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Chapters: Ch. 1 – Orienting Yourself: The Use of Coordinates | Ch. 3 – The World of Numbers

Total Marks: 40

Time: 1 Hour 30 Minutes

General Instructions

1. All questions are compulsory.
2. Section A: Q1 (MCQ) – 1 mark each $\times 10 = 10$ marks
3. Section B: Q2 (Assertion-Reasoning) – 1 mark each $\times 4 = 4$ marks
4. Section C: Short Answer – 2 marks each $\times 6 = 12$ marks (Q3–Q8)
5. Section D: Long Answer – 3 marks each $\times 3 = 9$ marks (Q9–Q11)
6. Section E: Case Study – 5 marks (Q12)
7. Use of calculators is NOT permitted.

SECTION A — Multiple Choice Questions (MCQ)

Each question carries 1 mark. Choose the most appropriate option.

Q1. The point $(-3, 0)$ lies on: **[1 Mark]**

- (a) The x-axis, to the right of the origin
- (b) The y-axis, below the origin
- (c) The x-axis, to the left of the origin
- (d) Quadrant III

Q2. A point P has coordinates $(-4, 7)$. In which quadrant does P lie? **[1 Mark]**

- (a) Quadrant I
- (b) Quadrant II
- (c) Quadrant III
- (d) Quadrant IV

Q3. What is the distance between the points $A(3, 4)$ and $B(0, 0)$? **[1 Mark]**

- (a) $\sqrt{7}$ units
- (b) 5 units
- (c) 7 units
- (d) $\sqrt{34}$ units

Q4. Brahmagupta formalised zero in which of the following works? **[1 Mark]**

- (a) Āryabhaṭīya
- (b) Lalitavistara
- (c) Brāhmasphuṭasiddhānta
- (d) Śhulbasūtra

Q5. Which of the following numbers is IRRATIONAL? **[1 Mark]**

- (a) $\sqrt{9}$
- (b) $\sqrt{4/9}$
- (c) $\sqrt{12}$
- (d) 0.141414...

Q6. The decimal expansion of $7/20$ is: **[1 Mark]**

- (a) Non-terminating, non-repeating
- (b) Non-terminating, repeating
- (c) Terminating
- (d) Cannot be determined

Q7. If point $Q(y, x)$ coincides with point $P(x, y)$, then which of the following must be TRUE? **[1 Mark]**

- (a) $x > y$
- (b) $x < y$
- (c) $x = y$
- (d) x and y are both zero

Q8. The product of a negative rational number and a positive rational number is always: **[1 Mark]**

- (a) Positive
- (b) Negative

(c) Zero

(d) Depends on the values

Q9. The coordinates of a point on the y-axis at a distance of 6 units below the origin are: **[1 Mark]**

(a) (6, 0)

(c) (0, -6)

(b) (0, 6)

(d) (-6, 0)

Q10. What is the rational number equivalent of the repeating decimal $0.\overline{6}$ (i.e., 0.6666...)? **[1 Mark]**

(a) $\frac{3}{5}$

(c) $\frac{6}{9}$

(b) $\frac{2}{3}$

(d) Both (b) and (c)

SECTION B — Assertion and Reasoning

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

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

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

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

Assertion (A): The point $(-5, -3)$ lies in Quadrant III.

Reason (R): In Quadrant III, the x-coordinate is negative and the y-coordinate is positive.

Q3. Assertion (A): $\sqrt{2}$ is an irrational number.

Reason (R): $\sqrt{2}$ cannot be expressed as $\frac{p}{q}$ where p and q are integers and $q \neq 0$, because assuming it can leads to a contradiction — both p and q would have to be even, violating the co-prime condition.

Q4 Assertion (A): The decimal expansion of $\frac{4}{15}$ is a terminating decimal.

Reason (R): A rational number $\frac{p}{q}$ (in lowest terms) has a terminating decimal if and only if the prime factorisation of q contains only 2s, only 5s, or both.

Q5. Assertion (A): The distance between points $M(9, 6)$ and $A(3, 4)$ is $\sqrt{40}$ units.

Reason (R): The distance formula between two points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

SECTION C — Short Answer Questions

Q3. Using the distance formula, verify whether the points $M(-3, -4)$, $A(0, 0)$ and $G(6, 8)$ are collinear (i.e., lie on the same straight line). Show your working. **[2 Marks]**

Q4. Convert the repeating decimal $2.\overline{357}$ (i.e., 2.357575757...) into the form $\frac{p}{q}$ where p and q are integers. Show all steps. **[2 Marks]**

Q5. Point R has coordinates $(3, 0)$, A has coordinates $(0, -2)$, M has coordinates $(-5, -2)$ and P has coordinates $(-5, 2)$. Without plotting, predict: **[2 Marks]**

(i) Which two sides of quadrilateral RAMP are perpendicular to each other?

(ii) Which side of RAMP is parallel to one of the axes?

Q6. Prove that $\sqrt{3}$ is an irrational number using proof by contradiction. **[2 Marks]**

Q7. A rectangular room has corners at $O(0, 0)$, $A(12, 0)$, $B(12, 10)$ and $C(0, 10)$. A wardrobe occupies the region with corners at $W_1(3, 0)$, $W_2(7, 0)$, $W_3(7, 2)$ and $W_4(3, 2)$. **[2 Marks]**

(i) What are the dimensions of the wardrobe?

(ii) A bed has one corner at $S_1(0, 5)$ and the diagonally opposite corner at $S_2(5, 8.5)$. What are the length and width of the bed? (Use the distance formula wherever needed.)

Q8. Let a and b be two non-zero rational numbers such that $a + 1/b = 0$. Without assigning numerical values, determine whether the product ab is positive or negative. Justify your answer.

SECTION D — Long Answer Questions

Q10. Study the following scenario about a coordinate plane and answer all parts: **[3 Marks]**

Reiaan's study table has three of its four legs at the points $(8, 9)$, $(11, 9)$ and $(11, 7)$ on a coordinate grid where 1 unit = 1 foot.

(i) Find the coordinates of the fourth leg. Justify why it must be at that point.

(ii) Calculate the length and width of the table.

(iii) The midpoints of the sides of a triangle ABC are $D(5, 1)$, $E(6, 5)$ and $F(0, 3)$. Using the midpoint formula (midpoint = $((x_1+x_2)/2, (y_1+y_2)/2)$), find the coordinates of vertices A , B and C .

Q11. Answer the following questions about real numbers: **[3 Marks]**

(i) Without performing long division, determine whether $7/20$, $4/15$ and $13/250$ give terminating or non-terminating repeating decimals. Explain your reasoning for each.

(ii) The decimal $1/7 = 0.142857$ is a cyclic number. Show that multiplying 142857 by 3 and by 5 produces cyclic permutations of the same digits.

(iii) A student claims: '0.9 (i.e., 0.9999...) is slightly less than 1.' Using algebra, show that the student is WRONG and that $0.9 = 1$ exactly.

SECTION E — Case Study

Q12. Case Study: The Grid Map of an Ancient City **[5 Marks]**

A historian is studying the ruins of an ancient city modelled after the Sindhu-Sarasvatī Civilisation. The city is mapped on a coordinate grid where each unit represents 10 metres. Two main roads cross at the city centre $O(0, 0)$ — one running North–South (along the y -axis) and one running East–West (along the x -axis). The city extends 5 units in each direction from the centre.

Four key structures are located at:

- Great Granary: $G(-3, 4)$
- Market Place: $M(4, -2)$
- City Well: $W(0, 3)$
- Eastern Gate: $E(5, 0)$

(i) In which quadrant do the Great Granary G and the Market Place M lie respectively?

(ii) What is the actual distance (in metres) between the Great Granary $G(-3, 4)$ and the Market Place $M(4, -2)$? Show all working.

(iii) The City Well $W(0, 3)$ is equidistant from two unknown temples $T_1(x, 1)$ and $T_2(x, 5)$. What is the value of x ? What can you say about the positions of T_1 and T_2 relative to W ?

(iv) A historian claims the path from O to G to M forms a right angle at G . Verify this claim using the distance formula and the converse of the Baudhāyana–Pythagoras theorem.

(v) The city planner decides to place a new Watchtower exactly at the midpoint of the segment joining the Eastern Gate $E(5, 0)$ and the Great Granary $G(-3, 4)$. Find the coordinates of the Watchtower. Does it lie on any axis? Justify.