conclusion: Icon B's center should be moved to x ≈ 261.25 pixels (or exactly 100 + 20√65 pixels)

CHAPTER-2:- Introduction to Linear Polynomials

1.	(a) The student is correct.
2.	(c) It becomes a constant polynomial.
3.	(c) It is a linear polynomial with degree 1.
4.	(b) $4x+30$
5.	(a) $4x+16$
6.	(d) $50+12x$
7.	(b) $4x+5y+3$
8.	(a) $2x+16$
9.	(c) Both the students
10.	(c) $x+8$
11.	(b) Cost of x pens at ₹10 each plus a fixed ₹20 charge.
12.	(b) The constant terms should be subtracted as $8-3$.
13.	(d) $3x+4$
14.	(c) Fixed charge in the bill
15.	(a) $4x^2+2x$
16.	(b) (3,0)
17.	(b) Student B
18.	(c) ₹80
19.	(a) Both Assertion (A) and Reason (R) are true, and R is the correct explanation of A.
20.	(d) Assertion (A) is false, but Reason (R) is true.

21.	No. Degree of a polynomial depends on the highest power of the variable (x), not the number of terms. The highest power is 1, so $4x+9$ is linear.

22.	Yes. $p(x)=0$ gives $x=5$; $q(x)=0$ also gives $x=5$.
23.	The constant term is -4 and coefficient is 3. So $p(x)=3x-4$.
24.	No. -3 is M(0), not M(1). The first allowed stage is n=1, where M(1) = 5.
25.	On the x-axis, $y=0$. So $2x-6=0 \Rightarrow 2x = 6 \Rightarrow x=3$. ∴ The coordinates of the point where the line crosses the x-axis = (3,0).
26.	(a) $P(6) = 15(6) + 40 = 130$. (b) The coefficient of x is 15 and the constant term is 40. (c) Here, 15 represents the increase in score per item, while 40 is the fixed starting score.
27.	(a) The claim is incorrect because negative coefficients are allowed in polynomials. (b) The degree is 1 because the highest power of x is 1. (c) The constant term is -5.
28.	(a) The constant increase is 5, and $P(0) = 11$. ∴ $P(x)=5x+11$. (b) $P(8) = 5(8) + 11 = 40 + 11 = 51$. (c) The coefficient 5 comes from the constant increase in the pattern.
29.	(a) Taking $4x-20 = 0 \Rightarrow 4x = 20 \Rightarrow x=5$. (b) Putting $x = 5$: $P(5) = 20 – 20 = 0$, so it is verified. (c) Graphically, $x=5$ is the point where the graph meets the x-axis.
30.	(a) -4 is zero of $p(x) \Rightarrow P(-4) = 0 \Rightarrow -4a + 8 = 0 \Rightarrow a = 2$. (b) Hence $P(x)=2x+8$. (c) $P(-4) = -8 + 8 = 0$, so the zero is correct.
31.	(a) The values increase by 4, so $a=4$. Using $P(1) = 9$ gives $4 + b = 9 \Rightarrow b=5$. ∴ $P(x)=4x+5$. (b) $P(0) = 4(0) + 5 = 5$. (c) $P(10) = 4(10) + 5 = 45$.
32.	(a) $F(x)=15x+50$ (b) Degree = 1, Coefficient of x = 15, constant term = 50 (c) $15x + 50 = 200 \Rightarrow x = 10$ km.

	(d) Degree of polynomial = 1, hence it is a linear polynomial.
33.	(a) p(2)=11, q(2)=3; (b) p(x) = q(x) gives x=6 (c) Zeros are -5/3 and 7/5, respectively.
34.	(a) 2a+b=7, 5a+b=16; (b) By solving these equations we get a=3, b=1 (c) p(x)=3x+1; (d) Zero = -1/3
35.	(a) The claim is correct. (b) Since p(3) = p(7), 3a+b = 7a+b, giving a=0. (c) The resulting polynomial is a constant polynomial, not a linear polynomial. (d) For a linear polynomial ax+b, $a \neq 0$.
36.	(a) The constant term is the value at n=0, not at n=1. The first tower has H(1)=3 cm. (b) H(1)=3, H(2)=8, H(10)=48 cm. (c) The model is defined here only for n=1,2,3,..., so n=0 is outside the physical domain even though the polynomial can be evaluated there. (d) Yes. 5n-2=48 gives 5n=50, hence n=10.
37.	(a) $4a + 9 = 29 \Rightarrow 4a = 20 \Rightarrow a=5$. $\therefore$ B(x)=5x+9. (b) 5x+9=0 gives x = -9/5. (c) No. Positive values observed at some inputs do not force the zero to be positive. (d) No. The zero -9/5 is neither whole nor non-negative, so it has algebraic meaning but no package-count meaning in that context.
38.	(a) Decreasing, because the coefficient of n is -35. (b) Not necessarily. A real pricing model would usually have a restricted domain or minimum price; the polynomial can produce values outside the practical range. (c) $500-35n \geq 0 \Rightarrow 35n \leq 500 \Rightarrow n \leq 500/35 \approx 14.28$. $\therefore$ The greatest whole number is 14.

CHAPTER-3: The World of Numbers

Q1.	C. Riya is incorrect because on the number line $-3/4$ lies to the left of -0.6.
Q2.	C. Infinitely many rational numbers exist between two numbers
Q3.	B. Q
Q4.	a. $x^2 = 5$
Q5.	C. Terminating
Q6.	a. 12
Q7.	C. $\sqrt{2}$
Q8.	d. 2/11
Q9.	B. The decimal digits repeat in a fixed pattern.
Q10.	c. 8
Q11.	d. 0.123451234512345………
Q12.	C. C
Q13.	b. 5/9
Q14.	C. 2/3
Q15.	C. Chitra
Q16.	b. counting begins from 1
Q17.	c. $4 - 9 = -5$
Q18.	b. Identity and zero property
Q19.	D. A is false but R is true.
Q20.	A. Both A and R are true and R is the correct explanation of A.
Q21.	Total movement $= 5 - (-2) = 7$. Virat is not correct.
Q22.	Final balance $= 200 - 350 + 150 = 0$. He has no profit, no loss.
Q23.	$35 + 0 = 35$ (additive identity) and $35 \times 0 = 0$ (zero property).
Q24.	$0.125 = 125/1000 = 5/40 = 1/8$
Q25.	By Pythagoras Theorem: $H^2 = P^2 + B^2$. Sides of the square are taken as perpendicular and base, each equal to 1 unit. $H^2 = 1^2 + 1^2 = 2$. $H = \sqrt{2}$. Here hypotenuse is an irrational number.
Q26.	(a) Total distance covered $= 5 - (-3) + (5 - 1) = 5 + 3 + 4 = 12$ units. (b) Net displacement $= 1 - (-3) = 1 + 3 = 4$ units. (c) Distance is the total length covered, whereas displacement is the movement from the initial position to the final position.
Q27.	(a) Remaining quantity $= 9/10 - 2/5 = 9/10 - 4/10 = 5/10$. (b) Simplest form $= 5/10 = 1/2$.

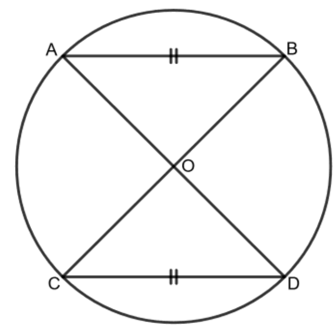
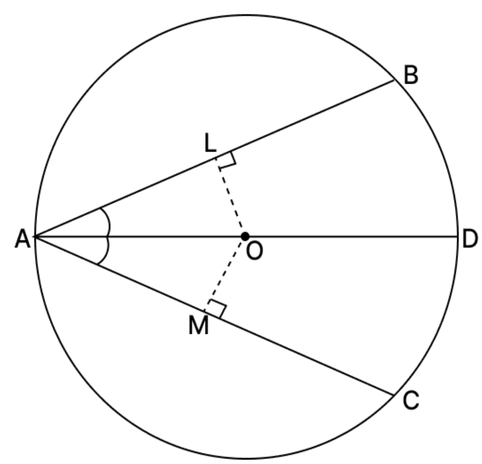
Q28.	1. Prime factorised form of 40 = $2^2 \times 5$. 2. The denominator contains only the prime factors 2 and 5. 3. Hence, the decimal expansion of 7/40 is terminating.
Q29.	$x = 0.2\overline{3} = 0.233333\ldots$ (1). Multiply by 10: $10x = 2.333333\ldots$ (2). Multiply by 100: $100x = 23.333333\ldots$ (3). Subtract: $100x - 10x = 23.333\ldots - 2.333\ldots$; $90x = 21$; $x = 21/90 = 7/30$.
Q30.	$34 \times 25 + 12 = 3/10 + 1/2 = 3/10 + 5/10 = 8/10 = 4/5$. No, Alexa is not correct. The result is a rational number.
Q31.	A. $49 = 7^2$, so $\sqrt{49} = 7$. $10 = 2 \times 5$. B. 7 is rational and $\sqrt{10}$ is irrational. C. 7 can be written as p/q, whereas 10 is not a perfect square; therefore $\sqrt{10}$ is irrational.
Q32.	a. Length of diagonal = $\sqrt{(5^2 + 5^2)} = \sqrt{50}$ m. b. $\sqrt{50} = \sqrt{(2 \times 5 \times 5)} = 5\sqrt{2}$ m. c. $5\sqrt{2}$ is an irrational number. d. $\sqrt{50} \approx 7.07$.
Q33.	i) (c) 2 ii) (b) 0.666… iii) (d) −5 iv) (a) 3/4 v) (b) 2/3
Q34.	Total distance travelled = $3 - (-5) + (-2) - 3 + 4 - (-2) = 8 + 5 + 6 = 19$ km. Net displacement = Final position − Initial position = $4 - (-5) = 9$ km. Interpretation: The total distance travelled is greater than the net displacement because the vehicle changes direction during its journey.
Q35.	a. $\sqrt{25} = 5$, $\sqrt{36} = 6$. b. Rational numbers: $\sqrt{25}$, $\sqrt{36}$. Irrational numbers: $\sqrt{5}$, $\sqrt{3}$. c. There are two irrational numbers in the group. d. Square roots of perfect squares (25, 36) are rational as they simplify to integers, whereas square roots of non-perfect squares (5, 3) are irrational since they cannot be expressed in the form p/q. e. $\sqrt{5}$ and $\sqrt{3}$ have non-terminating, non-repeating decimal expansions.
Q36.	a. Diagonal = $\sqrt{(2^2 + 2^2)} = \sqrt{8}$. b. $\sqrt{8} = 2\sqrt{2}$, which is irrational. c. 2 is a non-perfect square number; therefore $\sqrt{2}$ is irrational. OR: $\sqrt{2} = 1.414213\ldots$; its decimal expansion is non-terminating and non-repeating.
Q37.	i) (c) 5 ii) (b) Terminating iii) (c) integer iv) (c) Some rational numbers are integers
Q38.	a. Change in temperature = $5/2 - (-3) = 5/2 + 3 = 11/2$. b. Rational. c. $5/2 = 2.5$, a terminating decimal. OR: −3 lies 3 units to the left of 0 and $5/2 = 2.5$ lies 2.5 units to the right of 0. Since $2.5 < 3$, 5/2°C is closer to 0°C.

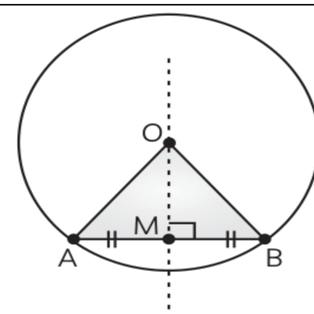
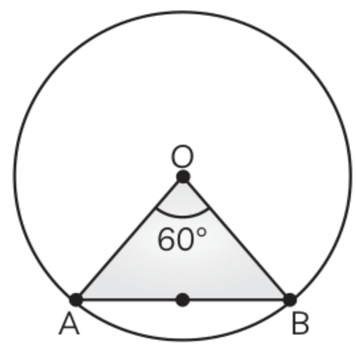
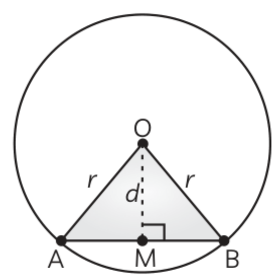
CHAPTER-4 :- Exploring Algebraic Identities

1	Correct answer: (A). $(x+3)^2 = x^2+6x+9$, so the missing term is 6x.
2	Correct answer: (B). $(x+5)(x-5)=x^2-5^2=x^2-25$.
3	Correct answer: (A). $102^2=(100+2)^2$, which uses $(a+b)^2$ and gives 10,404 quickly.
4	Correct answer: (B). $(x+2)^3 = x^3 + 6x^2 + 12x + 8$.
5	Correct answer: (B). $(2p-1)^2=4p^2-4p+1$.
6	Correct answer: (C). $49m^2-64n^2=(7m)^2-(8n)^2=(7m-8n)(7m+8n)$.
7	Correct answer: (C). The identity is $(a+b)^2=a^2+2ab+b^2$ and is valid for all real a,b.
8	Correct answer: (B). $(y+4)(y+7)=y^2+11y+28$, so 11y is missing.
9	Correct answer: (A). $(x+1/x)^2=x^2+2+1/x^2=25$, hence $x^2+1/x^2=23$.
10	Correct answer: (B). $(a+b)^2-(a-b)^2=4ab$; here a=3x,b=2, so the result is 24x.
11	Correct answer: (B). Original side=$\sqrt{144}$=12 cm. New side=14 cm, so new area=196 cm².
12	Correct answer: (B). $x^2-10x+25=(x-5)^2$.

13	Correct answer: (B). For $p=2, q=1$, LHS$=(2-1)^2=1$, but $p^2-q^2=4-1=3$; hence the claim is false.
14	If $(x+7)(x-7)=51$, then x^2 is: (A) 44 (B) 51 (C) 100 (D) 58
15	Correct answer: (A). $98\times102=(100-2)(100+2)=100^2-2^2=9996$.
16	Correct answer: (A). $(x+8)(x-3)=x^2+5x-24$, so compared with x^2 the difference is $5x-24$.
17	Correct answer: (B). $(m+n)^2=m^2+2mn+n^2$, so $169=89+2mn$. Thus $2mn=80$ and $mn=40$.
18	Correct answer: (A). $x^2+10x+25=x^2+2(x)(5)+5^2=(x+5)^2$.
19	Correct answer: (A). Using $(a+b)^2-(a-b)^2=4ab$ with $a=x, b=4$ gives $16x$. Thus R correctly explains A.
20	Correct answer: (A). $(a-b)^2=a^2+b^2-2ab=50-14=36$. Hence both statements are true and R explains A.
21	Area$=(x+2)^2=100$. Thus $x+2=10$ (side length is positive), so $x=8$. Side length$=10$ cm.
22	$49^2=(50-1)^2=50^2-2(50)(1)+1^2=2500-100+1=2401$.
23	$9a^2-24ab+16b^2=(3a)^2-2(3a)(4b)+(4b)^2=(3a-4b)^2$.
24	At $x=2$, claimed RHS gives $4(4)+9=25$, while LHS$=(7)(1)=7$. The claim is false. Correct expression: $(2x+3)(2x-3)=(2x)^2-3^2=4x^2-9$.
25	Length$=p$, Breadth$=q$, $p^2+q^2=(p+q)^2-2pq=12^2-2(20)$
26	Area$=(3x-2)^2=9x^2-12x+4$. For $x=4$: $9(16)-48+4=100$ cm².
27	Area$=(2x+5)(2x-5)=(2x)^2-5^2=4x^2-25$. For $x=6$: $144-25=119$ m².
28	$1003^2=(1000+3)^2=1{,}000{,}000+6{,}000+9=1{,}006{,}009$. The identity avoids lengthy multiplication.
29	$(x-y)^2=(x+y)^2-4xy=121-96=25$. Hence $\|x-y\|=5$. Together with $x+y=11$, the positive pair is 8 and 3.
30	$(n+3)^2-(n-3)^2=[(n+3)-(n-3)][(n+3)+(n-3)]=6\times2n=12n$ cm².
31	$4a^2-12ab+9b^2-25=(2a-3b)^2-5^2=[(2a-3b)-5][(2a-3b)+5]$.
32	(a) Area$=(x+6)(x+2)=x^2+8x+12$. (b) Square area$=(x+4)^2=x^2+8x+16$. Difference (square minus rectangle)$=4$ m². (c) At $x=10$, rectangle$=16\times12=192$ m²; square$=14^2=196$ m²; difference$=4$ m², verified.
33	(a) Remaining area$=(2x+5)^2-(2x-5)^2=4(2x)(5)=40x$ m². (b) For $x=8$, area$=320$ m². (c) The expression is a difference of two squares, so the identity $a^2-b^2=(a-b)(a+b)$ gives the result directly.
34	(a) $6^2=x^2+2+1/x^2$, so $x^2+1/x^2=34$. (b) Let $S=x+1/x=6$. Then $x^3+1/x^3=S^3-3S=216-18=198$. Identities used: $(a+b)^2$ and $a^3+b^3=(a+b)^3-3ab(a+b)$, with $ab=1$.
35	A rectangular sheet has length $(y+9)$ cm and breadth $(y-9)$ cm. Its area is 319 cm². (a) Find y. (b) If the length is increased by 2 cm while the breadth is unchanged, find the new area. (c) Find the increase in area and verify it algebraically.

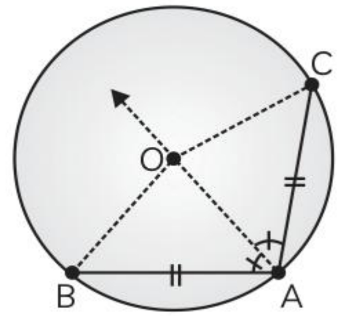
36	(i) Area=$(x+1)^2=x^2+2x+1$ cm². (ii) For x=9, area=$10^2=100$ cm². (iii) Difference=$(x+1)^2-(x-1)^2=4x$ cm².
37	(i) Area=$(p+6)(p-6)=p^2-36$ cm². (ii) For p=10, area=100−36=64 cm². (iii) No. p^2+36 differs from p^2-36 by 72 cm², so they are not equal in general.
38	(i) $99\times101=(100-1)(100+1)=100^2-1^2=9999$. (ii) This uses $a^2-b^2=(a-b)(a+b)$. (iii) At ₹5 per item, total cost=9999×5=₹49,995.
	CHAPTER-5 : I'm Up and Down, and Round and Round
	SECTION A
1	(B) 75^0
2	(D) 8
3	(A) 2
4	(C) 10
5	B) Radii
6	(C) rectangle
7	(C) In the exterior of the circle
8	(B) 1
9	(A) First
10	(A) 2 times
11	(A) Perpendicular Bisector the common chord
12	(B) 70º
13	(A) 2:3
14	(C) $2r = a\sqrt{2}$
15	(B) 60º
16	(A) the centre
17	(A) 48°
18	(C) AB = BC = CD

19	(C)
20	(A)
	SECTION B
21	The smallest circle passing through A and B is the one having AB as its diameter. In this case the centre is the midpoint of AB and the radius equals half the length of AB. Therefore, the least possible radius = $\frac{AB}{2}$.
22	21. Given: AB and CD are two equal chords of a circle with center O. To prove: ∠AOB = ∠COD Construction: Join OA, OB, OC, OD. Proof: In Δ AOB and Δ COD, OA = OC (Radii of a circle) OB = OD (Radii of a circle) AB = CD (Given) By SSS congruency criterion, Δ AOB ≅ Δ COD Using corresponding parts of congruent triangles, ∠AOB = ∠COD 
23	30^0
24	10 cm
25	let AB and AC be two chords. AOD be a diameter such that ∠BAO = ∠CAO. OL ⊥ AB and OM ⊥ AC.  In △OLA and △OMA, OA = OA [common side] ∠OLA = ∠OMA = 90° ∠LAO = ∠MAO [AO bisects ∠A] ∴ △OLA ≅ △OMA [By A.A.S. rule] Then, OL = OM (By C.P.C.T.C.) AB = AC [Chords which are equidistant from centre are equal] **Hence, proved that the two chords are equal.**
	SECTION C

26	Let AB be a chord of a circle with centre O.Since OA = OB (both are radii), O is equidistant from A and B. Therefore, O lies on the perpendicular bisector of AB (by the locus property of the perpendicular bisector). Hence, the perpendicular bisector of the chord AB passes through the centre O. 
27	Opposite angles of a cyclic quadrilateral are supplementary. (2x + 10) + (3x – 20) = 180 5x – 10 = 180 x = 38 Thus, ∠P = 86° and ∠R = 94°.
28	In ΔOAB, OA = OB = 12 cm (radii), so the triangle is isosceles. The angle at the vertex ∠AOB = 60°. The base angles are $\angle OAB = \angle OBA = \frac{180° - 60°}{2} = 60°$. So, all angles are 60° i.e., ΔOAB is equilateral. Therefore, AB = OA = OB = 12 cm. Length of chord AB = 12 cm. 
29	Given statement can be explained (as true statement) with following justification: Let us consider a circle with centre O, chord AB and M be the foot of perpendicular from O to AB. Then, $OM = d$ and $OA = r$. Since, the perpendicular from the centre of a circle to a chord bisects the chord. i.e., $\frac{AM}{AB} = 2$ In right triangle OMA (right-angled at M), by the Baudhāyana–Pythagoras theorem: $OA^2 = OM^2 + AM^2$ $r^2 = d^2 + AM^2$ $AM^2 = r^2 - d^2$ $AM = \sqrt{r^2 - d^2}$ Therefore, chord length $AB = 2AM = 2\sqrt{r^2 - d^2}$. 

30

In triangles OAB and OAC:



$$OA = OA \text{ [Common]}$$
$$OB = OC \text{ [Radii of circle]}$$
$$AB = AC \text{ [Given]}$$

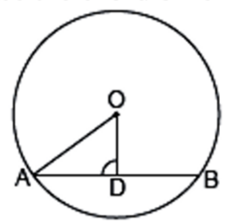
By SSS congruence, $\triangle OAB \cong \triangle OAC$.
Hence, corresponding angles are equal

$$i.e., \angle OAB = \angle OAC$$

This means the line AO bisects $\angle BAC$, i.e., the centre O lies on the angle bisector of $\angle BAC$.

31

Ans: Let in a circle having centre O, AB be the chord of length 10 cm.



Distance of chord AB from centre is OD
$\therefore$ OD = 12 cm
OA = radius of circle
In ΔAOD, OD $\perp$ AB
As we know perpendicular drawn from the centre to the chord bisects the chord.
$\therefore$ AD = $\frac{1}{2}$ AB = $\frac{1}{2} \times 10 = 5$ cm
Now, in ΔAOD
$OA^2 = AD^2 + OD^2$ (Applying Pythagoras theorem)
$\Rightarrow OA^2 = (5)^2 + (12)^2 = 25 + 144$
$\Rightarrow OA^2 = 169$
$\therefore$ OA = $\sqrt{169}$ = 13 cm
$\therefore$ diameter = 2 (OA) = 2 × 13 cm = 26 cm

SECTION D

32

Let O be the centre of the circle.

Length of the two chords are AB = 6 cm and CD = 8 cm.
Given: Radius of the circle OA = OC = 5 cm
Let us draw OM ⊥ AB and ON ⊥ CD.
The perpendiculars from the centre O to the chords AB and CD bisects the chords at M and N respectively.
For chord CD = 8 cm: CN = 4 cm.
Using Pythagoras in ΔOCN:

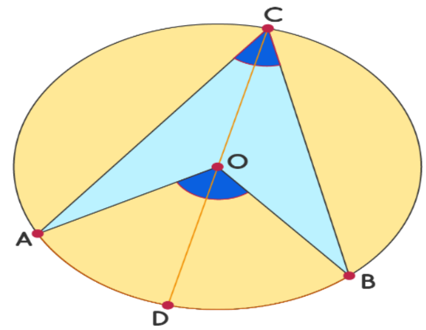
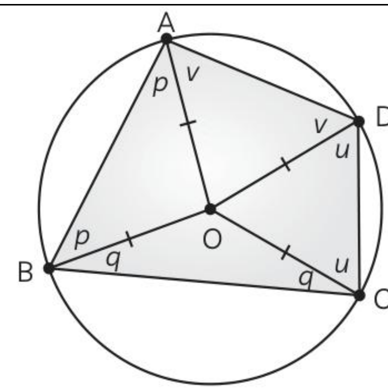
$$ON^2 = OC^2 - CN^2 = 5^2 - 4^2 = 25 - 16 = 9$$

So, ON = 3 cm.
For chord AB = 6 cm: AM = 3 cm.
Using Pythagoras in ΔOAM:

$$OM^2 = OA^2 - AM^2 = 5^2 - 3^2 = 25 - 9 = 16$$

So, OM = 4 cm.
Since, the chords are on opposite sides of the centre and their centres lies on same line.
So, the distance between the midpoints

$$= ON + OM = 3 + 4 = 7 \text{ cm.}$$

33	**Proof:** Consider the following figure, in which an arc (or segment) AB subtends ∠AOB at the center O and ∠ACB at a point C on the circumference. We have to prove that ∠AOB = 2 × ∠ACB. Draw the line through O and C, and let it intersect the circle again at D, as shown.  There are two triangles formed ΔOAC and ΔOBC. So, we make the following observations. 1. In ΔOAC, ∠OAC = ∠OCA, because OA = OC 2. In ΔOBC, ∠OBC = ∠OCB, because OB = OC. Hence, using the exterior angle theorem, we get, ∠AOD= 2×∠ACO ⋯ (1) ∠DOB= 2×∠OCB ⋯ (2) Add equations (1) and (2): ∠AOD+ ∠DOB= 2× (∠ACO+ ∠OCB) ⇒ ∠AOB= 2× ∠ACB
34	Given: $ABCD$ is a cyclic quadrilateral with centre O.  Since, $OA = OB = OC = OD$ [Radii of the same circle] ∴ Triangles OAB, OBC, OCD and ODA are isosceles, so their base angles are equal: $\angle OAB = \angle OBA = p,$ $\angle OBC = \angle OCB = q,$ $\angle OCD = \angle ODC = u,$ $\angle ODA = \angle OAD = v$ Now, the radius at each vertex divides that angle into two parts, so $\angle A = p + v,$ $\angle B = p + q,$ $\angle C = q + u,$ $\angle D = u + v$ Since the sum of the angles of a quadrilateral is 360°, $\angle A + \angle B + \angle C + \angle D = 360°$ $2(p + q + u + v) = 360°$ $\therefore p + q + u + v = 180°$ Therefore $\angle A + \angle C = (p + v) + (q + u) = 180°$ $\angle B + \angle D = (p + q) + (u + v) = 180°$ Hence, the opposite angles of a cyclic quadrilateral are supplementary. Hence proved.

35	Let $\angle MOP = x$ and $\angle MNP = y$ Since MN is a diameter, $\angle MPN = \angle MON = 90°$[Angle in semicircle] ...(i) Now, in cyclic quadrilateral MNOP, $\angle NOP + \angle NMP = 180°$ But $\angle NOP = \angle NOM + \angle MOP = 90° + x$ Hence, $90° + x + \angle NMP = 180°$ $\angle NMP = 90° - x$ ...(ii) In $\triangle MNP$, $\angle NMP + \angle MPN + \angle MNP = 180°$. [Angle sum property] Substituting, $(90° - x) + 90° + y = 180°$ [From (i) and (ii)] $y = x$ Therefore, $\angle MOP = \angle MNP$.
	Case study ANSWER KEY
36	(i) 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. reflex $\angle POR = 2\angle PQR$ $\Rightarrow$ reflex $\angle POR = 2 \times 110° = 220°$ (ii) $\angle PAR$ and $\angle PQR$ are opposite angles of cyclic quadrilateral APQR. $\therefore$ $\angle PAR + \angle PQR = 180°$ $\Rightarrow$ $\angle PAR + 110° = 180°$ $\Rightarrow$ $\angle PAR = 180° - 110° = 70°$ (iii) Now, $\angle POR = 2\angle PAR$ $\angle POR = 2 \times 70° = 140$ In $\triangle POR$, we have $\angle OPR + \angle POR + \angle ORP = 180°$ $\Rightarrow$ $\angle OPR + 140° + \angle OPR = 180°$ $\Rightarrow$ $2\angle OPR = 180° - 140° = 40°$ $\Rightarrow$ $\angle OPR = 40°/2 = 20°$
37	(i) Since AB = BC = CA, $\triangle ABC$ is an equilateral triangle. (ii)We have, CB = $2x$ cm, Now, $OP \perp BC \Rightarrow$ P is mid-point of BC. $\therefore$ CP = $1/2 \times$ CB = $1/2 \times 2x = x$ cm (iii) In right $\triangle ACP$, we have $\Rightarrow$ $AC^2 = AP^2 + CP^2$ $\Rightarrow$ $AP^2 = AC^2 - CP^2$ $\Rightarrow$ $AP^2 = (2x)^2 - x^2 = 4x^2 - x^2 = 3x^2$ [$\because$ AC = CB = $2x$ cm] $\Rightarrow$ $AP = \sqrt{3}x$ cm (iv) We have, OP = AP – OA $\Rightarrow$ OP = $(\sqrt{3}x-50)$ cm, In right $\triangle OCP$, we have $\Rightarrow OC^2 = OP^2 + CP^2$ $\Rightarrow 50^2 = (\sqrt{3}x - 50)^2 + x^2$ $\Rightarrow$ $50^2 = 3x^2 + 50^2 - 100\sqrt{3}x + x^2$ $\Rightarrow$ $4x^2 = 100\sqrt{3}x$ $\Rightarrow$ $4x(x - 25\sqrt{3}) = 0$ $\Rightarrow$ $x = 0$ or $x = 25\sqrt{3}$ $\therefore$ $x = 25\sqrt{3}$ [$\because x \neq 0$] (v) We have, AB = BC = CA = $2x = 2(25\sqrt{3}) = 50\sqrt{3}$ cm $\therefore$ $m\sqrt{3} = 50\sqrt{3} \Rightarrow$ $m = 50$
38	(i) x = 35 (ii) 30 m (iii) 40° (iv) (b)

CHAPTER-6: Measuring Space: Perimeter and Area

1	C. 150m
2	B. Garden B has greater area
3	B. 220 m
4	C. Incorrect, because the radius is 7 m
5	A. The diameter of the semicircle
6	B. 22 cm
7	A. (49 π)/4cm²
8	C. It remains unchanged
9	C. Both have area 96 cm²
10	C. The product should be divided by 2
11	B. 16 m
12	B. Rectangle has greater perimeter
13	B. 25 m
14	B. 176 m
15	B. 5 : 4
16	C. It becomes 4 times
17	B. No, additional information such as its cyclic nature is needed for the relevant formula
18	B. Circumference/arc length of circles
19	(A) Both A and R are true, and R is the correct explanation of A. Every side of the triangle is multiplied by 3. Area scales by the square of the scale factor: $3^2=9$ Therefore, the new area is 9 times the original area. Heron's formula is $\Delta=\sqrt{s(s-a)(s-b)(s-c)}$ If all sides are multiplied by k, then s and each of a,b,c are multiplied by k. Thus, $\Delta'=\sqrt{(ks)(k(s-a))(k(s-b))(k(s-c))} = k^2\Delta$ Therefore, the reason is true and correctly explains the assertion.
20	(C) A is true, but R is false. For the regular hexagon, each side equals r. Its area is six times the area of an equilateral triangle of side r: $A_H=6(\sqrt{3}\, r^2)/4$ $A_H=3\sqrt{3}r^2/2$

	For the equilateral triangle: $A_T = \sqrt{3}r^2/4$ Therefore, $\dfrac{A_H}{A_T} = \dfrac{\frac{3\sqrt{3}}{2}r^2}{\frac{\sqrt{3}}{4}r^2} = 6$ So the area of the hexagon is **six times**, not twice, the area of the triangle. Since both are compared with the same circle, their ratios to the circle are also in the ratio 6:1, not 2:1. Therefore, A is false **Reason** An equilateral triangle inscribed in a circle of radius r has side r. Also, a regular hexagon can indeed be divided into six equilateral triangles of side r.
21	$C = 2\pi r = 2 \times 22/7 \times 7 = 44$ m. Cost = 44 × ₹28 = ₹1,232. Therefore, the budget is sufficient. Assumption: the contractor charges ₹28 per metre for the complete boundary and there are no additional charges.
22	$C = 2 \times 22/7 \times 3.5 = 22$ m. Cost = 22 × ₹40 = ₹880. Therefore, ₹500 is not sufficient. Assumption: the complete circumference needs the border.
23	$A = \pi r^2 = 22/7 \times 14 \times 14 = 616$ cm^2. Assumption: the entire circular region is painted.
24	Circumference = 22/7 × 56 = 176 cm. 1 km = 100,000 cm. Rotations = 100,000/176 ≈ 568.18. Therefore, 569 complete rotations are needed to cover at least 1 km. Assumption: no slipping.
25	Area ratio = $14^2/7^2 = 4$. Garden B has four times, not twice, the area. Assumption: both are perfect circles.
26	The areas are: 11, 20, 27, 32, 35, 36 cm^2 The area increases as the sides become closer in length. The maximum area is obtained by: 6×6=36 cm^2 Thus, among these rectangles, the **square gives the maximum area** for a fixed perimeter.
27	Floor area = 8 × 6 = 48 m^2 Tile side = 40 cm = 0.4 m Area of one tile = 0.4 × 0.4 = 0.16 m^2 Number of tiles = 48 ÷ 0.16 = 300
28	It is possible because two shapes can have different dimensions and shapes but the same area. The required square must have an area equal to the area of the rectangle. If the rectangle has sides a and b, A=ab

	The side s of the equivalent square must satisfy: $s^2=ab$ Therefore, the square and rectangle have the same area, although their shapes are different. The chapter also discusses geometrically constructing a square with the same area as a rectangle.
29	Area of a trapezium depends on: 1/2(a+b)h For the first trapezium: a+ b= 18+32 = 50 For the second: a + b = 25+25= 50 Since their heights are also equal, their areas are equal.
30	Each semicircle has radius: r=a/2 Area of one semicircle: $\frac{1}{2}\pi(\frac{a}{2})^2 = \frac{\pi a^2}{8}$ Area of four semicircles: $4 \times \frac{\pi a^2}{8} = \frac{\pi a^2}{2}$ Area of square: a^2 Since $a^2 \neq \frac{\pi a^2}{2}$ the student's claim is **not correct**.
31	Draw a **median** from any vertex of the triangle to the midpoint of the opposite side. If the opposite side is divided into two equal parts, the two triangles formed have: • equal bases, • the same perpendicular height. Therefore, A_1 = ½ bh And A_2 = ½ bh Hence, $A_1 = A_2$ So, a **median divides a triangle into two regions of equal area**.
32	Field = 45 m × 32 m After dividing along its length: Breadth of each part = 32 ÷ 2 = 16 m Area of each part = 45 × 16 = 720 m² Perimeter of each part = 2(45 + 16) = 122 m Total fencing = outer perimeter + dividing line = 2(45 + 32) + 45 = 199 m
33	Original area = 30 × 20 = 600 cm² Area of square cut out = 8 × 8 = 64 cm² Remaining area = 600 − 64 = 536 cm² Original perimeter = 2(30 + 20) = 100 cm After cutting the corner square, the perimeter remains 100 cm, because the two removed portions are replaced by two new edges of equal total length.
34	Same Perimeter, Different Area

Total fencing = 40 m

For a rectangle:
2(L + B) = 40 ⇒ L + B = 20

Possible dimensions:

Length	Breadth	Area
18 m	2 m	36 m²
15 m	5 m	75 m²
12 m	8 m	96 m²
10 m	10 m	100 m²

Greatest area = 100 m², when the garden is a 10 m × 10 m square.

Observation: For a fixed perimeter, a square gives the maximum area among rectangles.

35 Perimeter = 60 m

So,
2(L + B) = 60
L + B = 30

The best choice is:

Length = 15 m

Breadth = 15 m

Therefore, the garden is a square.

Area = 15 × 15 = 225 m²
Reason: When the length and breadth are equal, the rectangular garden has the maximum possible area for a fixed perimeter

36 **(1) Arc length and perimeter of intersecting figures.**

Step 1: Identify bounds. A single petal is bounded by two distinct arcs. Each arc is exactly one-quarter of the circumference of a circle with radius $r = 1$.

Step 2: Calculate perimeter. Perimeter of one petal = $2 \times (1/4 \times 2 \times \pi \times r) = \pi \times r$. With $r = 1$, the perimeter is π.

Conclusion: The assertion is **false**. The circumference of the circle is $2 \times \pi \times (1) = 2 \times \pi$, while the petal perimeter is π.

(2) Area subtraction.

Step 1: Calculate base areas. Area of Square = 2 × 2 = 4 sq. units. Area of two semicircles (one full circle) = $\pi \times (1)^2 = \pi$ sq. units.

Step 2: Determine corner area. Area of two unshaded corners = $4 - \pi$. Total area of all four unshaded corners = $2 \times (4 - \pi) = 8 - 2\pi$ sq. units.

(3) Complex area synthesis.

Calculation: Area of Flower = Area of Square - Area of 4 corners. Area = $4 - (8 - 2\pi) = 2\pi - 4$ sq. units.

37	**(1) Circle theorems relating tangents and chords.** **Reasoning:** Radius OA is perpendicular to tangent chord BC. A perpendicular from the centre to a chord bisects it. Therefore, A is the midpoint of BC. The assumption is **correct**. **(2) Applying the Baudhāyana-Pythagoras theorem.** **Derivation:** In triangle OAC, OC = R, OA = r, and AC = l / 2. $R^2 = r^2 + (l / 2)^2$ => $R^2 = r^2 + l^2 / 4$. **(3) Synthesizing algebraic expressions with area formulas.** **Proof:** Area = $\pi \times R^2 - \pi \times r^2 = \pi \times (R^2 - r^2)$. Substituting $R^2 - r^2 = l^2 / 4$, we get Area = $1 / 4 \times \pi \times l^2$.
38	**(1) Adapting area formulas.** **Formula:** Full circle area = $\pi r^2 = (\pi \times d^2) / 4$. Semicircle area = $1/2 \times (\pi \times d^2) / 4 = (\pi \times d^2) / 8$. **(2) Evaluating linear scaling versus quadratic scaling.** **Reasoning:** Arc sum = $\pi / 2 \times (a + b)$. Large arc = $\pi \times c / 2$. Since $a + b > c$ by triangle inequality, the hypothesis is **false**. **(3)Pythagorean area theorem.** **Synthesis:** $a^2 + b^2 = c^2 \Rightarrow (\pi \times a^2) / 8 + (\pi \times b^2) / 8 = (\pi \times c^2) / 8$. Thus, Area A + Area B = Area C.

CHAPTER-7: The Mathematics of Maybe: Introduction to Probability

1	(a) 9/10
2	(a) Yes, probability = 5/8
3	(a) Probability > 4 = 1/3
4	(c) 4/5
5	(b) 1/4
6	(b) Probability of king = 1/13
7	(a) 2/5
8	(a) 1/4
9	(a) Probability of black = 2/5
10	(a) Probability of black < probability of white
11	(c) Probability of composite < probability of prime
12	(a) 1/5
13	(d) 4/5
14	(a) 17/24
15	(a) 11/12
16	(b) No, probability of tail = 1/2
17	(b)1/2
18	(a) 7/50
19	(c)A true, R true, R correct explanation (a)
20	(a)A true (valid = 110/120 = 11/12), R true, correct explanation
21	Probability of banana or orange = (30+20)/100 = 50/100. Probability of apple = 40/100. Since 50/100 > 40/100 → Yes, banana/orange > apple.
22	P(Balcony) = 120/300 = 2/5 = 0.4. Compare with 1/3 ≈ 0.33. Since 0.4 > 0.33 → Yes, balcony > 1/3.

23	Probabilities: P(Clothes) = 30/80 = 3/8, P(Electronics) = 25/80 = 5/16 P(Groceries) = 15/80 = 3/16 P(Toys) = 10/80 = 1/8 (i) Toys have the lowest probability. (ii) Yes, the probability of selecting a clothes coupon is greater than one-third.
24	P(Prime) = 3/6 = 1/2. P(Composite) = 2/6 = 1/3. Since 1/2 > 1/3 SO Probability of getting Prime > Probability of getting Composite.
25	P(Not failed) = 35/40 = 0.875. Compare with 0.85. Since 0.875 > 0.85 So, Yes, probability > 0.85.
	3 MARKS
26	Probability of Winning = 7/12; Probability of getting Losing > Probability of having Draw Probability of Winning > 1/2
27	Probability of getting Prime = 3/6 = 1/2; Probability of getting Composite = 2/6 = 1/3 So, Probability of getting Prime > Probability of getting Composite; P(Odd) = P(Even)= 3/6= 1/2
28	P(Defective) = 50/500 = 1/10; P(Good) > P(Defective) P(Good) = 9/10 > 4/5
29	Probability of student studying Only Maths = 8/40; Probability of student studying Science = 12/40 > Probability of student studying Both = 10/40; Probability of student studying Maths = 18/40 > 1/3
30	P(Valid) = 140/150 = 14/15; P(A) > P(B); P(NOTA) = 1/15 < 1/12
31	Highest = Children; P(Adults) > P(Seniors); Highest group = Children
	5 marks
32	Probability of Carrying Handbag = 90/200=9/20 Probability of Carrying Backpack = 70/200=7/20 Probability of Carrying Suitcase = 40/200 =1/5 Probability of Not Carrying suitcase = 160/200 = 4/5 P(Handbag + Backpack) = 160/200= 4/5
33	P(Veg) = 60/150= 2/5 P(Non-veg) = 50/150 = 1/3 P(Vegan) = 40/150 = 4/15 P(Not vegan) = 110/150 = 11/15 P(Veg+Vegan) = 100/150 = 2/3
34	Probability of getting Window seat = 25/100 = ¼ Probability of getting Aisle seat= 35/100 Probability of getting Middle = 40/100= 4/10=2/5 Probability of Not getting window seat = 75/100= ¾ P(Aisle+Middle) = 75/100= 3/4
35	Probability of selecting Clothes = 100/250 = 2/25 Probability of selecting Electronics = 80/250 = 8/25 Probability of selecting Groceries = 50/250 =1/5 Probability of selecting Not books = 230/250 = 23/25 Probability of selecting Clothes+ Electronics = 180/250= 18/25
	Case study
36	P(Sandwiches) = 25/60 = 5/12 Most chosen food item is Sandwiches P(Fruits) = 20/60 < 1/3

	P(Sandwiches +Snacks) = 40/60= 2/3
37	Lowest = Vans; P(Cars) = 30/80 = 3/8 > 1/3 P(Bike+Scooter) = 40/80 = ½
38	Probability is 1/5 = 20/100 The category is books P(Electronics) = 30/100 = 3/10 P(Books +Toys) = 30/100 = 3/10 P(Not clothes) = 60/100 = 3/5

CHAPTER-8: Predicting What Comes Next: Exploring Sequences and Progressions

1	B) 33. The AP has a=12, d=3. a_8=12+7(3)=33.
2	A) 5n+3. For n=1, it gives 8; each term increases by 5.
3	B) Each step has 3 more tiles. The consecutive differences are 3.
4	. C) 10th. 4+(n−1)5=44 gives n−1=8, so n=9. Therefore the correct option is B) 9th. (The options intentionally test indexing.)
5	C) ₹400. a_7=100+6(50)=₹400.
6	C) Each term is doubled, so the terms grow much faster. The sequence is geometric, not arithmetic.
7	A) n^2+1. For n=1,2,3,… it gives 2,5,10,17,26.
8	B) 21. $a_{12}-a_9$=(7·12−2)−(7·9−2)=21.
9	D) 36. The terms are 4+5k, so 36 is not obtained for an integer k.
10	C) 7th. 20+(n−1)(−3)=2 gives n=7.
11	B) 5. Since 11−x=6, x=5.
12	C) 144. The nth term is n^2, so the 12th figure has 12^2=144 tiles.
13	C) 4. a_9-a_5=4d=34−18=16, hence d=4.
14	B) 16,19. 3(3)+7=16 and 3(4)+7=19.
15	B) Use the AP sum formula after finding the number of terms. It is systematic and avoids lengthy addition.
16	B) 9th. a_9=50+8(−5)=10, so the first term below 10 is a_{10}=5. Thus C) 10th is correct. The options test strict inequality.
17	A) 240. a=6,d=4,n=10; S_{10}=10/2[12+9(4)]=240.
18	A) Corresponding terms differ by 5 because the difference of the first terms remains unchanged when equal common differences are added.
19	A) Both are true, and R correctly explains A.
20	D) Assertion is false; the differences are not constant. The reason is true.
21	a=14,d=5. a_{15}=14+14(5)=84.
22	31=a+6(4), so a=7
23	a_{12}=60+11(15)=225. Charge = ₹225.
24	92=7+(n−1)5. Thus 85=5(n−1), n−1=17, n=18.
25	a_{20}=5(20)−1=99. Consecutive terms differ by 5.

26	$a=18, d=4, n=15$. $a_{15}=18+14(4)=74$. $S_{15}=15/2(18+74)=690$ seats.
27	$a=200, d=75, n=12$. $a_{12}=200+11(75)=1025$. $S_{12}=12/2(200+1025)=7350$. Total saving = ₹7,350.
28	$a+3d=17$ and $a+9d=41$. Subtracting gives $6d=24$, $d=4$. Then $a=5$. $a_{20}=5+19(4)=81$.
29	$a_n=35-4(n-1)$. Set equal to 3: $35-4(n-1)=3$, so $4(n-1)=32$ and $n=9$. Therefore 3 is the 9th term.
30	$a=3, d=4, n=20$. $a_{20}=3+19(4)=79$. $S_{20}=20/2(3+79)=820$ books.
31	No. Differences are 2,3,4,5,…, not constant. The next differences are 6 and 7, so the next terms are 21 and 28.
32	$a=25, d=6, n=18$. (i) $a_{18}=25+17(6)=127$. (ii) $S_{18}=18/2(25+127)=1368$. (iii) $1368>1000$, so yes, it can seat 1,000 people, with 368 seats to spare.
33	$a=500, d=125, n=16$. $a_{16}=500+15(125)=2375$. $S_{16}=16/2(500+2375)=23000$. Target 25000 is not met; shortfall = ₹2,000.
34	$S_{10}=230$, $a_{10}=41$. $10/2(a+41)=230$, so $a+41=46$ and $a=5$. Then $41=5+9d$, so $d=4$. $a_{20}=5+19(4)=81$.
35	$a=7, d=5, n=25$. $S_{25}=25/2[14+24(5)]=25/2(134)=1675$. Need 325 more. After 5 more levels: $a_{26}=132$, $a_{27}=137$, $a_{28}=142$, $a_{29}=147$, $a_{30}=152$. Extra total for levels 26–30 = 710, so the target is first crossed at level 30. Thus 5 additional complete levels are needed.
36	(a) $a=9, d=4$. (b) $a_{12}=9+11(4)=53$. (c) $S_{12}=12/2(9+53)=372$ plants.
37	(a) $a_{15}=20+14(10)=160$ points. (b) $S_{15}=15/2(20+160)=1350$ points. (c) No. Shortfall = $1500-1350=150$ points.
38	(a) $a_{20}=30+19(4)=106$ seats. (b) $S_{20}=20/2(30+106)=1360$ seats. (c) Yes. $1360-750=610$ seats remain.