UNIQUE STUDY POINT

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Class: X	**Subject:** Mathematics	**Session:** 2024-25
Chapter: 07 - Coordinate Geometry	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.
8. There is no overall choice.
9. Use of calculators is not permitted.

SECTION A - Multiple Choice Questions (1 mark each)

1. The distance between points A(3, 4) and B(–1, 1) is

(a) 5 units

(b) 3 units

(c) 4 units

(d) 7 units

2. If the mid-point of the line segment joining (3, 4) and (k, 6) is (x, y) and x + y – 10 = 0, then the value of k is

(a) 10

(b) 12

(c) 14

(d) 16

3. The coordinates of the point which divides the line segment joining the points (2, 3) and (5, 6) in the ratio 2 : 1 is

(a) (4, 5)

(b) (3, 4)

(c) (5, 6)

(d) (7/3, 4)

4. The area of triangle with vertices (0, 0), (3, 0) and (0, 4) is

(a) 5 sq. units

(b) 6 sq. units

(c) 7 sq. units

(d) 12 sq. units

5. If points (a, 0), (0, b) and (1, 1) are collinear, then

(a) a + b = 1

(b) 1/a + 1/b = 1

(c) a + b = ab

(d) 1/a + 1/b = 2

6. The point on Y-axis which is equidistant from (–5, 2) and (3, 2) is

(a) (0, 2)

(b) (2, 0)

(c) (0, –1)

(d) (0, 0)

7. If A(4, 9), B(2, 3) and C(6, 5) are the vertices of triangle ABC, then the length of median through A is

(a) 5 units

(b) √10 units

(c) 10 units

(d) √5 units

8. The ratio in which the point P(–3, k) divides the line segment joining A(–5, –4) and B(–2, 3) is

(a) 2 : 1

(b) 1 : 2

(c) 3 : 1

(d) 1 : 3

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

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

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

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

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

9. Assertion (A): The distance of the point (3, 4) from the origin is 5 units.
Reason (R): The distance formula is $\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$.

10. Assertion (A): The points (1, 2), (2, 3) and (3, 4) are collinear.
Reason (R): Three points are collinear if the area of triangle formed by them is zero.

SECTION B - Short Answer Questions (2 marks each)

11. Find the distance between the points A(cos θ, sin θ) and B(sin θ, –cos θ).

12. If A(–1, 3), B(1, –1) and C(5, 1) are the vertices of a triangle ABC, find the length of the median through vertex A.

13. Find the coordinates of the point which divides the line segment joining points (–1, 7) and (4, –3) in the ratio 2 : 3.

14. If the point C(–1, 2) divides internally the line segment joining A(2, 5) and B in the ratio 3 : 4, find the coordinates of B.

SECTION C - Short Answer Questions (3 marks each)

15. Find the area of triangle whose vertices are (1, –1), (–4, 6) and (–3, –5).

16. Show that the points A(2, 3), B(–2, 2), C(–1, –2) and D(3, –1) are the vertices of a square.

17. Find the ratio in which the Y-axis divides the line segment joining the points (5, –6) and (–1, –4). Also find the point of intersection.

OR

If A(5, 2), B(2, –2) and C(–2, t) are the vertices of a right angled triangle with ∠B = 90°, then find the value of t.

SECTION D - Long Answer Question (5 marks)

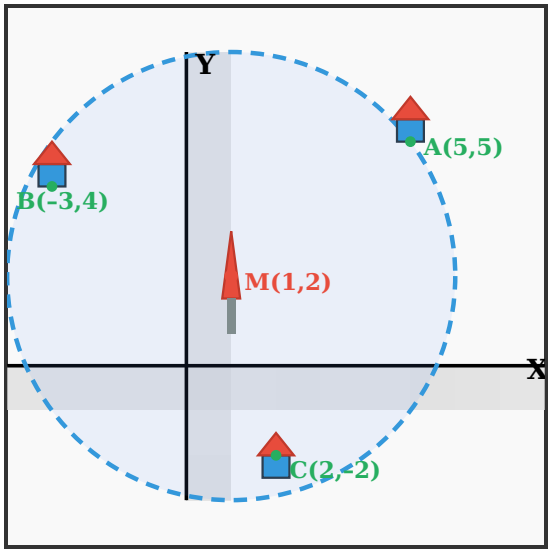
18. Prove that the points A(1, 7), B(4, 2), C(–1, –1) and D(–4, 4) are the vertices of a square ABCD. Also find its area.

OR

Find the coordinates of the points of trisection of the line segment joining (4, –1) and (–2, –3). Also find the centroid of triangle formed by these two points and the origin.

SECTION E - Case Study Based Questions (4 marks each)

19. A mobile tower stands at the point M(1, 2) in a coordinate plane. Three houses are located at points A(5, 5), B(–3, 4) and C(2, –2). The tower transmits signals within a range of 5 km (considering 1 unit = 1 km).



Based on the above information, answer the following questions:

(i) Find the distance of house A from the tower M. **[1 mark]**

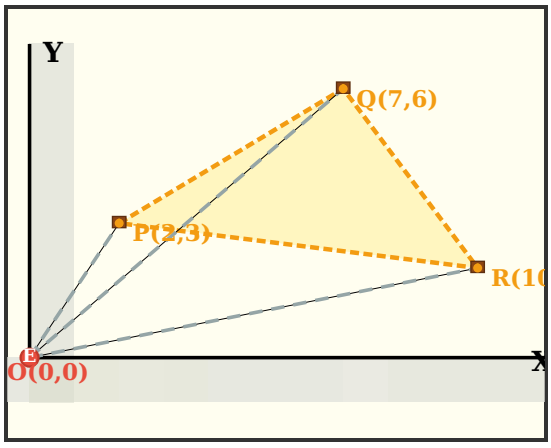
(ii) Find the distance of house B from the tower M. **[1 mark]**

(iii) Which house is exactly at the edge of the signal range? **[2 marks]**

OR

If a house D is located at point (4, 6), will it receive the signal from tower M? Justify your answer. **[2 marks]**

20. An adventure park has a rectangular coordinate system set up for a treasure hunt. Three treasures are buried at points P(2, 3), Q(7, 6) and R(10, 2). The park entrance is at the origin O(0, 0).



Based on the above information, answer the following questions:

(i) Find the distance from entrance O to treasure P. **[1 mark]**

(ii) (a) Find the perimeter of triangle PQR. **[1 mark]**

OR

(b) Find the coordinates of the centroid of triangle PQR. **[1 mark]**

(iii) If a fourth treasure is to be placed at point S such that PQRS forms a parallelogram, find the coordinates of S. **[2 marks]**

DETAILED ANSWER KEY - PAPER 01

SECTION A - Answers to MCQs

1. (a) 5 units

Distance AB = $\sqrt{[(-1 - 3)^2 + (1 - 4)^2]} = \sqrt{[16 + 9]} = \sqrt{25} = 5$ units

2. (c) 14

Mid-point: $((3 + k)/2, (4 + 6)/2) = ((3 + k)/2, 5)$
Since $x + y - 10 = 0$: $(3 + k)/2 + 5 - 10 = 0$
$(3 + k)/2 = 5$
$3 + k = 10$
$k = 14$

3. (a) (4, 5)

Using section formula with ratio 2:1:
$x = (2\times5 + 1\times2)/(2+1) = 12/3 = 4$
$y = (2\times6 + 1\times3)/(2+1) = 15/3 = 5$
Point is (4, 5)

4. (b) 6 sq. units

Area $= (1/2)|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$
$= (1/2)|0(0 - 4) + 3(4 - 0) + 0(0 - 0)|$
$= (1/2)|12| = 6$ sq. units

5. (b) 1/a + 1/b = 1

For collinear points, area of triangle = 0
$(1/2)|a(b - 1) + 0(1 - 0) + 1(0 - b)| = 0$
$ab - a - b = 0$
Dividing by ab: $1 - 1/b - 1/a = 0$
$1/a + 1/b = 1$

6. (a) (0, 2)

Let point be (0, y). It is equidistant from (–5, 2) and (3, 2)
$\sqrt{[(0+5)^2 + (y-2)^2]} = \sqrt{[(0-3)^2 + (y-2)^2]}$
$25 + (y-2)^2 = 9 + (y-2)^2$
Since both points have same y-coordinate, the equidistant point is (0, 2)

7. (a) 5 units

Midpoint of BC = $((2+6)/2, (3+5)/2) = (4, 4)$
Length of median from A(4, 9) to (4, 4) $= \sqrt{[(4-4)^2 + (9-4)^2]} = \sqrt{25} = 5$ units

8. (a) 2 : 1

Using section formula: $-3 = (m\times(-2) + n\times(-5))/(m+n)$
$-3(m+n) = -2m - 5n$
$-3m - 3n = -2m - 5n$
$-m = -2n$
$m/n = 2/1$
Ratio is 2:1

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

Distance from origin (0, 0) to (3, 4) = $\sqrt{[(3-0)^2 + (4-0)^2]} = \sqrt{[9+16]} = \sqrt{25} = 5$ units
Both A and R are true, and R correctly explains A.

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

Area = $(1/2)|1(3-4) + 2(4-2) + 3(2-3)| = (1/2)|-1+4-3| = 0$
Points are collinear. Both A and R are true, and R correctly explains A.

SECTION B - Answers to Short Answer Questions

11.

Distance AB = $\sqrt{[(\sin\theta - \cos\theta)^2 + (-\cos\theta - \sin\theta)^2]}$
$= \sqrt{[\sin^2\theta + \cos^2\theta - 2\sin\theta\cos\theta + \cos^2\theta + \sin^2\theta + 2\sin\theta\cos\theta]}$
$= \sqrt{[2\sin^2\theta + 2\cos^2\theta]}$
$= \sqrt{[2(\sin^2\theta + \cos^2\theta)]}$
$= \sqrt{2}$ units

12.

Midpoint of BC = $((1+5)/2, (-1+1)/2) = (3, 0)$
Median from A(–1, 3) to (3, 0):
Length = $\sqrt{[(3-(-1))^2 + (0-3)^2]}$
$= \sqrt{[16 + 9]}$
$= \sqrt{25} = 5$ units

13.

Using section formula with ratio 2:3:
$x = (2\times4 + 3\times(-1))/(2+3) = (8-3)/5 = 1$
$y = (2\times(-3) + 3\times7)/(2+3) = (-6+21)/5 = 3$
Point is (1, 3)

14.

Let B = (x, y). Using section formula with ratio 3:4:
$-1 = (3x + 4\times2)/(3+4) \rightarrow -7 = 3x + 8 \rightarrow x = -5$
$2 = (3y + 4\times5)/(3+4) \rightarrow 14 = 3y + 20 \rightarrow y = -2$
Coordinates of B are (–5, –2)

SECTION C - Answers to Short Answer Questions

15.

Area = $(1/2)|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$
$= (1/2)|1(6 - (-5)) + (-4)(-5 - (-1)) + (-3)(-1 - 6)|$
$= (1/2)|1(11) + (-4)(-4) + (-3)(-7)|$
$= (1/2)|11 + 16 + 21|$
$= (1/2)|48|$
$= 24$ sq. units

16.

AB = $\sqrt{[(-2-2)^2 + (2-3)^2]} = \sqrt{[16+1]} = \sqrt{17}$

BC = $\sqrt{[(-1-(-2))^2 + (-2-2)^2]} = \sqrt{[1+16]} = \sqrt{17}$
CD = $\sqrt{[(3-(-1))^2 + (-1-(-2))^2]} = \sqrt{[16+1]} = \sqrt{17}$
DA = $\sqrt{[(2-3)^2 + (3-(-1))^2]} = \sqrt{[1+16]} = \sqrt{17}$
All sides equal.
Diagonal AC = $\sqrt{[(-1-2)^2 + (-2-3)^2]} = \sqrt{[9+25]} = \sqrt{34}$
Diagonal BD = $\sqrt{[(3-(-2))^2 + (-1-2)^2]} = \sqrt{[25+9]} = \sqrt{34}$
All sides equal and diagonals equal, hence ABCD is a square.

17.

Main Solution:
Y-axis divides at point (0, y). Using section formula:
$0 = (m\times(-1) + n\times5)/(m+n)$
$-m + 5n = 0 \rightarrow m = 5n$
Ratio m:n = 5:1
$y = (5\times(-4) + 1\times(-6))/(5+1) = -26/6 = -13/3$
Point of intersection is $(0, -13/3)$

OR
For right angle at B, $AB^2 + BC^2 = AC^2$
$AB^2 = (2-5)^2 + (-2-2)^2 = 9 + 16 = 25$
$BC^2 = (-2-2)^2 + (t-(-2))^2 = 16 + (t+2)^2$
$AC^2 = (-2-5)^2 + (t-2)^2 = 49 + (t-2)^2$
$25 + 16 + (t+2)^2 = 49 + (t-2)^2$
$41 + t^2 + 4t + 4 = 49 + t^2 - 4t + 4$
$8t = 8$
$t = 1$

SECTION D - Answer to Long Answer Question

18.

Main Solution:
AB = $\sqrt{[(4-1)^2 + (2-7)^2]} = \sqrt{[9+25]} = \sqrt{34}$
BC = $\sqrt{[(-1-4)^2 + (-1-2)^2]} = \sqrt{[25+9]} = \sqrt{34}$
CD = $\sqrt{[(-4-(-1))^2 + (4-(-1))^2]} = \sqrt{[9+25]} = \sqrt{34}$
DA = $\sqrt{[(1-(-4))^2 + (7-4)^2]} = \sqrt{[25+9]} = \sqrt{34}$
All sides equal.
Diagonal AC = $\sqrt{[(-1-1)^2 + (-1-7)^2]} = \sqrt{[4+64]} = \sqrt{68} = 2\sqrt{17}$
Diagonal BD = $\sqrt{[(-4-4)^2 + (4-2)^2]} = \sqrt{[64+4]} = \sqrt{68} = 2\sqrt{17}$
All sides equal and diagonals equal, hence ABCD is a square.
Area = $(\text{side})^2 = (\sqrt{34})^2 = 34$ sq. units

OR
Points of trisection divide line in ratio 1:2 and 2:1
Point P (ratio 1:2): $x = (1\times(-2)+2\times4)/(1+2) = 6/3 = 2$
$y = (1\times(-3)+2\times(-1))/(1+2) = -5/3$
$P = (2, -5/3)$
Point Q (ratio 2:1): $x = (2\times(-2)+1\times4)/(2+1) = 0$
$y = (2\times(-3)+1\times(-1))/(2+1) = -7/3$
$Q = (0, -7/3)$
Centroid of triangle with O(0,0), (4,–1), (–2,–3):
$= ((0+4-2)/3, (0-1-3)/3) = (2/3, -4/3)$

SECTION E - Answers to Case Study Based Questions

19.

(i) Distance MA = $\sqrt{[(5–1)^2 + (5–2)^2]} = \sqrt{[16+9]} = \sqrt{25} = 5$ km

(ii) Distance MB = $\sqrt{[(–3–1)^2 + (4–2)^2]} = \sqrt{[16+4]} = \sqrt{20} = 2\sqrt{5} \approx 4.47$ km

(iii) Distance MC = $\sqrt{[(2–1)^2 + (–2–2)^2]} = \sqrt{[1+16]} = \sqrt{17} \approx 4.12$ km
House A is exactly at the edge of signal range (exactly 5 km away).

OR
Distance MD = $\sqrt{[(4–1)^2 + (6–2)^2]} = \sqrt{[9+16]} = \sqrt{25} = 5$ km
Yes, house D will receive signal as it is exactly at the edge of 5 km range.

20.

(i) Distance OP = $\sqrt{[(2–0)^2 + (3–0)^2]} = \sqrt{[4+9]} = \sqrt{13}$ units

(ii) (a) PQ = $\sqrt{[(7–2)^2 + (6–3)^2]} = \sqrt{[25+9]} = \sqrt{34}$
QR = $\sqrt{[(10–7)^2 + (2–6)^2]} = \sqrt{[9+16]} = \sqrt{25} = 5$
PR = $\sqrt{[(10–2)^2 + (2–3)^2]} = \sqrt{[64+1]} = \sqrt{65}$
Perimeter = $\sqrt{34} + 5 + \sqrt{65} \approx 5.83 + 5 + 8.06 = 18.89$ units

OR
(b) Centroid = $((2+7+10)/3, (3+6+2)/3) = (19/3, 11/3)$

(iii) In parallelogram PQRS, diagonals bisect each other.
Midpoint of PR = Midpoint of QS
$((2+10)/2, (3+2)/2) = ((7+x)/2, (6+y)/2)$
$6 = (7+x)/2 \rightarrow x = 5$
$2.5 = (6+y)/2 \rightarrow y = –1$
Coordinates of S are (5, –1)