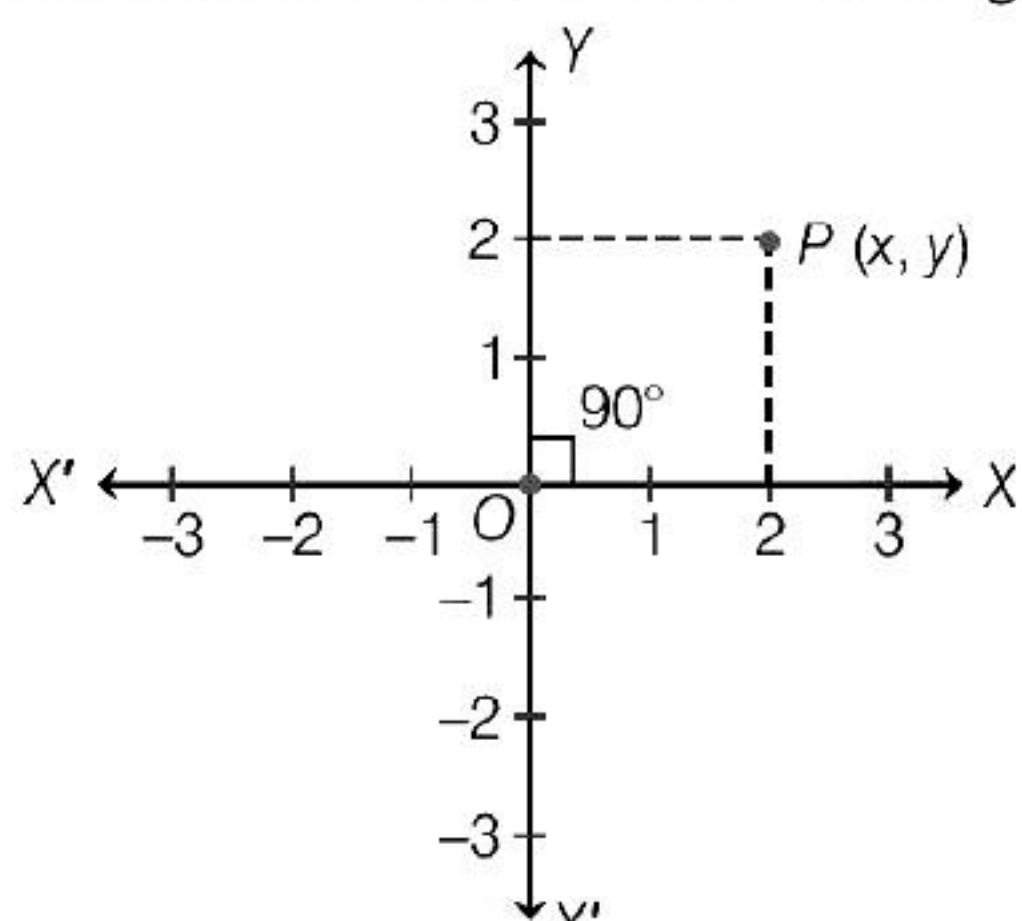


# Coordinate Geometry

## Quick Revision

### Cartesian System

The system used to describe the position of a point in a plane, is called cartesian system. In cartesian system, there are two mutually perpendicular straight lines  $XX'$  and  $YY'$ , which intersect each other at origin point  $O$ .



The horizontal line  $XOX'$  is called  $X$ -axis (or abscissa) and the vertical line  $YOY'$  is called  $Y$ -axis (or ordinate).

### Distance between Two Points in a Cartesian Plane

The distance between any two points  $P(x_1, y_1)$  and  $Q(x_2, y_2)$  is given by

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

or 
$$PQ = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

i.e. 
$$PQ = \sqrt{(\text{Difference of abscissae})^2 + (\text{Difference of ordinates})^2}$$

If one coordinate is at origin say  $P(x_1, y_1) = P(0, 0)$ , then distance between two points is

$$PQ = \sqrt{x_2^2 + y_2^2}$$

### Collinear Points

When three or more than three points lie on a same line, then they are called collinear points.

Suppose  $A, B$  and  $C$  are three points, then the condition for collinearity of three points is

$$AB + BC = AC$$

or 
$$AC + CB = AB$$

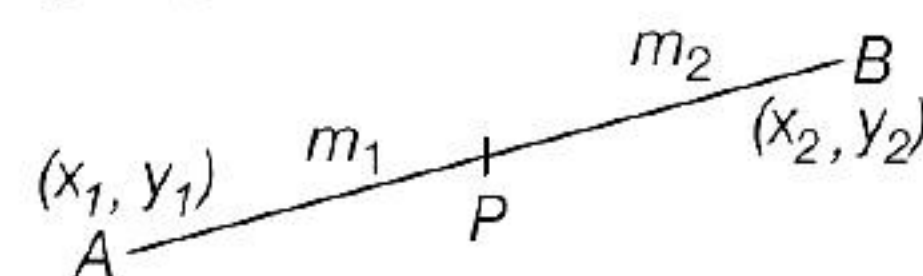
or 
$$BA + AC = BC$$

### Section Formulae

In section formula, we find the coordinates of a point which divides the given line segment internally (or externally) in a given ratio.

### Internal Division of a Line Segment

Let  $A(x_1, y_1)$  and  $B(x_2, y_2)$  are two points and  $P(x, y)$  is a point on the line segment joining  $A$  and  $B$  such that  $AP : BP = m_1 : m_2$ , then point  $P$  is said to divide line segment  $AB$  internally in the ratio  $m_1 : m_2$ .



The coordinates of point  $P$  are given by

$$\left( \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2} \right).$$

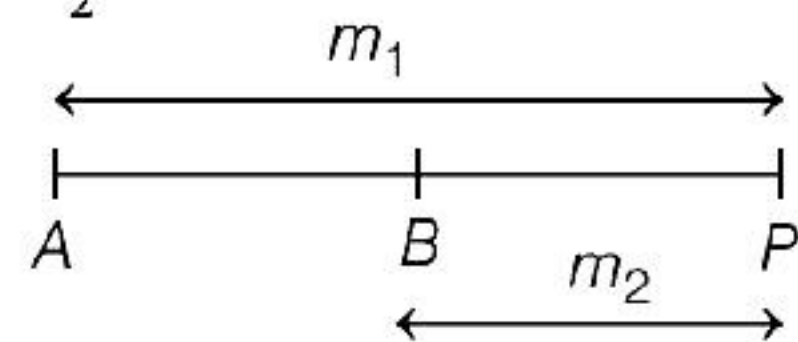
Generally, for finding internal division ratio, we consider  $P$  divides  $AB$  in the ratio  $k : 1$ , then the coordinates of the point  $P$  will be

$$\left( \frac{kx_2 + x_1}{k + 1}, \frac{ky_2 + y_1}{k + 1} \right).$$



External Division of a Line Segment

If a point  $P$  divides line segment  $AB$  externally in the ratio  $m_1 : m_2$



Then, coordinates of point  $P$  are

$$\left( \frac{m_1x_2 - m_2x_1}{m_1 - m_2}, \frac{m_1y_2 - m_2y_1}{m_1 - m_2} \right)$$

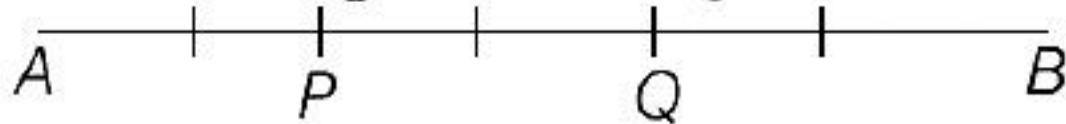
This formula is known as section formula for external division.

Coordinates of Mid-point of Line Segment

If the point  $P$  divides the line segment equally i.e.,  $1 : 1$ , then the coordinates of  $P$  will be

$\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ . This is also called **mid-point formula**.

**Note** Trisection of the line segment means, a line is divided into three equal line segment



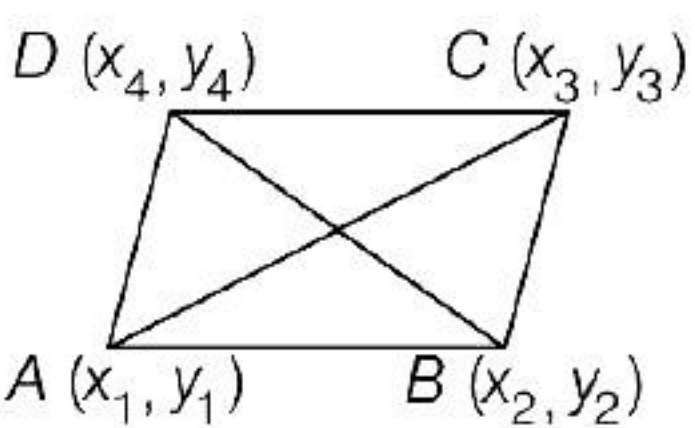
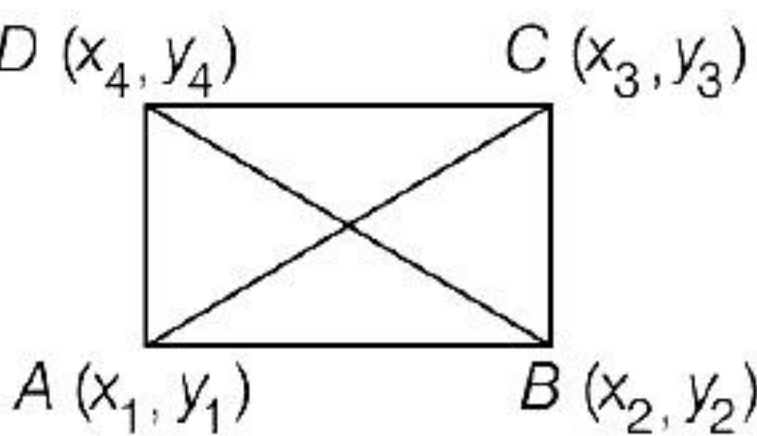
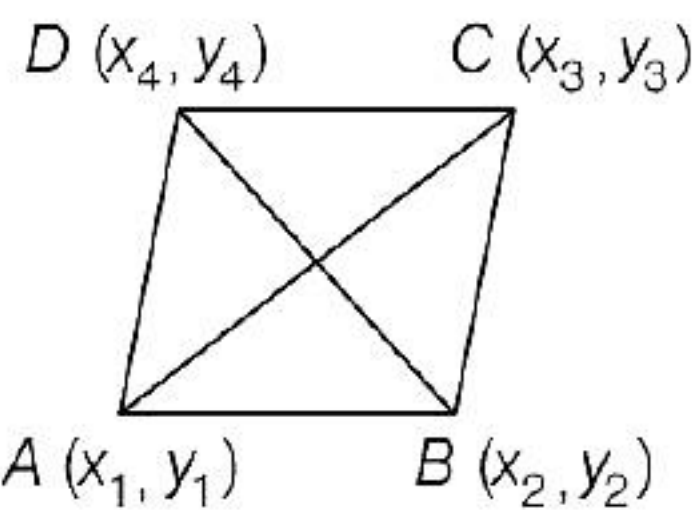
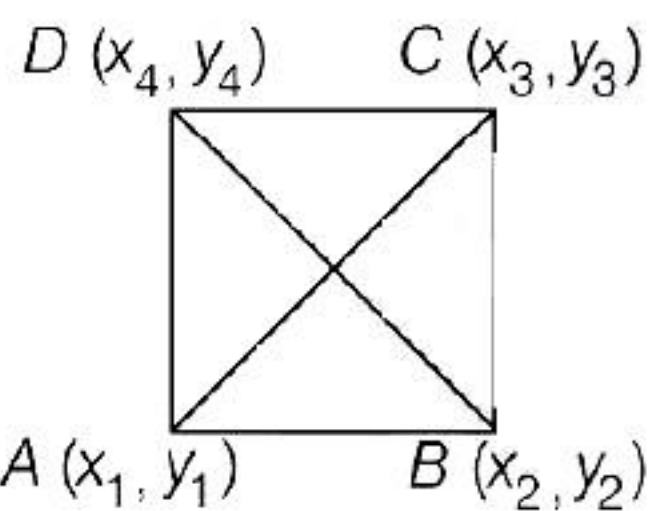
i.e.  $AP = PQ = QB$ .

Different Types of Triangle and Their Conditions

Types of Triangle	Figures	Properties	Conditions
Scalene triangle		All sides are unequal.	$AB \neq BC \neq CA$
Isosceles triangle		Length of any two sides are equal.	$AB = AC \Rightarrow \angle C = \angle B$
Right isosceles triangle		Angle between two equal sides is $90^\circ$ .	$AB = BC$ and $\angle B = 90^\circ$
Equilateral triangle		Length of all the three sides are equal.	$AB = BC = CA$ and $\angle A = \angle B = \angle C = 60^\circ$
Right angled triangle		Sum of the squares of two sides is equal to the square of third side. It is also called Pythagoras theorem.	$AC^2 = AB^2 + BC^2$



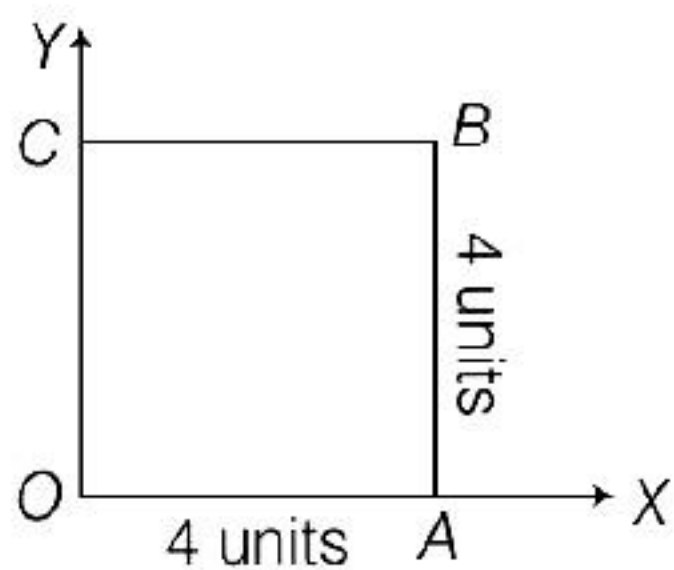
Different Types of Quadrilateral and Their Conditions

Types of Quadrilateral	Figures	Properties	Conditions
Parallelogram		Both pairs of opposite sides are equal. Diagonals bisect each other.	$AB = CD, AD = BC$ and $AC \neq BD$
Rectangle		A parallelogram with equal diagonals. Diagonals bisect each other.	$AB = CD, AD = BC$ and diagonal $AC$ = diagonal $BD$
Rhombus		A parallelogram with all the sides are equal. Diagonals bisect each other at right angle.	$AB = BC = CD = DA$ and $AC \neq BD$
Square		A rhombus with equal diagonals. Diagonals bisect each other at right angle.	$AB = BC = CD = DA$ and diagonal $AC$ = diagonal $BD$

Objective Questions

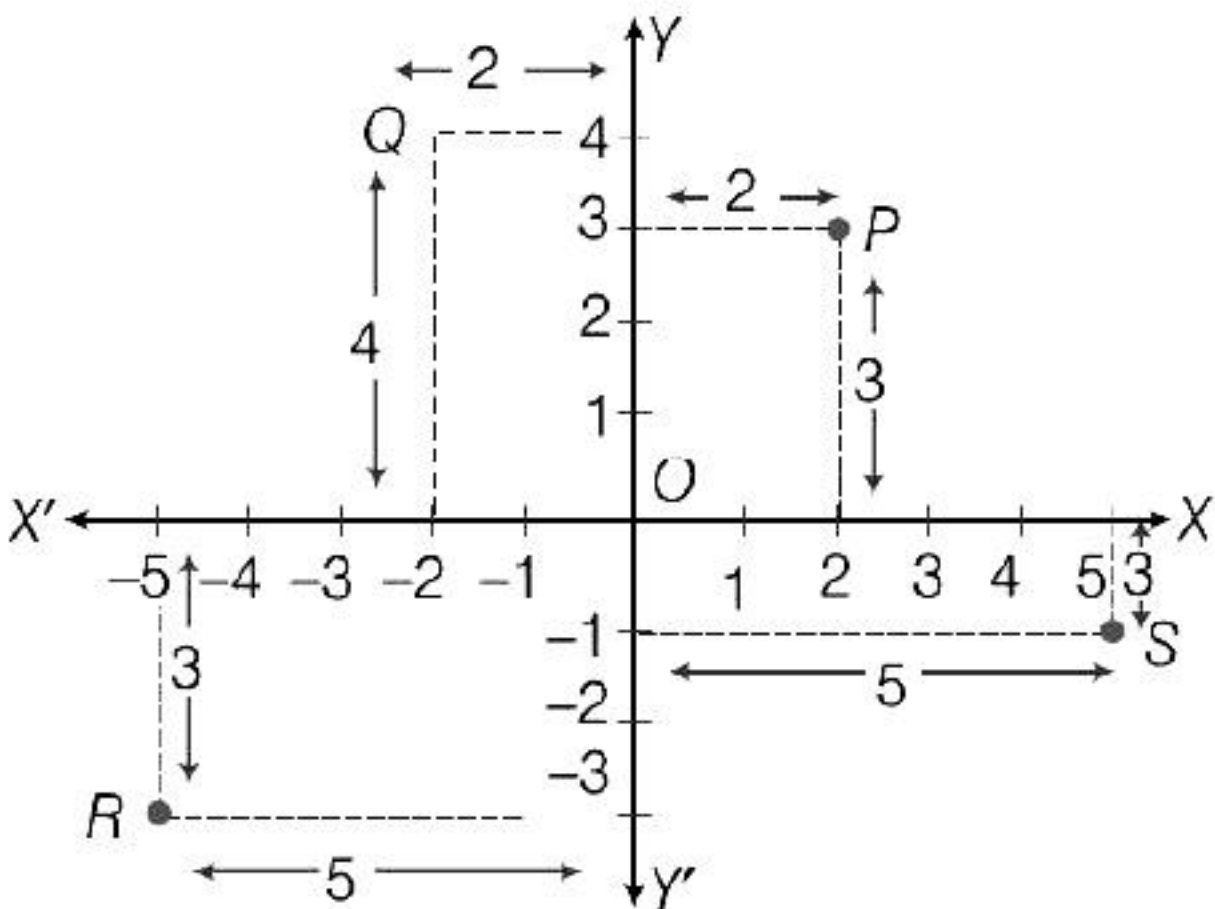
Multiple Choice Questions

1. In the given figure,  $O$  is the intersecting point of  $OA$  and  $OC$  and  $OABC$  is a square of side 4 units, then the position of  $A, B$  and  $C$  is



- (a)  $(4, 0)(4, 4)(0, 4)$
- (b)  $(4, 0)(0, 4)(4, 4)$
- (c)  $(0, 4)(4, 4)(4, 0)$
- (d) None of the above

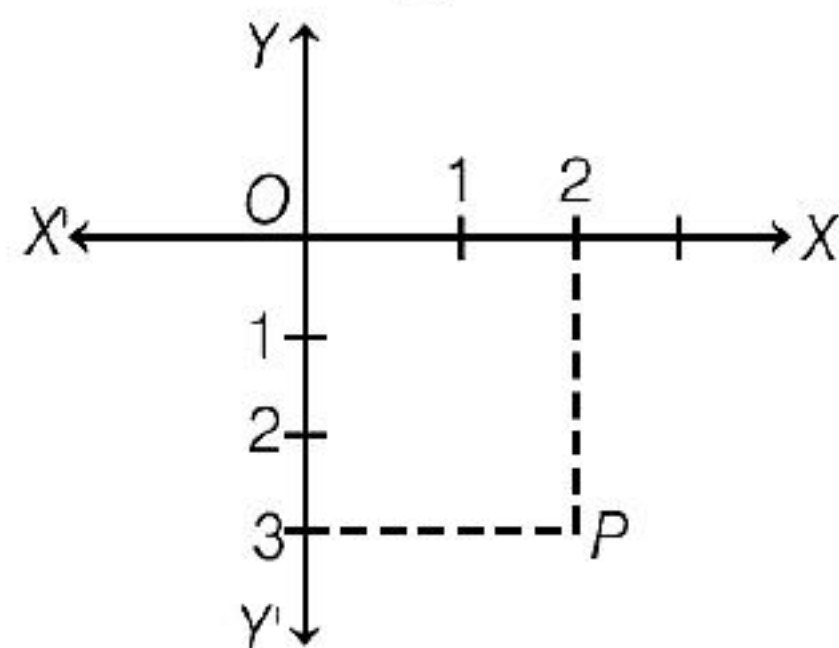
2. In the given figure, the ordinates of the points  $P, Q, R$  and  $S$  is



- (a)  $2, -2, -5, 5$
- (b)  $3, 4, -3, -1$
- (c)  $3, 4, -5, 5$
- (d)  $2, 4, -5, -1$



3. The coordinates of the point  $P$  as shown in the diagram will be



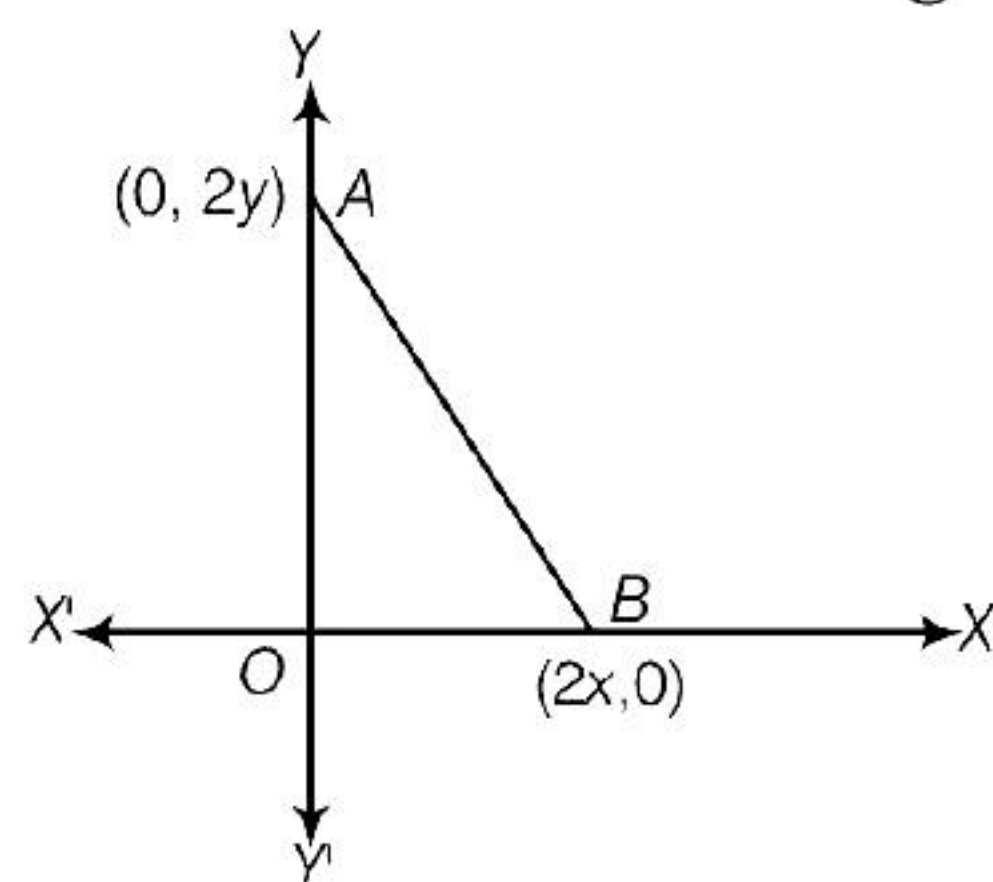
- (a)  $(2, -3)$  (b)  $(-3, 2)$   
(c)  $(2, 3)$  (d)  $(3, 2)$
4. The coordinate of the vertices of a rectangle whose length and breadth are 6 and 4 units, respectively. Its one vertex is at the origin. The longer side is on the  $X$ -axis and one of the vertices lies in second quadrant is  
(a)  $(0, 0)(6, 4)(6, 0)(0, 4)$   
(b)  $(0, 0)(0, 4)(6, 0)(6, 4)$   
(c)  $(0, 0)(6, 4)(-6, 0)(6, 4)$   
(d)  $(0, 0)(0, 4)(-6, 4)(-6, 0)$
5. The point  $P(-4, 2)$  lies on the line segment joining the points  $A(-4, 6)$  and  $B(-4, -6)$ .  
(a) True (b) False  
(c) Can't say (d) Partially True/False
6. The distance of the point  $P(2, 3)$  from the  $X$ -axis is **[NCERT Exemplar]**  
(a) 2 units (b) 3 units  
(c) 1 units (d) 5 units
7. The distance between the points  $P(-6, 7)$  and  $Q(-1, -5)$  is  
(a) -6 units (b) 13 units  
(c) 1 units (d) 5 units
8. The distance between the points  $(a \cos \theta + b \sin \theta, 0)$  and  $(0, a \sin \theta - b \cos \theta)$ , is  
(a)  $a^2 + b^2$  (b)  $a^2 - b^2$   
(c)  $\sqrt{a^2 + b^2}$  (d)  $\sqrt{a^2 - b^2}$
9. The value of  $y$ , if the distance between the points  $(2, y)$  and  $(-4, 3)$  is 10 is  
(a) 6 (b) -11 (c) 5 (d) 11
10. Point  $P(0, 2)$  is the point of intersection of  $Y$ -axis and perpendicular bisector of line segment joining the points  $A(-1, 1)$  and  $B(3, 3)$ .  
(a) True (b) False  
(c) Can't say (d) Partially True/False
11. If the distance between the points  $(4, p)$  and  $(1, 0)$  is 5, then the value of  $p$  is  
(a) 4 (b) -4  
(c) Both (a) and (b) (d) 0
12. A circle has its centre at the origin and a point  $P(5, 0)$  lies on it. The point  $Q(6, 8)$  lies outside the circle.  
(a) True (b) False  
(c) Can't say (d) Partially True/False
13. The radius of the circles whose centre is at  $(0, 0)$  and which passes through the points  $(-6, 8)$  is .....  
(a) 10 units (b) 11 units  
(c) 9 units (d) 8 units
14. Is the points  $(1, -1)$ ,  $(5, 2)$  and  $(9, 5)$  are collinear?  
(a) Yes  
(b) No  
(c) Can't find  
(d) None of the above
15. If the point  $P(2, 1)$  lies on the line segment joining points  $A(4, 2)$  and  $B(8, 4)$ , then .....  
(a)  $AP = \frac{1}{3} AB$  (b)  $AP = PB$   
(c)  $PB = \frac{1}{3} AB$  (d)  $AP = \frac{1}{2} AB$
16. If the point  $P(x, y)$  is equidistant from the points  $A(5, 1)$  and  $B(1, 5)$ , then  
(a)  $y = 3x$  (b)  $x = y$   
(c)  $x = -8y$  (d)  $-8x = y$
17. A point on  $X$ -axis which is equidistant from the points  $(1, 3)$  and  $(-1, 2)$ .  
(a)  $(5/2, 0)$  (b)  $(5, 0)$   
(c)  $(4, 0)$  (d)  $(5/4, 0)$



18. The point on  $X$ -axis, which is equidistant from the point  $(7, 6)$  and  $(-3, 4)$  is

(a)  $(0, 3)$  (b)  $(4, 3)$   
(c)  $(3, 0)$  (d) None of these

19. The coordinates of the point which is equidistant from the three vertices of the  $\triangle AOB$  as shown in the figure is



(a)  $(x, y)$  (b)  $(y, x)$   
(c)  $\left(\frac{x}{2}, \frac{y}{2}\right)$  (d)  $\left(\frac{y}{2}, \frac{x}{2}\right)$

20. The coordinate of a point on  $Y$ -axis which is equidistant from the point  $A(6, 5)$  and  $B(-4, 3)$ , will be

(a)  $(0, 9)$  (b)  $(0, -9)$   
(c)  $(0, 5)$  (d)  $(0, 3)$

21. The radius of the circle whose end points of diameter are  $(24, 1)$  and  $(2, 23)$  is

(a)  $22\sqrt{2}$  units (b)  $23\sqrt{2}$  units  
(c)  $11\sqrt{2}$  units (d) None of these

22. If the points  $A(4, 3)$  and  $B(x, 5)$  are on the circle with centre  $O(2, 3)$ , then the value of  $x$  is

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

23. The perimeter of a triangle with vertices  $(0, 4)$ ,  $(0, 0)$  and  $(3, 0)$  is

[NCERT Exemplar]

(a) 5 units (b) 12 units  
(c) 11 units (d)  $(7 + \sqrt{5})$  units

24. If three points  $(0, 0)$ ,  $(3, \sqrt{3})$  and  $(3, \lambda)$  form an equilateral triangle, then  $\lambda$  equals

(a) 2 (b) -3  
(c) -4 (d) None of these

25. If  $AOBC$  is a rectangle whose three vertices are  $A(0, 3)$ ,  $O(0, 0)$  and  $B(5, 0)$ , then the length of its diagonal is

[NCERT Exemplar]

(a) 5 units (b) 3 units  
(c)  $\sqrt{34}$  units (d) 4 units

26. The points  $(3, 2)$ ,  $(-2, -3)$  and  $(2, 3)$  form a triangle name the type of triangle formed.

(a) equilateral (b) isosceles  
(c) right angle (d) None of these

27.  $(5, -2)$ ,  $(6, 4)$  and  $(7, -2)$  are the vertices of an ..... triangle.

(a) equilateral (b) right angle  
(c) isosceles (d) None of these

28. The points  $(-4, 0)$ ,  $(4, 0)$  and  $(0, 3)$  are the vertices of a

(a) right angled triangle  
(b) isosceles triangle  
(c) equilateral triangle  
(d) scalene triangle

29. The points  $(2, 3)$ ,  $(3, 4)$ ,  $(5, 6)$  and  $(4, 5)$  are the vertices of a

(a) Parallelogram (b) Triangle  
(c) Square (d) None of these

30. The coordinates of the point which divides the line segment joining the points  $(4, -3)$  and  $(9, 7)$  internally in the ratio 3 : 2 is

(a)  $(7, 3)$  (b)  $(3, 7)$   
(c)  $(35, 15)$  (d)  $(27, 21)$

31. The point which divides the line segment joining the points  $(7, -6)$  and  $(3, 4)$  in ratio 1 : 2 internally lies in the

[NCERT Exemplar]

(a) I quadrant  
(b) II quadrant  
(c) III quadrant  
(d) IV quadrant



- 32.** If  $P(9a - 2, -b)$  divides line segment joining  $A(3a + 1, -3)$  and  $B(8a, 5)$  in the ratio  $3 : 1$ , then the values of  $a$  and  $b$  is  
[NCERT Exemplar]  
(a)  $a = -1, b = 3$  (b)  $a = -1, b = -3$   
(c)  $a = 0, b = 0$  (d)  $a = 1, b = -3$
- 33.** The point  $(-4, 6)$  divides the line segment joining the points  $A(-6, 10)$  and  $B(3, -8)$ . The ratio is  
(a)  $1 : 2$  (b)  $7 : 2$   
(c)  $2 : 7$  (d)  $4 : 1$
- 34.** If  $P\left(\frac{a}{3}, 4\right)$  is the mid-point of the line segment joining the points  $Q(-6, 5)$  and  $R(-2, 3)$ , then the value of  $a$  is  
(a)  $-4$  (b)  $-12$   
(c)  $12$  (d)  $-6$
- 35.** The fourth vertex  $D$  of a parallelogram  $ABCD$  whose three vertices are  $A(-2, 3)$ ,  $B(6, 7)$  and  $C(8, 3)$  is  
(a)  $(0, 1)$  (b)  $(0, -1)$   
(c)  $(-1, 0)$  (d)  $(1, 0)$
- 36.** If  $x - 2y + k = 0$  is a median of the triangle whose vertices are at points  $A(-1, 3)$ ,  $B(0, 4)$  and  $C(-5, 2)$ , then the value of  $k$  is  
(a)  $2$  (b)  $4$   
(c)  $6$  (d)  $8$
- 37.** The perpendicular bisector of the line segment joining the points  $A(1, 5)$  and  $B(4, 6)$  cuts the  $Y$ -axis at  
(a)  $(0, 13)$  (b)  $(0, -13)$   
(c)  $(0, 12)$  (d)  $(13, 0)$
- 38.** The point ..... lies on the perpendicular bisector of the line segment joining the points  $A(-2, -5)$  and  $B(2, 5)$ .  
(a)  $(0, 0)$  (b)  $(0, 2)$   
(c)  $(2, 0)$  (d)  $(-2, 0)$
- 39.** A line intersects the  $Y$ -axis and  $X$ -axis at the points  $P$  and  $Q$ , respectively. If  $(2, -5)$  is the mid-point of  $PQ$ , then the coordinates of  $P$  and  $Q$  are, respectively  
(a)  $(0, -5)$  and  $(2, 0)$   
(b)  $(0, 10)$  and  $(-4, 0)$   
(c)  $(0, 4)$  and  $(-10, 0)$   
(d)  $(0, -10)$  and  $(4, 0)$
- 40.**  $\triangle ABC$  with vertices  $A(-2, 0)$ ,  $B(2, 0)$  and  $C(0, 2)$  is similar to  $\triangle DEF$  with vertices  $D(-4, 0)$ ,  $E(4, 0)$  and  $F(0, 4)$ .  
(a) True (b) False  
(c) Can't say (d) Partially True/False
- 41.** If  $(a, b)$  is the mid-point of the line segment joining the points  $A(10, -6)$  and  $B(k, 4)$  and  $a - 2b = 18$ , then the value of  $k$  is  
(a)  $30$  (b)  $22$   
(c)  $4$  (d)  $40$
- 42.** Using section formula, check that the points  $A(-3, -1)$ ,  $B(1, 3)$  and  $C(-1, 1)$  are collinear.  
(a) Yes (b) No  
(c) Can't say (d) None of these
- 43.** The ratio, in which the  $Y$ -axis divides the line segment joining the points  $(5, -6)$  and  $(-1, -4)$  is  
(a)  $1 : 5$  (b)  $5 : 1$   
(c)  $2 : 4$  (d) None of these
- 44.** Find the coordinates of the point which divides the join of  $(-1, 7)$  and  $(4, -3)$  in the ratio  $2 : 3$ .  
(a)  $(1, 3)$  (b)  $(2, 6)$   
(c)  $(3, 4)$  (d)  $(4, 6)$
- 45.** The ratio in which the point  $P(m, 6)$  divides the join  $A(-4, 3)$  and  $B(2, 8)$  is .....  
(a)  $2 : 3$  (b)  $1 : 2$   
(c)  $3 : 2$  (d)  $2 : 1$



- 46.** If the points  $A(6, 1)$ ,  $B(8, 2)$ ,  $C(9, 4)$  and  $D(p, 3)$  are the vertices of a parallelogram, taken in order, then the value of  $p$  is  
 (a) 5 (b) 6  
 (c) 8 (d) 7
- 47.** The coordinates of point  $A$ , where  $AB$  is the diameter of a circle whose centre is  $(3, -4)$  and  $B$  is  $(1, 4)$  is  
 (a)  $(2, 0)$   
 (b)  $(12, -5)$   
 (c)  $(5, -12)$   
 (d) None of the above
- 48.** The coordinates of the point of trisection of the line segment joining  $(2, -3)$  and  $(4, -1)$ . (when the point is near the point  $(2, -3)$ ) is  
 (a)  $(10/3, -5/3)$   
 (b)  $(8/3, -7/3)$   
 (c)  $(3, -2)$   
 (d) None of the above

## Matching Type

- 49.** List-II gives the coordinates of the point  $P$  that divides the line segment joining the points in the given ratio given in List-I, match them correctly.

	List I		List II
P.	$A(-1, 3)$ and $B(-5, 6)$ internally in the ratio $1 : 2$	1.	$(7, 3)$
Q.	$A(-2, 1)$ and $B(1, 4)$ internally in the ratio $2 : 1$	2.	$(0, 3)$
R.	$A(1, 7)$ and $B(3, 4)$ internally in the ratio $3 : 2$	3.	$\left(\frac{11}{5}, \frac{26}{5}\right)$
S.	$A(4, -3)$ and $B(8, 5)$ internally in the ratio $3 : 1$	4.	$\left(-\frac{7}{3}, 4\right)$

### Codes

- |             |             |
|-------------|-------------|
| P Q R S     | P Q R S     |
| (a) 4 2 3 1 | (b) 3 2 4 1 |
| (c) 1 4 3 2 | (d) 3 1 2 4 |

- 50.** Match the following

	List I		List II
P.	Distance between $(-6, 7)$ and $(-1, -5)$ is	1.	$-3, 7$
Q.	The value of $k$ for which the distance between $A(k, -5)$ and $B(2, 7)$ is 13 units	2.	$x + y = 5$
R.	$(x, y)$ is equidistant from $(5, 1)$ and $(-1, 5)$ , if	3.	$3x = 2y$
S.	$(x, y)$ , $(2, 3)$ and $(4, 1)$ are collinear, if	4.	13 units

### Codes

- |             |             |
|-------------|-------------|
| P Q R S     | P Q R S     |
| (a) 3 4 2 1 | (b) 1 2 4 3 |
| (c) 4 1 3 2 | (d) 3 2 4 1 |

## Assertion-Reasoning MCQs

**Directions** (Q. Nos. 46-54) Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, any one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

- (a) A is true, R is true; R is a correct explanation for A.  
 (b) A is true, R is true; R is not a correct explanation for A.  
 (c) A is true; R is False.  
 (d) A is false; R is true.

- 51. Assertion** There is no such point on  $X$ -axis which are at a distance  $c$  ( $c < 3$ ) from the point  $(2, 3)$

**Reason** The distance between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

- 52. Assertion** The distance of a point  $P(x, y)$  from the origin is  $\sqrt{x^2 + y^2}$ .

**Reason** If  $P(-1, 1)$  is the mid-point of the line segment joining  $A(-3, b)$  and  $B(1, b + 4)$ , then value of  $b$  is  $-1$ .



- 53. Assertion** If the points  $A(4, 3)$  and  $B(x, 5)$  are on the circle with centre  $O(2, 3)$ , then find the value of  $x$  is 2.

**Reason** If three points  $(0, 0)$ ,  $(3, \sqrt{3})$  and  $(3, \lambda)$  form an equilateral triangle, then  $\lambda$  equals to  $\pm\sqrt{2}$ .

- 54. Assertion** Three points  $A, B, C$  are such that  $AB + BC > AC$ , then they are collinear.

**Reason** Three points are collinear if they lie on a straight line.

- 55. Assertion** Points  $A(6, 4)$ ,  $B(-4, -6)$  and  $C(4, 6)$  are such that  $AB = \sqrt{200}$ ,  $BC = \sqrt{208}$ ,  $AC = \sqrt{8}$ .

Since,  $AB + BC > AC$ , points  $A, B$  and  $C$  form a triangle.

**Reason** If  $BC^2 = AB^2 + AC^2$ , then  $\triangle ABC$  is a right triangle, right angled at  $A$ .

- 56. Assertion** Points  $(3, 2)$ ,  $(-2, -3)$  and  $(2, 3)$  form a right triangle.

**Reason** If  $(x, y)$  is equidistant from  $(3, 6)$  and  $(-3, 4)$ , then  $3x + y = 5$ .

- 57. Assertion** In quadrilateral  $ABCD$ , if  $AB = BC = CD = DA$  and  $AC = BD$ , then  $ABCD$  is a square.

**Reason** A quadrilateral is a square if all its sides are equal and the diagonals are equal.

- 58. Assertion** The distance between the points  $(10 \cos 30^\circ, 0)$  and  $(0, 10 \cos 60^\circ)$  is 10 units

**Reason** Mid-point of line segment joining  $(a, b)$  and  $(c, d)$  is given by  $\left(\frac{a+c}{2}, \frac{b+d}{2}\right)$ .

- 59. Assertion** The coordinates of the points which divide the line segment joining  $A(2, -8)$  and  $B(-3, -7)$  into three equal parts are  $\left(\frac{1}{3}, \frac{-23}{3}\right)$  and  $\left(\frac{-4}{3}, \frac{-22}{3}\right)$ .

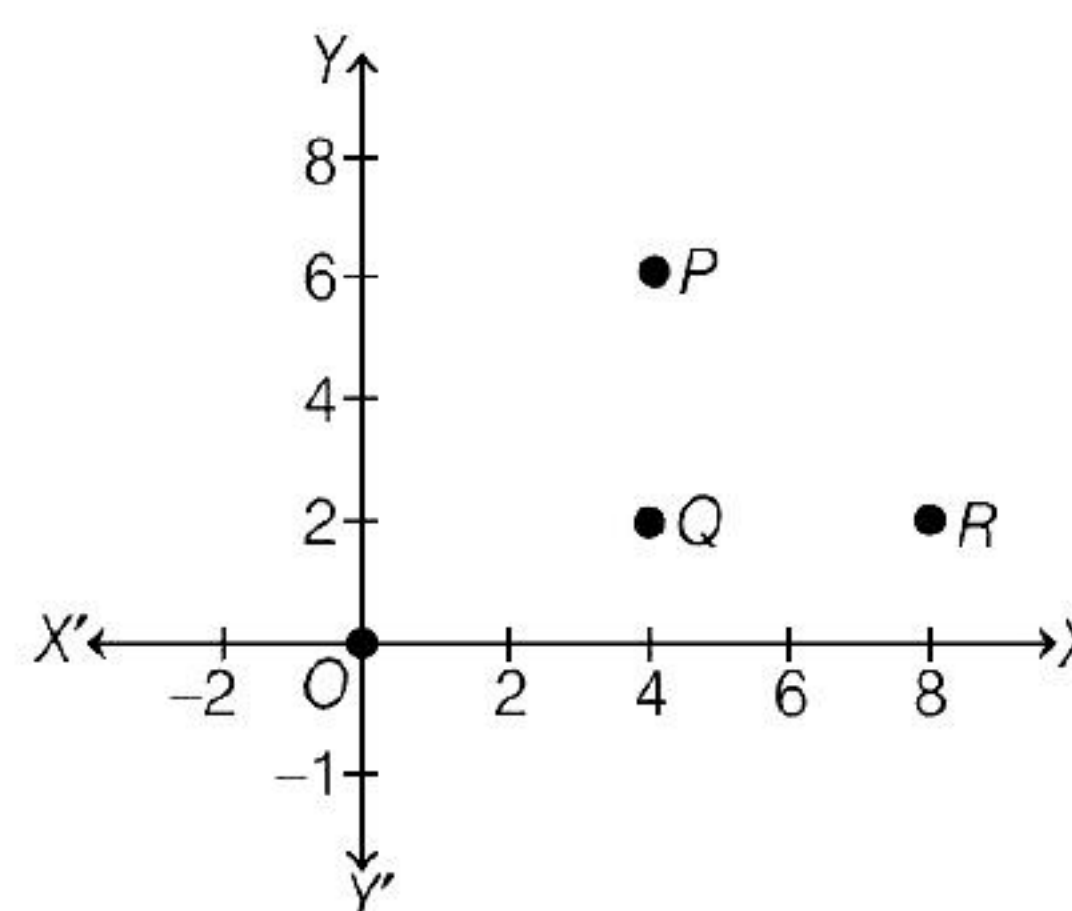
**Reason** The points which divide  $AB$  in the ratio  $1:3$  and  $3:1$  are called points to trisection of  $AB$ .

- 60. Assertion** Mid-point of a line segment divides line in the ratio  $1:1$ .

**Reason** If area of triangle is zero that means points are collinear.

### Case Based MCQs

- 61.** Malika and Karishma are friends living on the same street in Govindpuri. Karishma's house is at the intersection of one street with another street on which there is a temple. They both study in the same school and that is not far from Karishma's house.



Suppose the school is situated at the point  $O$ , i.e., the origin, Malika's house is at  $P$ , Karishma's house is at  $Q$  and temple is at  $R$ .

Based on the above information, answer the following questions.



(i) How far is Malika's house from Karishma's house?

- (a) 3 units (b) 4 units  
(c) 5 units (d) 2 units

(ii) How far is the temple from Karishma's house?

- (a) 3 units (b) 2 units  
(c) 5 units (d) 4 units

(iii) How far is the temple from Malika's house?

- (a)  $2\sqrt{2}$  units (b)  $3\sqrt{2}$  units  
(c)  $4\sqrt{2}$  units (d) None of these

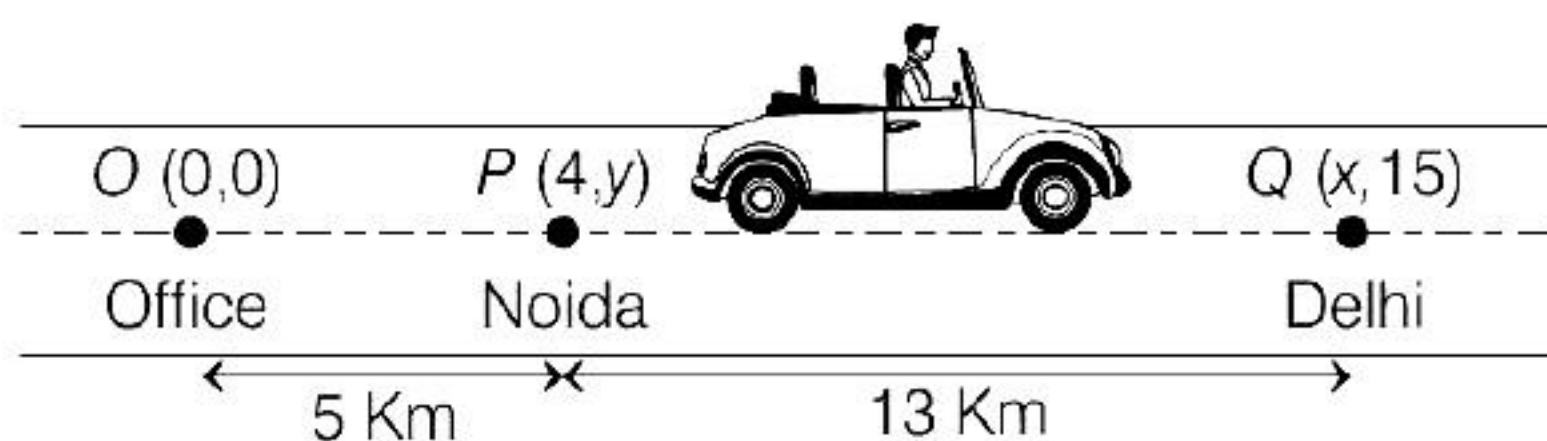
(iv) Which of the following is true?

- (a)  $PQR$  forms a scalene triangle  
(b)  $PQR$  forms an isosceles triangle  
(c)  $PQR$  forms an equilateral triangle  
(d) None of the above

(v) How far is the school from Malika's house?

- (a)  $2\sqrt{13}$  units  
(b)  $\sqrt{5}$  units  
(c)  $(\sqrt{13} + \sqrt{5})$  units  
(d)  $(\sqrt{13} - \sqrt{5})$  units

**62.** Anmol is driving his car on a straight road towards East from his office to Noida and then to Delhi. At some point in between Noida and Delhi, he suddenly realises that there is not enough Petrol for the journey. Also, there is no Petrol pump on the road between these two cities.



Based on the above information, answer the following questions.

(i) The value of  $y$  is equal to

- (a) 2 (b) 3  
(c) 4 (d) 5

(ii) The value of  $x$  is equal to

- (a) 4 (b) 5  
(c) 8 (d) 9

(iii) If  $M$  is any point exactly in between Noida and Delhi, then coordinates of  $M$  are

- (a) (3, 3) (b) (6.5, 9)  
(c) (5, 5) (d) (6, 6)

(iv) The ratio in which Noida divides the line segment joining the office and Delhi is

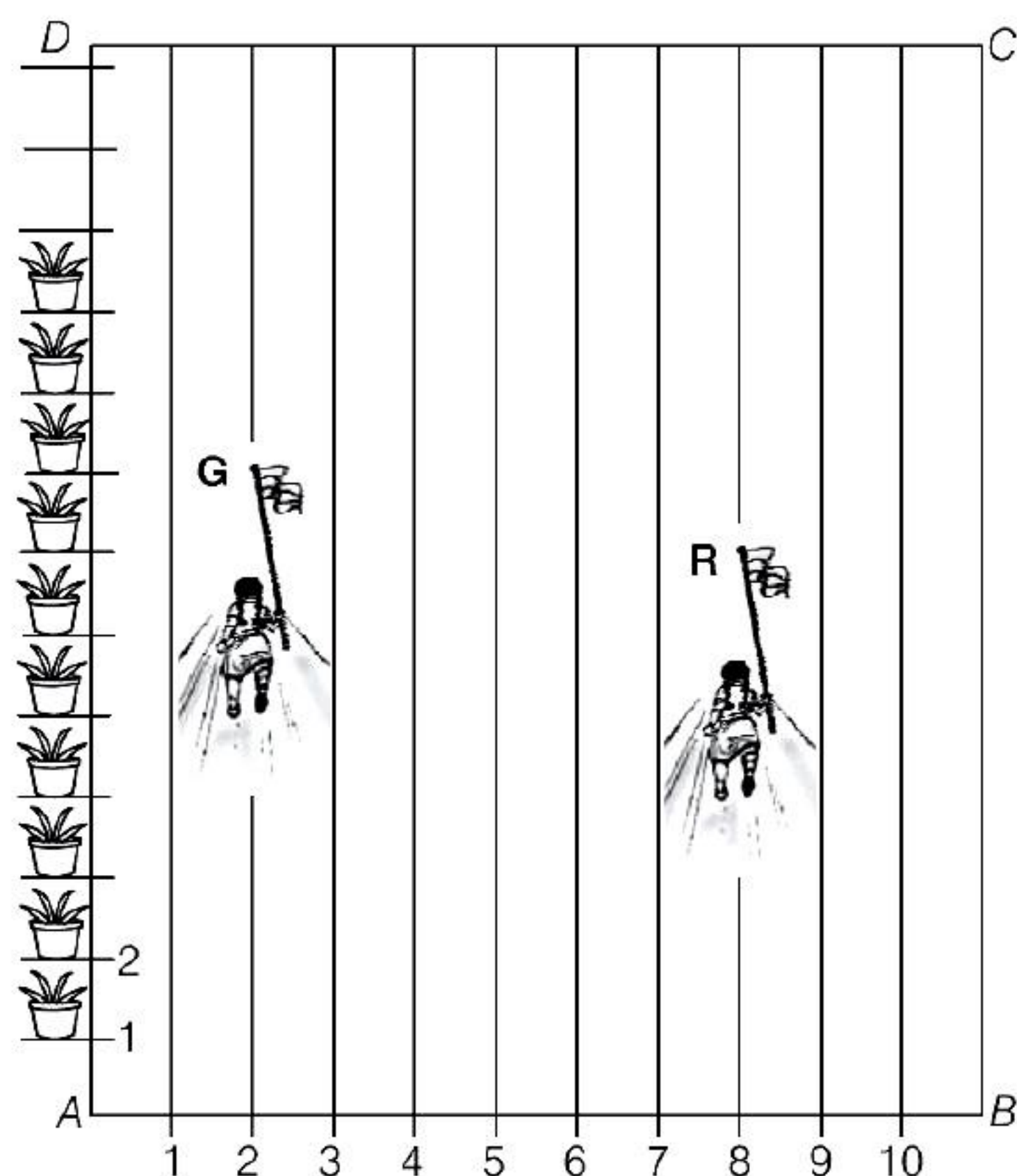
- (a) 1 : 4 (b) 2 : 1  
(c) 3 : 2 (d) 2 : 3

(v) If Anmol analyse the CNG at the point  $M$  (the mid point of Noida-Delhi), then what should be his decision?

- (a) Should he travel back to office  
(b) Should try his luck to move towards Delhi  
(c) Should be travel back to Noida  
(d) None of the above

**63.** In order to conduct Sports Day activities in your School, lines have been drawn with chalk powder at a distance of 1 m each, in a rectangular shaped ground  $ABCD$ , 100 flowerpots have been placed at a distance of 1 m from each other along  $AD$ , as shown in given figure below. Niharika runs  $\frac{1}{4}$  th the distance  $AD$  on the 2nd line and posts a green flag. Preet runs  $\frac{1}{5}$  th distance  $AD$  on the eighth line and posts a red flag. [CBSE Question Bank]





- (i) Find the position of green flag
  - (a) (2, 25)                      (b) (2, 0.25)
  - (c) (25, 2)                      (d) (0, -25)
- (ii) Find the position of red flag
  - (a) (8, 0)                      (b) (20, 8)
  - (c) (8, 20)                      (d) (8, 0.2)
- (iii) What is the distance between both the flags?
  - (a)  $\sqrt{41}$  m                      (b)  $\sqrt{11}$  m
  - (c)  $\sqrt{61}$  m                      (d)  $\sqrt{51}$  m
- (iv) If Rashmi has to post a blue flag exactly halfway between the line segment joining the two flags, where should she post her flag?
  - (a) (5, 22.5)                      (b) (10, 22)
  - (c) (2, 8.5)                      (d) (2.5, 20)
- (v) If Joy has to post a flag at  $\frac{1}{4}$ th distance from green flag, in the line segment joining the green and red flags, then where should he post his flag?
  - (a) (3.5, 24)
  - (b) (0.5, 12.5)
  - (c) (2.25, 8.5)
  - (d) (25, 20)

- 64.** In a cinema hall, peoples are seated at a distance of 1 m from each other, to maintain the social distance due to CORONA virus pandemic. Let three peoples sit at points  $P$ ,  $Q$  and  $R$  whose coordinates are  $(6, -2)$ ,  $(9, 4)$  and  $(10, 6)$  respectively.



Based on the above information, answer the following questions.

- (i) The distance between  $P$  and  $R$  is
  - (a)  $\sqrt{5}$  units                      (b)  $4\sqrt{5}$  units
  - (c)  $3\sqrt{5}$  units                      (d) None of these
- (ii) If a TC at the point  $I$ , lying on the straight line joining  $Q$  and  $R$  such that it divides the distance between them in the ratio of 1 : 2. Then coordinates of  $I$  are
  - (a)  $\left(\frac{22}{3}, \frac{11}{3}\right)$                       (b)  $\left(\frac{28}{3}, \frac{14}{3}\right)$
  - (c) (6, 1)                      (d) (9, 1)
- (iii) The mid-point of the line segment joining  $P$  and  $R$  is
  - (a) (1, 6)                      (b) (6, 1)
  - (c)  $\left(\frac{11}{2}, 0\right)$                       (d) None of these
- (iv) The ratio in which  $Q$  divides the line segment joining  $P$  and  $R$  is
  - (a) 2 : 1                      (b) 3 : 1
  - (c) 1 : 2                      (d) None of these
- (v) The points  $P$ ,  $Q$  and  $R$  lies on
  - (a) a straight line
  - (b) an equilateral triangle
  - (c) a scalene triangle
  - (d) an isosceles triangle



- 65.** To raise social awareness about hazards of cancer, an organisation decided to start a campaign. 5 students were asked to prepare campaign banners in the shape of a triangle. The vertices of the triangle are,  $A(0, 6)$ ,  $B(6, 6)$  and  $C(1, 1)$ .

Based on the above information, answer the following questions.

- (i) The coordinates of centroid of  $\triangle ABC$  are  
 (a)  $\left(\frac{2}{3}, \frac{7}{3}\right)$  (b)  $\left(\frac{7}{3}, \frac{13}{3}\right)$   
 (c)  $\left(\frac{-2}{3}, \frac{7}{3}\right)$  (d)  $\left(\frac{7}{3}, \frac{2}{3}\right)$
- (ii) If  $S$  be the mid-point of line joining  $A$  and  $B$ , then coordinates of  $S$  are  
 (a)  $(4, 0)$  (b)  $(2, 0)$   
 (c)  $(3, 6)$  (d)  $(0, 4)$
- (iii) If  $T$  be the mid-point of the line joining  $C$  and  $B$ , then coordinates of  $T$  are  
 (a)  $\left(\frac{1}{2}, \frac{1}{2}\right)$  (b)  $\left(\frac{3}{2}, \frac{1}{2}\right)$   
 (c)  $\left(\frac{1}{2}, \frac{3}{2}\right)$  (d) None of these
- (iv) If  $U$  be the mid-point of line joining  $C$  and  $A$  then coordinates of  $U$  are  
 (a)  $\left(-\frac{5}{2}, \frac{3}{2}\right)$  (b)  $\left(\frac{1}{2}, \frac{7}{2}\right)$   
 (c)  $\left(\frac{3}{2}, \frac{5}{2}\right)$  (d)  $\left(\frac{5}{2}, \frac{3}{2}\right)$
- (v) The coordinates of centroid of  $\triangle STU$  are  
 (a)  $\left(\frac{2}{3}, \frac{7}{3}\right)$  (b)  $\left(\frac{1}{3}, \frac{1}{3}\right)$   
 (c)  $\left(-\frac{2}{3}, \frac{7}{3}\right)$  (d)  $\left(\frac{7}{3}, \frac{13}{3}\right)$

## ANSWERS

### Multiple Choice Questions

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a)  | 2. (b)  | 3. (a)  | 4. (d)  | 5. (a)  | 6. (b)  | 7. (b)  | 8. (c)  | 9. (d)  | 10. (b) |
| 11. (c) | 12. (a) | 13. (a) | 14. (a) | 15. (d) | 16. (b) | 17. (d) | 18. (c) | 19. (a) | 20. (a) |
| 21. (c) | 22. (c) | 23. (b) | 24. (d) | 25. (c) | 26. (c) | 27. (c) | 28. (b) | 29. (a) | 30. (a) |
| 31. (d) | 32. (d) | 33. (c) | 34. (b) | 35. (b) | 36. (d) | 37. (a) | 38. (a) | 39. (d) | 40. (a) |
| 41. (b) | 42. (a) | 43. (b) | 44. (a) | 45. (c) | 46. (d) | 47. (c) | 48. (b) | 49. (a) | 50. (c) |

### Assertion-Reasoning MCQs

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 51. (a) | 52. (d) | 53. (c) | 54. (d) | 55. (b) | 56. (b) | 57. (a) | 58. (c) | 59. (c) | 60. (b) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|

### Case Based MCQs

- |   |   |
|---|---|
| 61. (i) - (b); (ii) - (d); (iii) - (c); (iv) - (b); (v) - (a) | 62. (i) - (b); (ii) - (d); (iii) - (b); (iv) - (a); (v) - (b) |
| 63. (i) - (a); (ii) - (c); (iii) - (c); (iv) - (a); (v) - (a) | 64. (i) - (b); (ii) - (b); (iii) - (d); (iv) - (b); (v) - (a) |
| 65. (i) - (b); (ii) - (c); (iii) - (d); (iv) - (b); (v) - (d) |   |



# SOLUTIONS

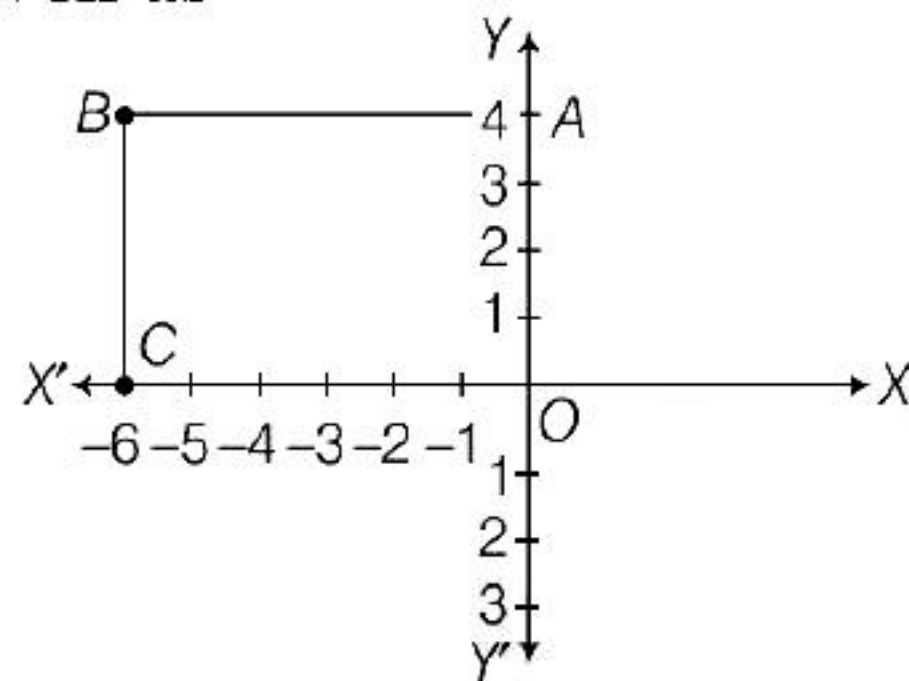
- Here, the point  $A$  lies on side  $OA$ , which is at a distance of 4 units from the intersection point  $O$  of the lines  $OX$  and  $OY$ , so its position will be  $(4, 0)$  and point  $C$  lies on the side  $OC$  at a distance of 4 units from the intersection point  $O$ , so its position will be  $(0, 4)$ . Point  $B$  lies 4 units away from both the sides (or axes), so its position will be  $(4, 4)$ .

- The  $y$ -coordinate is also called the ordinate so,  
for  $P$  : ordinate = 3  
for  $Q$  : ordinate = 4  
for  $R$  : ordinate = - 3  
for  $S$  : ordinate = - 1

- It is clear from the graph that point  $P$  has 3 unit distance from  $X$ -axis in negative  $y$ -direction and 2 unit distance from  $Y$ -axis in positive  $x$ -direction.

Hence, coordinates of  $P$  are  $(2, - 3)$ .

- According to the question, the figure would be given as



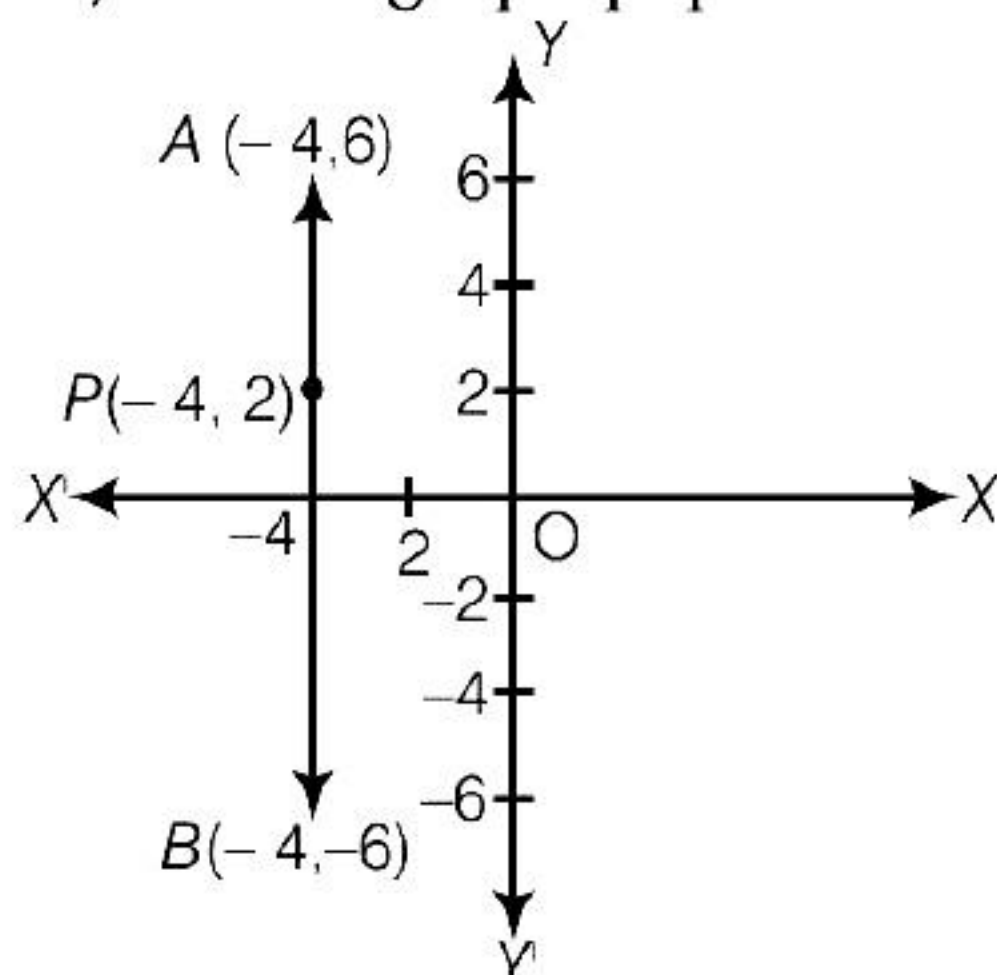
Coordinates of point  $O = (0, 0)$

Coordinates of point  $A = (0, 4)$

Coordinates of point  $B = (-6, 4)$

Coordinates of point  $C = (-6, 0)$

- We plot all the points  $P(-4, 2)$ ,  $A(-4, 6)$  and  $B(-4, -6)$  on the graph paper.

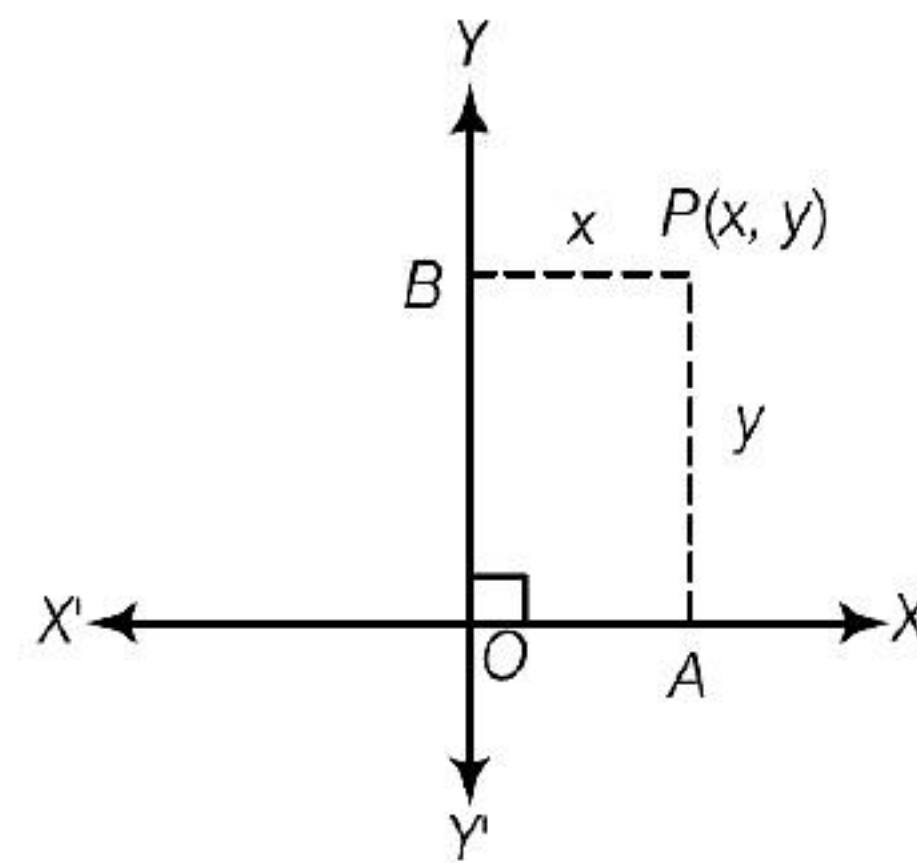


From the figure, point  $P(-4, 2)$  lies on the line segment joining the points  $A(-4, 6)$  and  $B(-4, -6)$ .

- We know that, if  $(x, y)$  is any point on the cartesian plane in first quadrant.

Then,  $x$  = Perpendicular distance from  $Y$ -axis

and  $y$  = Perpendicular distance from  $X$ -axis



Distance of the point  $P(2, 3)$  from the  $X$ -axis = Ordinate of a point  $P(2, 3)$   
= 3 units.

- Here,  $x_1 = -6$ ,  $y_1 = 7$ ,  $x_2 = -1$  and  $y_2 = -5$

$\therefore$  Distance between two points,

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

[by distance formula]

$$\begin{aligned} &= \sqrt{(-1 + 6)^2 + (-5 - 7)^2} \\ &= \sqrt{(5)^2 + (-12)^2} \\ &= \sqrt{25 + 144} = \sqrt{169} = 13 \text{ units} \end{aligned}$$

- The given points are  $(a \cos \theta + b \sin \theta, 0)$  and  $(0, a \sin \theta - b \cos \theta)$ .

Here,  $x_1 = a \cos \theta + b \sin \theta$ ,  $y_1 = 0$

$x_2 = 0$ ,  $y_2 = a \sin \theta - b \cos \theta$

$\therefore$  Required distance =  $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

$$\begin{aligned} &= \sqrt{(a \cos \theta + b \sin \theta - 0)^2} \\ &\quad + (0 - a \sin \theta + b \cos \theta)^2 \\ &= \sqrt{(a \cos \theta + b \sin \theta)^2 + (b \cos \theta - a \sin \theta)^2} \end{aligned}$$



$$\begin{aligned}
 &= \sqrt{a^2 \cos^2 \theta + b^2 \sin^2 \theta + 2ab \cos \theta \sin \theta} \\
 &= \sqrt{+b^2 \cos^2 \theta + a^2 \sin^2 \theta - 2ab \sin \theta \cos \theta} \\
 &= \sqrt{\cos^2 \theta (a^2 + b^2) + \sin^2 \theta (a^2 + b^2)} \\
 &= \sqrt{(a^2 + b^2)(\cos^2 \theta + \sin^2 \theta)} \\
 &= \sqrt{a^2 + b^2} \quad [\because \cos^2 \theta + \sin^2 \theta = 1]
 \end{aligned}$$

9. Let points are  $A(2, y)$  and  $B(-4, 3)$ .

Here,  $(x_1, y_1) = (2, y)$  and  $(x_2, y_2) = (-4, 3)$

$\therefore$  Distance between two points,

$$AB = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

[by distance formula]

$$\Rightarrow AB = \sqrt{(2 + 4)^2 + (y - 3)^2}$$

$$\Rightarrow 10 = \sqrt{(6)^2 + y^2 + 9 - 6y}$$

$$[\because AB = 10 \text{ and } (a - b)^2 = a^2 + b^2 - 2ab]$$

On squaring both sides, we get

$$\Rightarrow (10)^2 = (6)^2 + y^2 + 9 - 6y$$

$$\Rightarrow 100 = 36 + y^2 + 9 - 6y$$

$$\Rightarrow 100 = 45 + y^2 - 6y$$

$$\Rightarrow y^2 - 6y - 55 = 0$$

$$\Rightarrow y^2 - 11y + 5y - 55 = 0$$

[by factorisation]

$$\Rightarrow y(y - 11) + 5(y - 11) = 0$$

$$\Rightarrow (y - 11)(y + 5) = 0$$

$$\Rightarrow y - 11 = 0 \text{ or } y + 5 = 0$$

$$\Rightarrow y = 11 \text{ or } y = -5$$

Hence, the required values of  $y$  are 11 and -5.

10. We know that, the points lies on perpendicular bisector of the line segment joining the two points is equidistant from these two points.

$$\therefore PA = \sqrt{(-1 - 0)^2 + (1 - 2)^2}$$

$$= \sqrt{1 + 1} = \sqrt{2} \text{ units}$$

$$PB = \sqrt{(3 - 0)^2 + (3 - 2)^2} = \sqrt{9 + 1} = 10 \text{ units}$$

$$\therefore PA \neq PB$$

So, the point  $P$  does not lie on the perpendicular bisector of  $AB$ .

11. According to the question, the distance between the points  $(4, p)$  and  $(1, 0) = 5$

$$\text{i.e.} \quad \sqrt{(1 - 4)^2 + (0 - p)^2} = 5$$

$$\left[ \because \text{distance between the points } (x_1, y_1) \text{ and } (x_2, y_2), d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \right]$$

$$\Rightarrow \sqrt{(-3)^2 + p^2} = 5$$

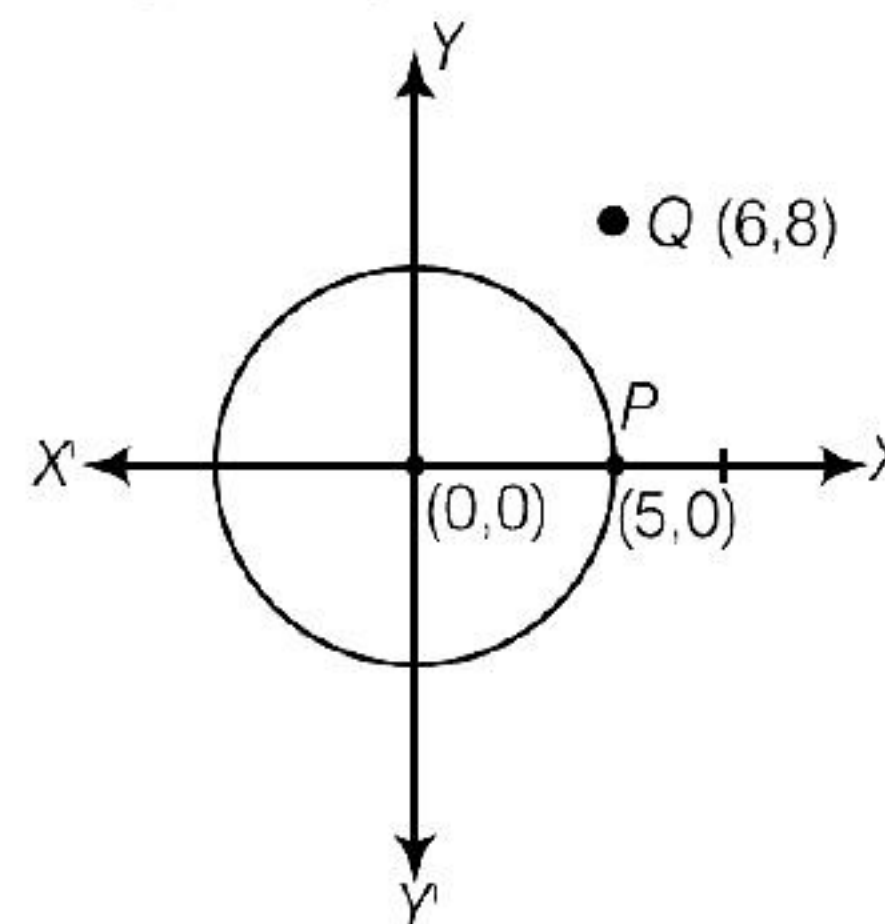
$$\Rightarrow \sqrt{9 + p^2} = 5$$

On squaring both the sides, we get

$$9 + p^2 = 25 \Rightarrow p^2 = 16 \Rightarrow p = \pm 4$$

Hence, the required value of  $p$  is  $\pm 4$ .

12. First, we draw a circle and a point from the given information.



Now, distance between origin i.e.  $O(0, 0)$

and  $P(5, 0)$ ,  $OP = \sqrt{(5 - 0)^2 + (0 - 0)^2}$

$$\left[ \because \text{Distance between two points } (x_1, y_1) \text{ and } (x_2, y_2), d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \right]$$

$$= \sqrt{5^2 + 0^2} = 5 \text{ units}$$

= Radius of circle and distance between origin  $O(0, 0)$

$$\begin{aligned}
 \text{and } Q(6, 8), OQ &= \sqrt{(6 - 0)^2 + (8 - 0)^2} \\
 &= \sqrt{6^2 + 8^2} = \sqrt{36 + 64} \\
 &= \sqrt{100} = 10 \text{ units}
 \end{aligned}$$

We know that, if the distance of any point from the centre is less than/equal to/ more than the radius, then the point is inside/on/outside the circle, respectively.

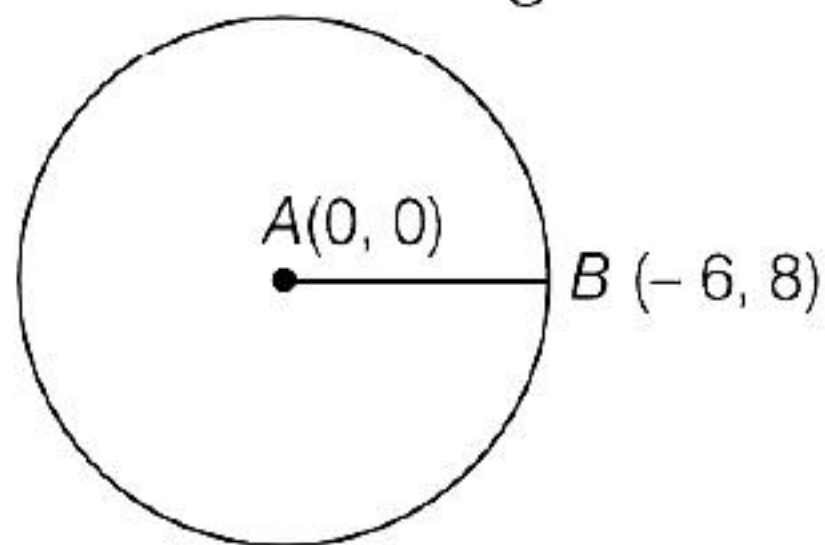


Here, we see that,  $OQ > OP$

Hence, it is true that point  $Q$  (6, 8), lies outside the circle.

13. Let  $A(0, 0)$  and  $B(-6, 8)$  be the given points.

Now, radius of the circle is same as the distance of the line segment  $AB$ .



$$\begin{aligned}\therefore AB &= \sqrt{(-6-0)^2 + (8-0)^2} \\ &= \sqrt{36 + 64} = \sqrt{100} = 10\end{aligned}$$

Hence, radius of the circle is 10 units.

14. Let  $A = (1, -1)$ ,  $B = (5, 2)$  and  $C = (9, 5)$ .

$$\begin{aligned}\text{Then, } AB &= \sqrt{(5-1)^2 + (2+1)^2} \\ [\because \text{distance} &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}] \\ &= \sqrt{(4)^2 + (3)^2} = \sqrt{16 + 9} \\ &= \sqrt{25} = 5 \text{ units}\end{aligned}$$

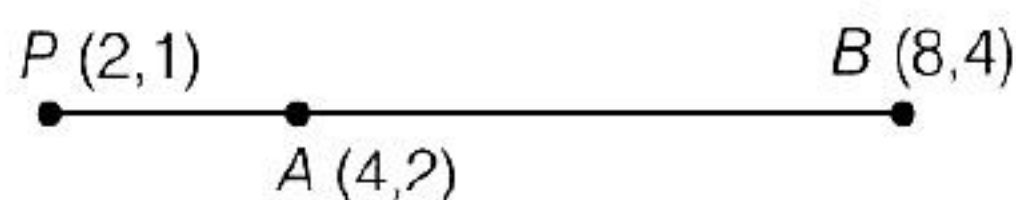
$$\begin{aligned}BC &= \sqrt{(9-5)^2 + (5-2)^2} \\ &= \sqrt{(4)^2 + (3)^2} = \sqrt{25} = 5 \text{ units}\end{aligned}$$

$$\begin{aligned}\text{and } AC &= \sqrt{(9-1)^2 + (5+1)^2} \\ &= \sqrt{(8)^2 + (6)^2} = \sqrt{100} = 10 \text{ units}\end{aligned}$$

$\therefore$  Here,  $AC = AB + BC$

$\therefore A, B$  and  $C$  are collinear points.

15. Given that the point  $P(2, 1)$  lies on the line segment joining the points  $A(4, 2)$  and  $B(8, 4)$ , which shows in the figure below



Now, distance between  $A(4, 2)$  and  $P(2, 1)$ ,

$$AP = \sqrt{(2-4)^2 + (1-2)^2}$$

$$\left[ \because \text{distance between two points } (x_1, y_1) \text{ and } B(x_2, y_2), \right. \\ \left. d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \right]$$

$$= \sqrt{(-2)^2 + (-1)^2} = \sqrt{4 + 1} = \sqrt{5} \text{ units}$$

Distance between  $A(4, 2)$  and  $B(8, 4)$ ,

$$\begin{aligned}AB &= \sqrt{(8-4)^2 + (4-2)^2} = \sqrt{(4)^2 + (2)^2} \\ &= \sqrt{16 + 4} = \sqrt{20} = 2\sqrt{5} \text{ units}\end{aligned}$$

Distance between  $B(8, 4)$  and  $P(2, 1)$ ,

$$\begin{aligned}BP &= \sqrt{(8-2)^2 + (4-1)^2} \\ &= \sqrt{6^2 + 3^2} = \sqrt{36 + 9} \\ &= \sqrt{45} = 3\sqrt{5} \text{ units}\end{aligned}$$

$$\therefore AB = 2\sqrt{5} = 2AP$$

$$\Rightarrow AP = \frac{AB}{2}$$

Hence, required condition is  $AP = \frac{AB}{2}$ .

16. Given, point  $P(x, y)$  is equidistant from the points  $A(5, 1)$  and  $B(1, 5)$ .

So,  $AP = BP$

$$\Rightarrow AP^2 = BP^2 \text{ [on squaring both sides]}$$

$$\begin{aligned}\Rightarrow (x-5)^2 + (y-1)^2 &= (x-1)^2 + (y-5)^2 \\ [\because \text{distance} &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]\end{aligned}$$

$$\Rightarrow x^2 + 25 - 10x + y^2 + 1 - 2y$$

$$= x^2 + 1 - 2x + y^2 + 25 - 10y$$

$$[\because (a-b)^2 = a^2 + b^2 - 2ab]$$

$$\Rightarrow -10x + 2x = -10y + 2y$$

$$\Rightarrow -8x = -8y$$

$$\Rightarrow x = y$$

17. Let  $A(x, 0)$  be any point on  $X$ -axis, which is equidistant from points  $B(1, 3)$  and  $(-1, 2)$ .

$$AB = AC$$

$$\Rightarrow AB^2 = AC^2$$

[squaring both sides]

$$\Rightarrow (1-x)^2 + (3-0)^2 = (-1-x)^2 + (2-0)^2$$

$$[\because \text{distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$$

$$\Rightarrow 1 + x^2 - 2x + 9 = 1 + x^2 + 2x + 4$$

$$\Rightarrow 9 - 4 = 2x + 2x$$

$$\Rightarrow 5 = 4x \Rightarrow x = 5/4$$

Hence, point on  $X$ -axis is  $(5/4, 0)$ .



18. Let  $A(x, 0)$  be any point on the  $X$ -axis, which is equidistant from points  $B(7, 6)$  and  $C(-3, 4)$ .

$$\begin{aligned} \therefore AB &= AC \\ \Rightarrow AB^2 &= AC^2 \\ &\quad [\text{on squaring both sides}] \\ \Rightarrow (7-x)^2 + (6-0)^2 &= (-3-x)^2 + (4-0)^2 \\ &\quad [\because \text{distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}] \\ \Rightarrow 49 + x^2 - 14x + 36 &= 9 + x^2 + 6x + 16 \\ &\quad [\because (a-b)^2 = a^2 + b^2 - 2ab] \\ \Rightarrow 20x &= 60 \Rightarrow x = 3 \end{aligned}$$

Hence, the required point is  $A(3, 0)$ .

19. Let the coordinate of the point which is equidistant from the three vertices  $O(0, 0)$ ,  $A(0, 2y)$  and  $B(2x, 0)$  is  $P(h, k)$ .

$$\begin{aligned} \text{Then, } PO &= PA = PB \\ \Rightarrow PO^2 &= PA^2 = PB^2 \quad \dots(i) \end{aligned}$$

By distance formula,

$$\begin{aligned} &[\sqrt{(h-0)^2 + (k-0)^2}]^2 \\ &= [\sqrt{(h-0)^2 + (k-2y)^2}]^2 \\ &= [\sqrt{(h-2x)^2 + (k-0)^2}]^2 \\ \Rightarrow h^2 + k^2 &= h^2 + (k-2y)^2 \\ &= (h-2x)^2 + k^2 \quad \dots(ii) \end{aligned}$$

Taking first two equations, we get

$$\begin{aligned} h^2 + k^2 &= h^2 + (k-2y)^2 \\ \Rightarrow k^2 &= k^2 + 4y^2 - 4yk \Rightarrow 4y(y-k) = 0 \\ \Rightarrow y &= k \quad [\because y \neq 0] \end{aligned}$$

Taking first and third equations, we get

$$\begin{aligned} h^2 + k^2 &= (h-2x)^2 + k^2 \\ \Rightarrow h^2 &= h^2 + 4x^2 - 4xh \\ \Rightarrow 4x(x-h) &= 0 \\ \Rightarrow x &= h \quad [\because x \neq 0] \end{aligned}$$

$\therefore$  Required points  $= (h, k) = (x, y)$

20. Let point on  $Y$ -axis be  $P(0, k)$ . Then,

$$\begin{aligned} PA^2 &= PB^2 \\ \Rightarrow (6-0)^2 + (5-k)^2 &= (-4-0)^2 + (3-k)^2 \end{aligned}$$

$$\begin{aligned} \Rightarrow 36 + 25 + k^2 - 10k &= 16 + 9 + k^2 - 6k \\ \Rightarrow 4k &= 36 \Rightarrow k = 9 \end{aligned}$$

Hence, coordinates of point on  $Y$ -axis are  $(0, 9)$ .

21. The distance between ends points of the diameter gives the value of the diameter. Here, the points are  $(24, 1)$  and  $(2, 23)$

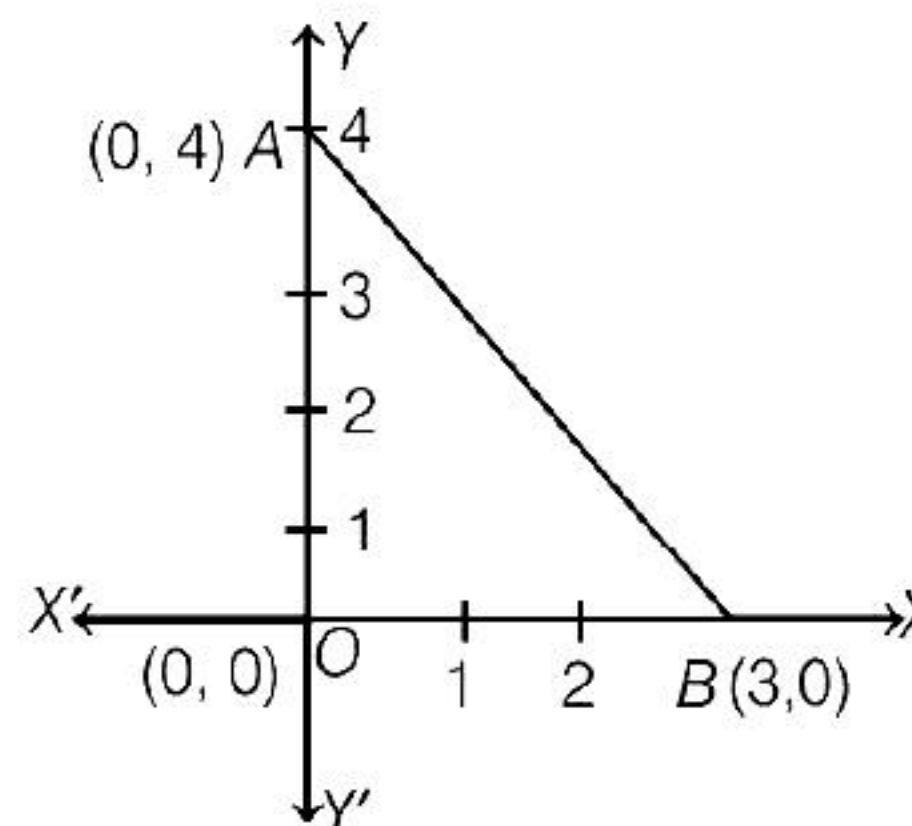
$$\begin{aligned} \therefore d &= \sqrt{(2-24)^2 + (23-1)^2} \\ &= \sqrt{(-22)^2 + (22)^2} \\ &= \sqrt{(22)^2 (1+1)} \\ &= 22\sqrt{2} \text{ units} \end{aligned}$$

$$\begin{aligned} \therefore \text{Radius of a circle } r &= \frac{d}{2} = \frac{22\sqrt{2}}{2} \\ &= 11\sqrt{2} \text{ units} \end{aligned}$$

22. Since,  $A$  and  $B$  lie on the circle having centre  $O$ .

$$\begin{aligned} OA &= OB \\ \Rightarrow \sqrt{(4-2)^2 + (3-3)^2} &= \sqrt{(x-2)^2 + (5-3)^2} \\ \Rightarrow 2 &= \sqrt{(x-2)^2 + 4} \\ \Rightarrow 4 &= (x-2)^2 + 4 \\ \Rightarrow (x-2)^2 &= 0 \\ \Rightarrow x &= 2 \end{aligned}$$

23. We plot the vertices of a triangle i.e.,  $(0, 4)$ ,  $(0, 0)$  and  $(3, 0)$  on the paper shown as given below



Now, perimeter of  $\triangle AOB$  = Sum of the length of all its sides

$$= d(AO) + d(OB) + d(AB)$$

$\therefore$  Distance between the points  $(x_1, y_1)$  and  $(x_2, y_2)$ , is



$$\begin{aligned}
 d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 &= \text{Distance between } A(0, 4) \text{ and } O(0, 0) \\
 &\quad + \text{Distance between } O(0, 0) \text{ and } B(3, 0) \\
 &\quad + \text{Distance between } A(0, 4) \text{ and } B(3, 0) \\
 &= \sqrt{(0-0)^2 + (0-4)^2} + \sqrt{(3-0)^2 + (0-0)^2} \\
 &\quad + \sqrt{(3-0)^2 + (0-4)^2} \\
 &= \sqrt{0+16} + \sqrt{9+0} + \sqrt{(3)^2 + (4)^2} \\
 &= 4 + 3 + \sqrt{9+16} \\
 &= 7 + \sqrt{25} = 7 + 5 = 12
 \end{aligned}$$

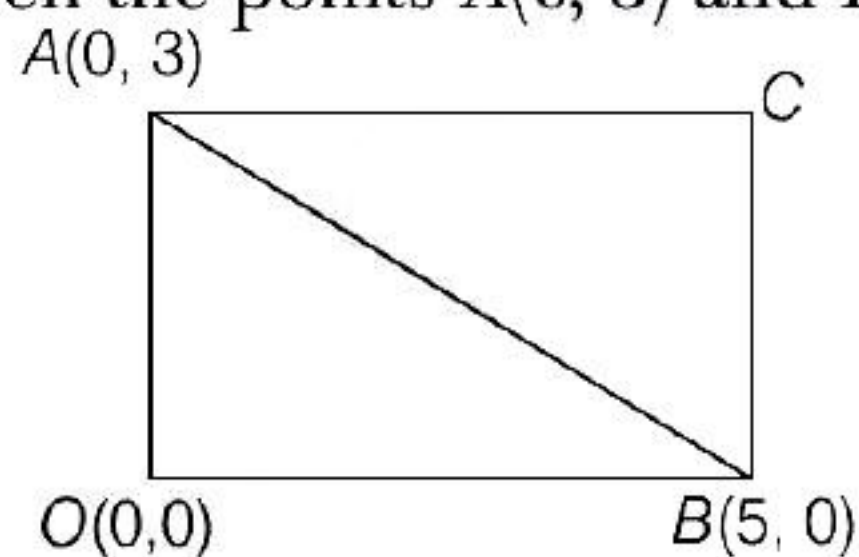
Hence, the required perimeter of triangle is 12 units.

24. Let the given points are  $A(0, 0)$ ,  $B(3, \sqrt{3})$  and  $C(3, \lambda)$ .

Since,  $\triangle ABC$  is an equilateral triangle, therefore

$$\begin{aligned}
 AB &= AC \\
 \Rightarrow \sqrt{(3-0)^2 + (\sqrt{3}-0)^2} &= \sqrt{(3-0)^2 + (\lambda-0)^2} \\
 \Rightarrow 9 + 3 &= 9 + \lambda^2 \\
 \Rightarrow \lambda^2 &= 3 \\
 \Rightarrow \lambda &= \pm \sqrt{3}
 \end{aligned}$$

25. Now, length of the diagonal  $AB$  = Distance between the points  $A(0, 3)$  and  $B(5, 0)$ .



$\therefore$  Distance between the points  $(x_1, y_1)$  and  $(x_2, y_2)$ ,

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Here,  $x_1 = 0$ ,  $y_1 = 3$  and  $x_2 = 5$ ,  $y_2 = 0$

$\therefore$  Distance between the points  $A(0, 3)$  and  $B(5, 0)$

$$\begin{aligned}
 AB &= \sqrt{(5-0)^2 + (0-3)^2} \\
 &= \sqrt{25+9} = \sqrt{34}
 \end{aligned}$$

Hence, the required length of its diagonal is  $\sqrt{34}$  units.

26. Let the points are  $A(3, 2)$ ,  $B(-2, -3)$  and  $C(2, 3)$ .

$$\text{Then, } AB = \sqrt{(-2-3)^2 + (-3-2)^2}$$

$$\begin{aligned}
 [\because \text{distance} &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}] \\
 &= \sqrt{(-5)^2 + (-5)^2} = \sqrt{25+25} = \sqrt{50} \\
 &= 7.07 \text{ units (approx)}
 \end{aligned}$$

$$\begin{aligned}
 BC &= \sqrt{(2+2)^2 + (3+3)^2} = \sqrt{(4)^2 + (6)^2} \\
 &= \sqrt{16+36} = \sqrt{52} = 7.21 \text{ units (approx)}
 \end{aligned}$$

$$\begin{aligned}
 \text{and } CA &= \sqrt{(3-2)^2 + (2-3)^2} \\
 &= \sqrt{(1)^2 + (-1)^2} = \sqrt{1+1} \\
 &= \sqrt{2} = 1.41 \text{ (approx)}
 \end{aligned}$$

$$\text{Also, } (\sqrt{52})^2 = (\sqrt{50})^2 + (\sqrt{2})^2$$

$$\Rightarrow BC^2 = AB^2 + CA^2$$

So, by converse of Pythagoras theorem,  $\angle A = 90^\circ$

Hence,  $\triangle BAC$  is a right angled triangle.

27. Let  $P(5, -2)$ ,  $Q(6, 4)$  and  $R(7, -2)$  are the given points.

$$\begin{aligned}
 \text{Then, } PQ &= \sqrt{(6-5)^2 + (4+2)^2} \\
 [\because d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}] \\
 &= \sqrt{1+36} = \sqrt{37} \text{ units} \\
 QR &= \sqrt{(7-6)^2 + (-2-4)^2} \\
 &= \sqrt{1+36} = \sqrt{37} \text{ units}
 \end{aligned}$$

Since,  $PQ = QR$

$\therefore \triangle PQR$  is an isosceles triangle.

28. Let  $A(-4, 0)$ ,  $B(4, 0)$ ,  $C(0, 3)$  are the given vertices.

Now, distance between  $A(-4, 0)$  and  $B(4, 0)$ ,

$$AB = \sqrt{[4 - (-4)]^2 + (0-0)^2}$$

$$\begin{aligned}
 [\because \text{distance between two points } (x_1, y_1) \\
 \text{and } (x_2, y_2), d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}] \\
 &= \sqrt{(4+4)^2} = \sqrt{8^2} = 8 \text{ units}
 \end{aligned}$$



Distance between  $B(4, 0)$  and  $C(0, 3)$ ,

$$\begin{aligned} BC &= \sqrt{(0-4)^2 + (3-0)^2} \\ &= \sqrt{16+9} = \sqrt{25} = 5 \text{ units} \end{aligned}$$

Distance between  $A(-4, 0)$  and  $C(0, 3)$ ,

$$\begin{aligned} AC &= \sqrt{[0-(-4)]^2 + (3-0)^2} \\ &= \sqrt{16+9} = \sqrt{25} = 5 \text{ units} \end{aligned}$$

$$\therefore BC = AC$$

Hence,  $\triangle ABC$  is an isosceles triangle because an isosceles triangle has two sides equal.

29. Let the points are  $A(2, 3)$ ,  $B(3, 4)$ ,  $C(5, 6)$  and  $D(4, 5)$ .

Then, by distance formula

$$\begin{aligned} AB &= \sqrt{(3-2)^2 + (4-3)^2} = \sqrt{(1)^2 + (1)^2} \\ &= \sqrt{2} \text{ units} \end{aligned}$$

$$\begin{aligned} BC &= \sqrt{(5-3)^2 + (6-4)^2} \\ &= \sqrt{(2)^2 + (2)^2} = \sqrt{4+4} \\ &= \sqrt{8} = 2\sqrt{2} \text{ units} \end{aligned}$$

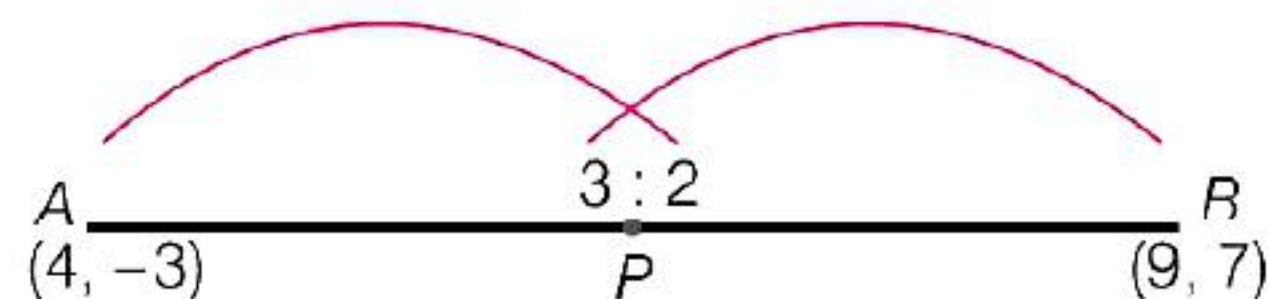
$$\begin{aligned} CD &= \sqrt{(4-5)^2 + (5-6)^2} \\ &= \sqrt{(-1)^2 + (-1)^2} = \sqrt{2} \text{ units} \end{aligned}$$

$$\begin{aligned} \text{and } AD &= \sqrt{(4-2)^2 + (5-3)^2} = \sqrt{(2)^2 + (2)^2} \\ &= \sqrt{4+4} = \sqrt{8} = 2\sqrt{2} \text{ units} \end{aligned}$$

Here,  $AB = CD$  and  $AD = BC$  i.e. the opposite sides are equal. So, given points are vertices of a parallelogram.

30. Let  $P(x, y)$  be the required point.

Then,  $P$  divides  $AB$  internally in the ratio  $3 : 2$ .



$$\text{Here, } \frac{m_1}{m_2} = \frac{3}{2} \text{ and } (x_1, y_1) = (4, -3),$$

$$(x_2, y_2) = (9, 7)$$

Then,  $P(x, y) =$

$$P\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

[by section formula]

$$\begin{aligned} &= P\left(\frac{3 \times 9 + 2 \times 4}{3 + 2}, \frac{3 \times 7 + 2 \times (-3)}{3 + 2}\right) \\ &= P\left(\frac{27 + 8}{5}, \frac{21 - 6}{5}\right) = P\left(\frac{35}{5}, \frac{15}{5}\right) \\ &= P(7, 3) \end{aligned}$$

Therefore,  $(7, 3)$  is the required point.

31. If  $P(x, y)$  divides the line segment joining  $A(x_1, y_1)$  and  $B(x_2, y_2)$  internally in the ratio

$$m : n, \text{ then } x = \frac{mx_2 + nx_1}{m + n} \text{ and } y = \frac{my_2 + ny_1}{m + n}$$

Given that,  $x_1 = 7, y_1 = -6, x_2 = 3, y_2 = 4, m = 1$  and  $n = 2$

$$\therefore x = \frac{1(3) + 2(7)}{1 + 2}, y = \frac{1(4) + 2(-6)}{1 + 2}$$

$$\Rightarrow x = \frac{3 + 14}{3}, y = \frac{4 - 12}{3} \quad [\text{by section formula}]$$

$$\Rightarrow x = \frac{17}{3}, y = -\frac{8}{3}$$

So,  $(x, y) = \left(\frac{17}{3}, -\frac{8}{3}\right)$  lies in IV quadrant.

[since, in IV quadrant,  $x$ -coordinate is positive and  $y$ -coordinate is negative]

32. Let  $P(9a - 2, -b)$  divides  $AB$  internally in the ratio  $3 : 1$ .

By section formula,

$$9a - 2 = \frac{3(8a) + 1(3a + 1)}{3 + 1}$$

[ $\therefore$  internal section formula, the coordinates

of point  $P$  divides the line segment joining the point  $(x_1, y_1)$  and  $(x_2, y_2)$  in the ratio

$$m_1 : m_2 \text{ internally is } \left(\frac{m_2x_1 + m_1x_2}{m_1 + m_2}, \frac{m_2y_1 + m_1y_2}{m_1 + m_2}\right)]$$

$$\text{and } -b = \frac{3(5) + 1(-3)}{3 + 1}$$

$$\Rightarrow 9a - 2 = \frac{24a + 3a + 1}{4}$$

$$\text{and } -b = \frac{15 - 3}{4}$$



$$\Rightarrow 9a - 2 = \frac{27a + 1}{4}$$

$$\text{and } -b = \frac{12}{4}$$

$$\Rightarrow 36a - 8 = 27a + 1 \text{ and } b = -3$$

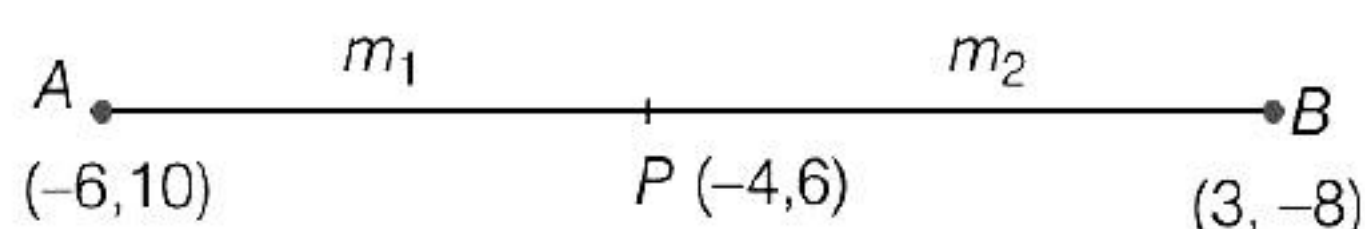
$$\Rightarrow 36a - 27a - 8 - 1 = 0$$

$$\Rightarrow 9a - 9 = 0$$

$$\therefore a = 1$$

Hence, the required values of  $a$  and  $b$  are 1 and  $-3$ .

33. Let point  $P(-4, 6)$  divides the line segment joining the points  $A(-6, 10)$  and  $B(3, -8)$  in the ratio  $m_1 : m_2$ .



By using section formula, we get

$$(-4, 6) = \left( \frac{3m_1 - 6m_2}{m_1 + m_2}, \frac{-8m_1 + 10m_2}{m_1 + m_2} \right) \dots (i)$$

On equating  $x$ -coordinate from both sides of Eq. (i), we get

$$-4 = \frac{3m_1 - 6m_2}{m_1 + m_2}$$

$$\Rightarrow -4(m_1 + m_2) = 3m_1 - 6m_2$$

$$\Rightarrow -4m_1 - 4m_2 = 3m_1 - 6m_2$$

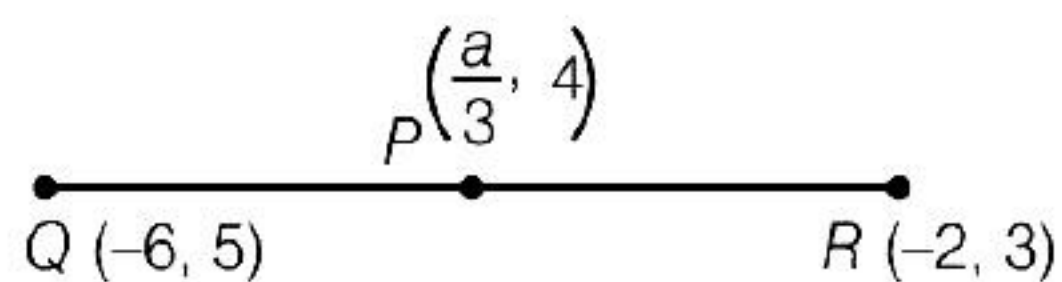
$$\Rightarrow -4m_1 - 3m_1 = -6m_2 + 4m_2$$

$$\Rightarrow -7m_1 = -2m_2$$

$$\Rightarrow \frac{m_1}{m_2} = \frac{2}{7}$$

$$m_1 : m_2 = 2 : 7$$

34. Given that,  $P\left(\frac{a}{3}, 4\right)$  is the mid-point of the line segment joining the points  $Q(-6, 5)$  and  $R(-2, 3)$ , which shows in the figure given below



$$\therefore \text{Mid-point of } QR = P\left(\frac{-6 - 2}{2}, \frac{5 + 3}{2}\right) \\ = P(-4, 4)$$

[since, mid-point of line segment having

$$\text{points } (x_1, y_1) \text{ and } (x_2, y_2) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)]$$

But mid-point  $P\left(\frac{a}{3}, 4\right)$  is given.

$$\therefore \left(\frac{a}{3}, 4\right) = (-4, 4)$$

On comparing the coordinates, we get

$$\frac{a}{3} = -4$$

$$\Rightarrow a = -12$$

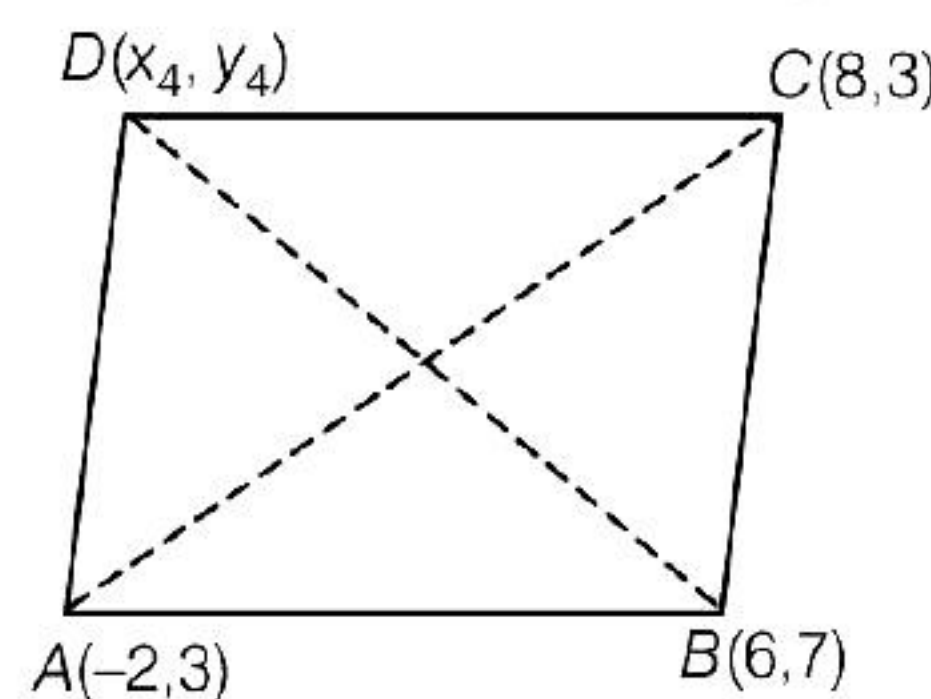
Hence, the required value of  $a$  is  $-12$ .

35. Let the fourth vertex of parallelogram,  $D \equiv (x_4, y_4)$  and  $L, M$  be the middle points of  $AC$  and  $BD$ , respectively.

$$\text{Then, } L = \left( \frac{-2 + 8}{2}, \frac{3 + 3}{2} \right) \equiv (3, 3)$$

[since, mid - point of a line segment having points  $(x_1, y_1)$  and  $(x_2, y_2) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)]$

$$\text{and } M = \left( \frac{6 + x_4}{2}, \frac{7 + y_4}{2} \right)$$



Since,  $ABCD$  is a parallelogram, therefore diagonals  $AC$  and  $BD$  will bisect each other.

Hence,  $L$  and  $M$  are the same points.

$$\therefore 3 = \frac{6 + x_4}{2} \text{ and } 3 = \frac{7 + y_4}{2}$$

$$\Rightarrow 6 = 6 + x_4 \text{ and } 6 = 7 + y_4$$

$$\Rightarrow x_4 = 0 \text{ and } y_4 = 6 - 7$$

$$\therefore x_4 = 0 \text{ and } y_4 = -1$$

Hence, the fourth vertex of parallelogram is  $D \equiv (x_4, y_4) \equiv (0, -1)$



36. Coordinate of the centroid  $G$  of  $\triangle ABC$

$$= \left( \frac{-1+0-5}{3}, \frac{3+4+2}{3} \right) = (-2, 3)$$

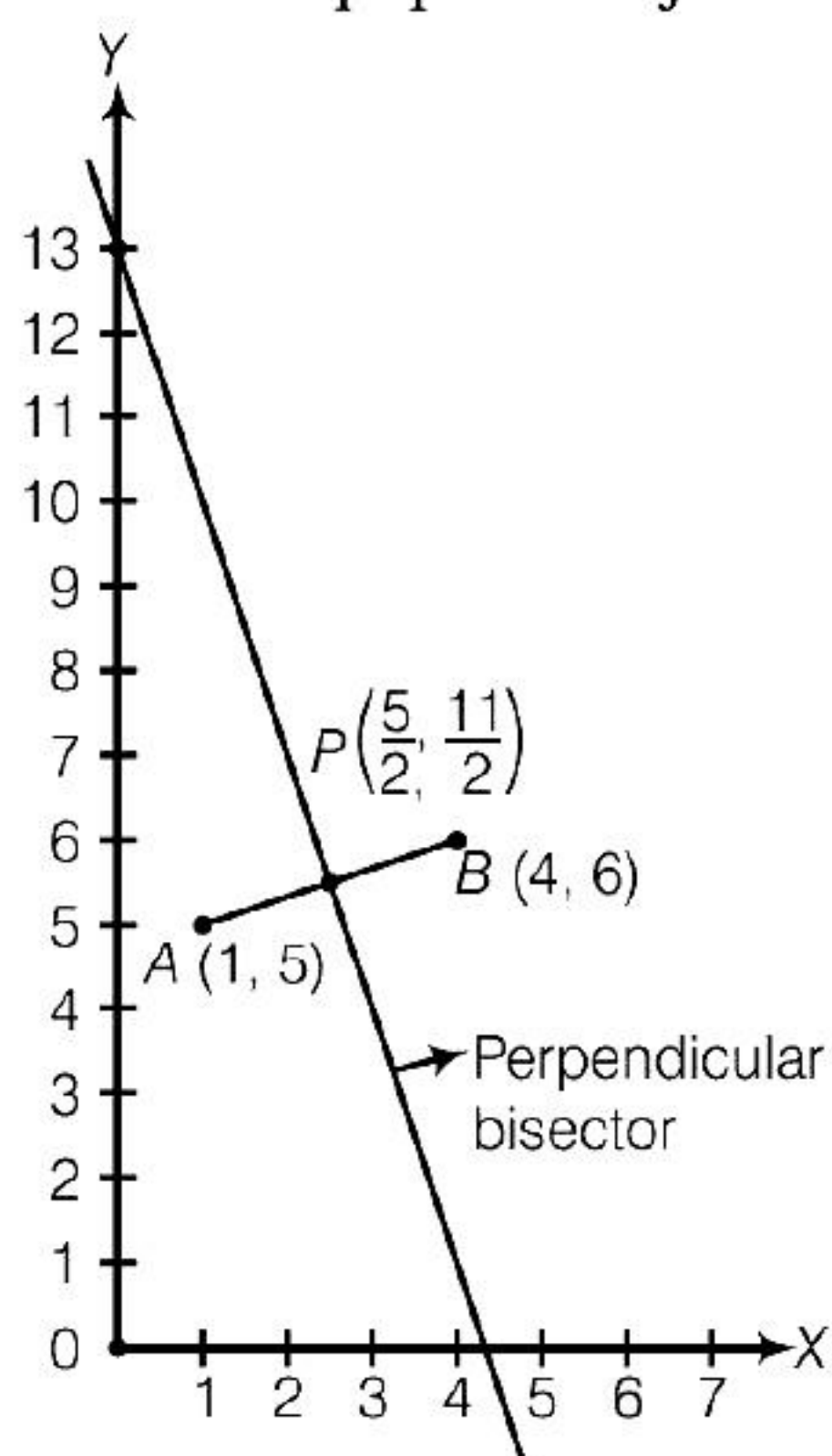
Since,  $G$  lies on the median  $x - 2y + k = 0$ .

So,  $G$  satisfy the equation  $x - 2y + k = 0$ .

$$\therefore -2 - 6 + k = 0$$

$$\Rightarrow k = 8$$

37. Firstly, we plot the points of the line segment on the paper and join them.



We know that, the perpendicular bisector of the line segment  $AB$  bisect the segment  $AB$ , i.e. perpendicular bisector of line segment  $AB$  passes through the mid-point of  $AB$ .

$$\therefore \text{Mid-point of } AB = \left( \frac{1+4}{2}, \frac{5+6}{2} \right)$$

$$\Rightarrow P = \left( \frac{5}{2}, \frac{11}{2} \right)$$

$$\left[ \because \text{mid-point of line segment passes through the points } (x_1, y_1) \text{ and } (x_2, y_2) \right. \\ \left. = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \right]$$

Now, we draw a straight line on paper passes through the mid-point  $P$ .

We see that the perpendicular bisector cuts the  $Y$ -axis at the point  $(0, 13)$ .

Hence, the required point is  $(0, 13)$ .

38. We know that, the perpendicular bisector of the any line segment divides the line segment into two equal parts i.e., the perpendicular bisector of the line segment always passes through the mid-point of the line segment.

$\therefore$  Mid-point of the line segment joining the points  $A(-2, -5)$  and  $B(2, 5)$

$$= \left( \frac{-2+2}{2}, \frac{-5+5}{2} \right) = (0, 0)$$

[since, mid-point of any line segment which

passes through the points  $(x_1, y_1)$  and

$$(x_2, y_2) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)]$$

Hence,  $(0, 0)$  is the required point lies on the perpendicular bisector of the lines segment.

39. Let the coordinates of  $P$  and  $Q(0, y)$  and  $(x, 0)$ , respectively.

So, the mid-point of  $P(0, y)$  and  $Q(x, 0)$  is

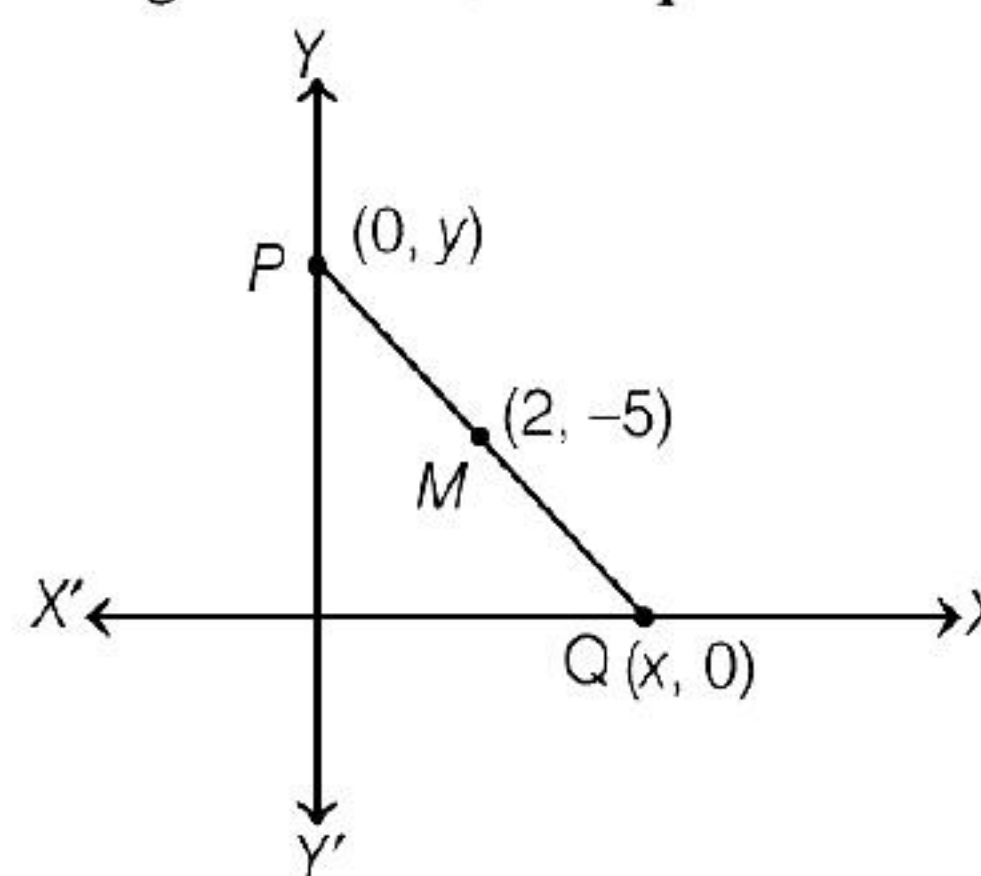
$$M \left( \frac{0+x}{2}, \frac{y+0}{2} \right).$$

[ $\because$  mid-point of a line segment having

points  $(x_1, y_1)$  and  $(x_2, y_2)$

$$= \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)]$$

But it is given that, mid-point of  $PQ$  is  $(2, -5)$ .





$$\therefore 2 = \frac{x+0}{2} \text{ and } -5 = \frac{y+0}{2}$$

$$\Rightarrow 4 = x \text{ and } -10 = y$$

$$\Rightarrow x = 4 \text{ and } y = -10$$

So, the coordinates of  $P$  and  $Q$  are  $(0, -10)$  and  $(4, 0)$ .

40.  $\therefore$  Distance between  $A(-2, 0)$  and  $B(2, 0)$ ,

$$\begin{aligned} AB &= \sqrt{[2 - (-2)]^2 + (0 - 0)^2} \\ &= \sqrt{(4)^2 + 0} = \sqrt{16} = 4 \text{ units} \end{aligned}$$

[ $\therefore$  distance between the points  $(x_1, y_1)$  and

$$(x_2, y_2), d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$$

Similarly, distance between  $B(2, 0)$  and

$$\begin{aligned} C(0, 2), BC &= \sqrt{(0 - 2)^2 + (2 - 0)^2} \\ &= \sqrt{4 + 4} = \sqrt{8} = 2\sqrt{2} \text{ units} \end{aligned}$$

In  $\triangle ABC$ , distance between  $C(0, 2)$  and  $A(-2, 0)$ ,

$$\begin{aligned} CA &= \sqrt{[0 - (-2)]^2 + (2 - 0)^2} \\ &= \sqrt{4 + 4} = \sqrt{8} = 2\sqrt{2} \text{ units} \end{aligned}$$

Distance between  $F(0, 4)$  and  $D(-4, 0)$ ,

$$\begin{aligned} FD &= \sqrt{(0 + 4)^2 + (0 - 4)^2} = \sqrt{4^2 + (-4)^2} \\ &= \sqrt{16 + 16} = \sqrt{32} = 4\sqrt{2} \text{ units} \end{aligned}$$

Distance between  $F(0, 4)$  and  $E(4, 0)$ ,

$$\begin{aligned} FE &= \sqrt{(4 - 0)^2 + (0 - 4)^2} = \sqrt{4^2 + (-4)^2} \\ &= \sqrt{16 + 16} = \sqrt{32} = 4\sqrt{2} \text{ units} \end{aligned}$$

and distance between  $E(4, 0)$  and  $D(-4, 0)$ ,

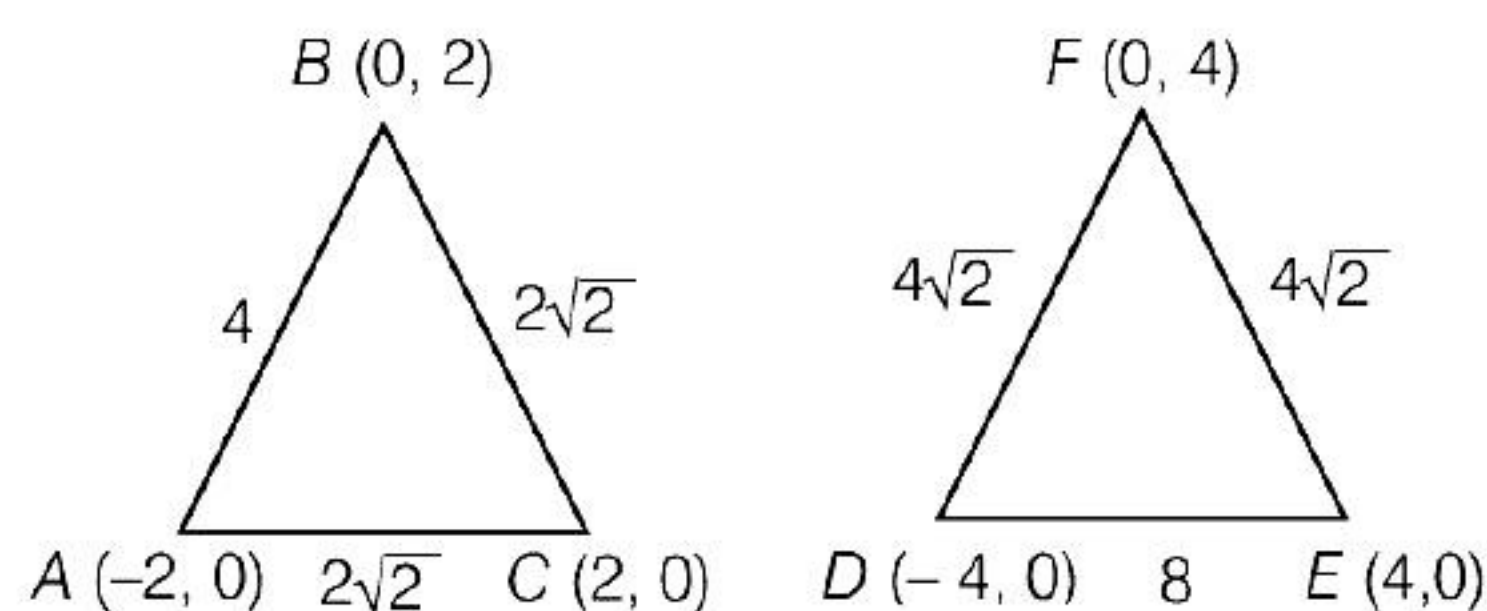
$$\begin{aligned} ED &= \sqrt{[4 - (-4)]^2 + (0)^2} \\ &= \sqrt{(4 + 4)^2 + 0} = \sqrt{8^2} = \sqrt{64} = 8 \text{ units} \end{aligned}$$

$$\text{Now, } \frac{AB}{DE} = \frac{4}{8} = \frac{1}{2}, \quad \frac{AC}{DF} = \frac{2\sqrt{2}}{4\sqrt{2}} = \frac{1}{2},$$

$$\frac{BC}{EF} = \frac{2\sqrt{2}}{4\sqrt{2}} = \frac{1}{2}$$

$$\therefore \frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$$

Here, we see that sides of  $\triangle ABC$  and  $\triangle FDE$  are proportional.



Hence, both the triangles are similar.

[by SSS rule]

41. Given, point  $(a, b)$  is the mid-point of the line segment joining the points  $A(10, -6)$  and  $B(k, 4)$ .

$\therefore$  Coordinate of mid-point of

$$AB = \left( \frac{10 + k}{2}, \frac{-6 + 4}{2} \right)$$

$$\Rightarrow (a, b) = \left( \frac{10 + k}{2}, -1 \right)$$

Equate the  $x$  and  $y$ -coordinates both sides, we get

$$a = \frac{10 + k}{2} \text{ and } b = -1$$

Also, given relation is

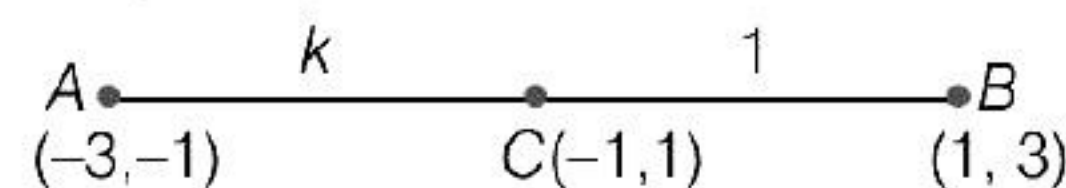
$$a - 2b = 18$$

$$\therefore \frac{10 + k}{2} - 2(-1) = 18$$

$$\Rightarrow \frac{10 + k}{2} = 18 - 2 \Rightarrow 10 + k = 2 \times 16$$

$$\Rightarrow k = 32 - 10 \Rightarrow k = 22$$

42. Let  $C(-1, 1)$  divides  $AB$  in the ratio  $k : 1$ .



Then, by using section formula, we get

Coordinates of  $C$  are  $\left( \frac{k - 3}{k + 1}, \frac{3k - 1}{k + 1} \right)$ .

$$\text{Thus, } C(-1, 1) = C \left( \frac{k - 3}{k + 1}, \frac{3k - 1}{k + 1} \right)$$

On equating  $x$ -coordinate from both sides, we get

$$-1 = \frac{k - 3}{k + 1} \Rightarrow -k - 1 = k - 3$$

$$\Rightarrow -2k = -3 + 1 \Rightarrow -2k = -2 \Rightarrow k = 1$$



On equating  $y$ -coordinate from both sides, we get

$$1 = \frac{3k - 1}{k + 1}$$

$$\Rightarrow k + 1 = 3k - 1$$

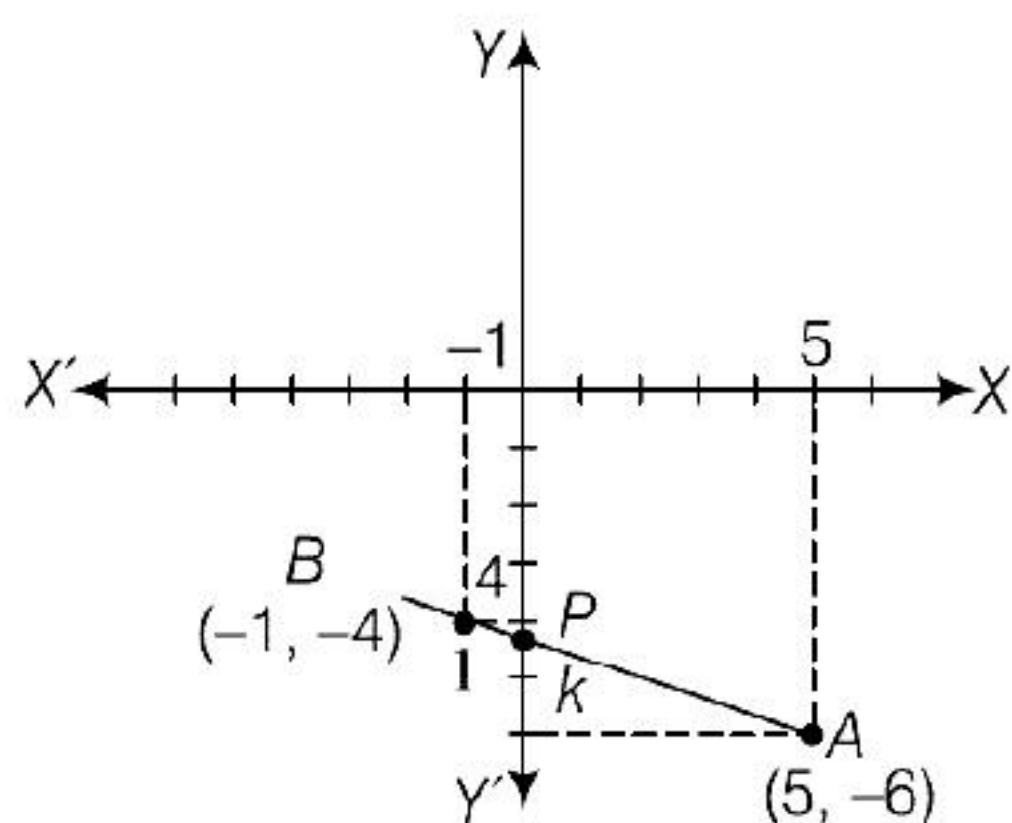
$$\Rightarrow 2k = 2 \Rightarrow k = 1$$

Since, in both cases value of  $k$  is same.

So,  $C$  divides  $AB$  in the ratio  $1:1$ , i.e.  $C$  is the mid-point of  $AB$ .

Hence,  $A$ ,  $B$  and  $C$  are collinear.

43. Let  $AB$  be the given line segment with end points  $A(5, -6)$  and  $B(-1, -4)$ . Also, let  $Y$ -axis divides  $AB$  in the ratio  $k:1$  at point  $P$ .



Then, by using section formula,

$$\text{Coordinates of } P = \left( \frac{-k + 5}{k + 1}, \frac{-4k - 6}{k + 1} \right) \dots (i)$$

Since, on the  $Y$ -axis, abscissa is 0.

So,  $x$ -coordinate of  $P$  will be zero.

On equating  $x$ -coordinate of  $P$  to 0, we get

$$\frac{-k + 5}{k + 1} = 0$$

$$\Rightarrow -k + 5 = 0 \Rightarrow k = 5$$

Thus, the required ratio is  $5:1$ .

44. Let the coordinates of a point are  $(x, y)$ .

$$\text{We have, } x_1 = -1, y_1 = 7;$$

$$x_2 = 4, y_2 = -3$$

$$\text{and } m_1 = 2, m_2 = 3$$

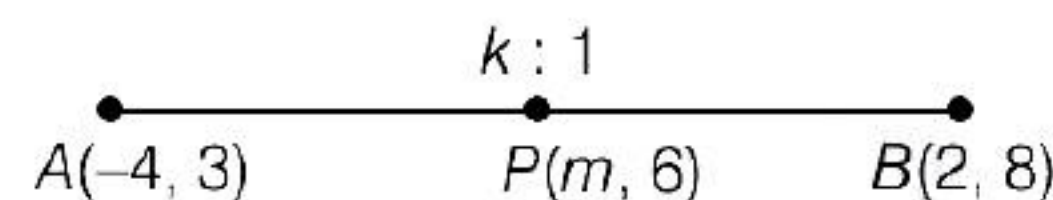
$\therefore$  By using section formula,

$$\begin{aligned} x &= \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2} \\ &= \frac{2(4) + 3(-1)}{2 + 3} = \frac{8 - 3}{5} = \frac{5}{5} = 1 \end{aligned}$$

$$\begin{aligned} \text{and } y &= \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2} = \frac{2(-3) + 3(7)}{2 + 3} \\ &= \frac{-6 + 21}{5} = \frac{15}{5} = 3 \end{aligned}$$

Hence, coordinates of the point are  $(1, 3)$ .

45.  $A(-4, 3)$ ,  $B(2, 8)$  and  $P(m, 6)$



Let  $P$  divides the join of  $AB$  in the ratio of  $k:1$ .

$$\therefore y\text{-coordinate of } P = \frac{k \times 8 + 1 \times 3}{k + 1}$$

$$\Rightarrow 6 = \frac{8k + 3}{k + 1}$$

$$\Rightarrow 6k + 6 = 8k + 3$$

$$\Rightarrow 2k = 3$$

$$\Rightarrow k = \frac{3}{2}$$

$\therefore P$  divides the join of  $AB$  in the ratio of  $3:2$ .

46. Given, vertices of a parallelogram are  $A(6, 1)$ ,  $B(8, 2)$ ,  $C(9, 4)$  and  $D(p, 3)$ .

Here, we have to find the value of  $p$ .

We know that, diagonals of a parallelogram bisect each other.

$\therefore$  Coordinates of mid-point of diagonal  $AC$   
= Coordinates of mid-point of diagonal  $BD$

$$\Rightarrow \left( \frac{6 + 9}{2}, \frac{1 + 4}{2} \right) = \left( \frac{8 + p}{2}, \frac{2 + 3}{2} \right)$$

$$\left[ \because \text{mid-point} = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \right]$$

$$\Rightarrow \left( \frac{15}{2}, \frac{5}{2} \right) = \left( \frac{8 + p}{2}, \frac{5}{2} \right)$$

On equating  $x$ -coordinate from both sides, we get

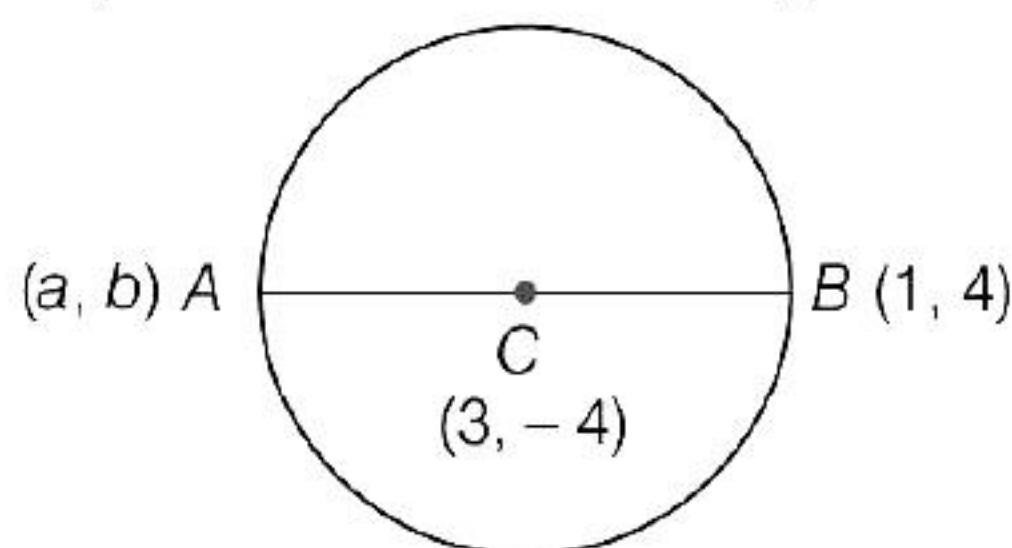
$$\frac{15}{2} = \frac{8 + p}{2} \Rightarrow 15 = 8 + p$$

$$\Rightarrow p = 15 - 8 \Rightarrow p = 7$$

Hence, the required value of  $p$  is 7.



47. Let,  $AB$  be the diameter and  $C$  be the centre of the circle. Let coordinates of  $A$  be  $(a, b)$ . Clearly,  $C$  will be the mid-point of  $AB$ .



$$\therefore \text{Coordinates of } C = \left( \frac{a+1}{2}, \frac{b+4}{2} \right)$$

$$\left[ \because \text{mid-point} = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \right]$$

$$\Rightarrow (3, -4) = \left( \frac{a+1}{2}, \frac{b+4}{2} \right)$$

$$[\text{given, coordinates of } C = (3, -4)]$$

On comparing the coordinates of  $x$  and  $y$  from both sides, we get

$$\frac{a+1}{2} = 3 \quad \text{and} \quad \frac{b+4}{2} = -4$$

$$\Rightarrow a+1 = 6 \quad \text{and} \quad b+4 = -8$$

$$\Rightarrow a = 5 \quad \text{and} \quad b = -12$$

Hence, the coordinates of point  $A$  are  $(5, -12)$ .

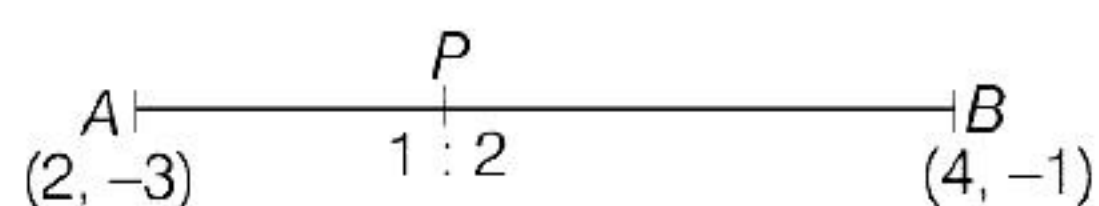
48. Let  $P$  and  $Q$  be the points of trisection as shown below



Then,  $AP : PB = 1 : 2$  and  $AQ : QB = 2 : 1$

- (i) When  $P$  divides  $AB$  in the ratio  $1 : 2$ .

$$\text{Then, } \frac{m_1}{m_2} = \frac{1}{2}$$



Here,  $A(x_1, y_1) = (2, -3)$  and  $B(x_2, y_2) = (4, -1)$

Now,

$$P(x, y) = P\left( \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2} \right)$$

[by section formula]

$$= P\left( \frac{1 \times 4 + 2 \times 2}{1+2}, \frac{1 \times (-1) + 2 \times (-3)}{1+2} \right)$$

$$= P\left( \frac{4+4}{3}, \frac{-1-6}{3} \right) = P\left( \frac{8}{3}, \frac{-7}{3} \right)$$

49. (P)

$$x = \frac{-5 - 2}{3} = -\frac{7}{3} \Rightarrow y = \frac{6+6}{3} = 4$$

$\therefore$  Point  $P$  is  $\left( -\frac{7}{3}, 4 \right)$

(Q)

$$x = \frac{2-2}{2+1} = 0, y = \frac{8+1}{2+1} = 3$$

$\therefore$  Point  $P$  is  $(0, 3)$

(R)

$$x = \frac{9+2}{5} = \frac{11}{5}, y = \frac{12+14}{5} = \frac{26}{5}$$

$\therefore$  Point  $P$  is  $\left( \frac{11}{5}, \frac{26}{5} \right)$

(S)

$$x = \frac{24+4}{3+1} = 7, y = \frac{15-3}{3+1} = 3$$

$\therefore$  Point  $P$  is  $(7, 3)$

50. (P) Distance between  $(-6, 7)$  and  $(-1, -5)$

$$= \sqrt{(-1+6)^2 + (-5-7)^2} = \sqrt{(5)^2 + (-12)^2}$$

$$= \sqrt{25 + 144} = \sqrt{169} = 13 \text{ units}$$

(Q)

The given points are  $A(k, -5)$  and  $B(2, 7)$ .

Now,  $AB = 13 \Rightarrow AB^2 = 169$

$$\Rightarrow (2-k)^2 + (7+5)^2 = 169$$

$$\Rightarrow k^2 - 4k + 4 + 144 = 169$$

$$\Rightarrow k^2 - 4k - 21 = 0$$



$$\Rightarrow (k-7)(k+3) = 0$$

$$\Rightarrow k = 7 \text{ or } k = -3$$

$$(R) P(x, y), A(5, 1), B(-1, 5)$$

$$PA = PB$$

$$\Rightarrow PA^2 = PB^2$$

$$\Rightarrow (5-x)^2 + (1-y)^2 = (-1-x)^2 + (5-y)^2$$

$$\Rightarrow 25 + x^2 - 10x + 1 + y^2 - 2y$$

$$= 1 + x^2 + 2x + 25 + y^2 - 10y$$

$$\Rightarrow 3x = 2y$$

(S)  $(x, y), (2, 3)$  and  $(4, 1)$  are collinear,

$$\text{then } x(3-1) + 2(1-y) + 4(y-3) = 0$$

$$\Rightarrow 2x + 2 - 2y + 4y - 12 = 0$$

$$\Rightarrow x + y = 5$$

51. Let a point on  $X$ -axis be  $(x_1, 0)$ , then its distance from the point  $(2, 3)$

$$\Rightarrow \sqrt{(x_1 - 2)^2 + 9} = c$$

$$\Rightarrow (x_1 - 2)^2 + 9 = c^2$$

$$\Rightarrow x_1 - 2 = \sqrt{c^2 - 9}$$

$$\Rightarrow \text{but } c < 3 \Rightarrow c^2 - 9 < 0$$

$\therefore x_1$  will be imaginary

Hence, both the Assertion are true and Reason is the correct explanation of Assertion.

52. The distance of point  $P(x, y)$  from origin

$$= \sqrt{(x-0)^2 + (y-0)^2}$$

$$= \sqrt{x^2 + y^2}$$

Mid-point of  $A(-3, b)$  and  $B(1, b+4)$  is

$$\left( \frac{-3+1}{2}, \frac{b+b+4}{2} \right) = (-1, b+2)$$

$$\therefore b+2 = 1 \Rightarrow b = -1$$

Assertion is false but Reason is true.

53. Since,  $A$  and  $B$  lie on the circle having centre  $O$ .

$$OA = OB$$

$$\Rightarrow \sqrt{(4-2)^2 + (3-3)^2}$$

$$= \sqrt{(x-2)^2 + (5-3)^2}$$

$$\Rightarrow 2 = \sqrt{(x-2)^2 + 4}$$

$$\Rightarrow 4 = (x-2)^2 + 4$$

$$\Rightarrow (x-2)^2 = 0 \Rightarrow x = 2$$

Let the given points are  $A(0, 0), B(3, \sqrt{3})$  and  $C(3, \lambda)$ .

Since,  $\triangle ABC$  is an equilateral triangle, therefore

$$AB = AC$$

$$\Rightarrow \sqrt{(3-0)^2 + (\sqrt{3}-0)^2}$$

$$= \sqrt{(3-0)^2 + (\lambda-0)^2}$$

$$\Rightarrow 9 + 3 = 9 + \lambda^2 \Rightarrow \lambda^2 = 3$$

$$\Rightarrow \lambda = \pm \sqrt{3}$$

Assertion is true but Reason is false.

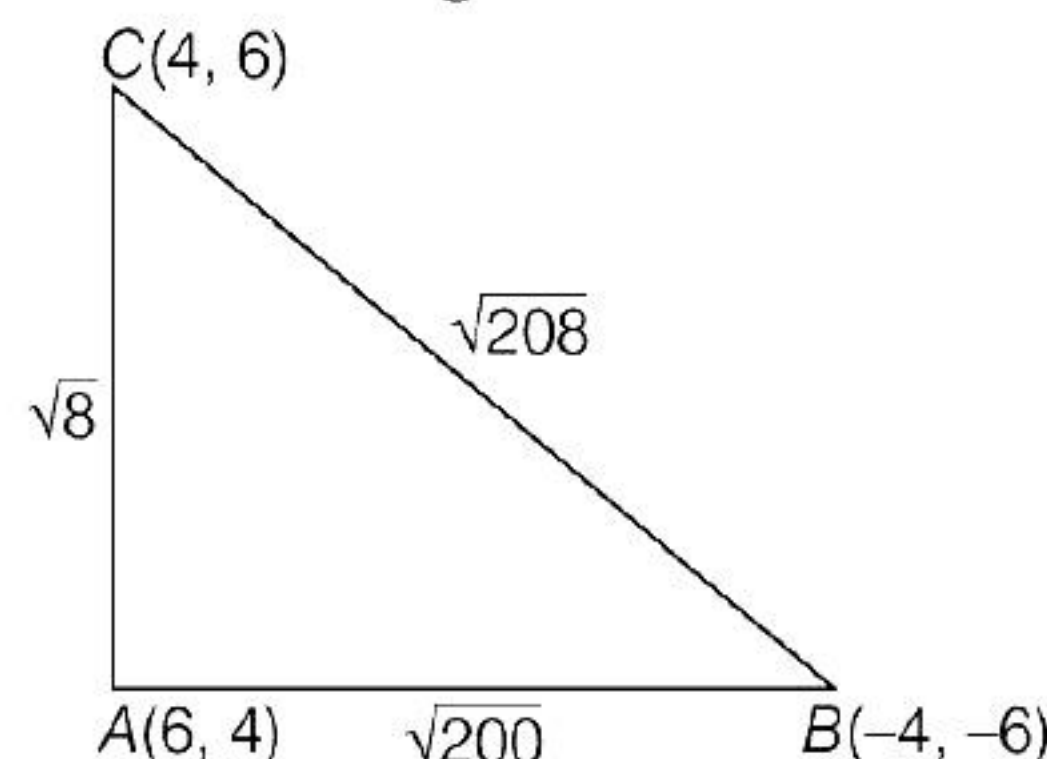
54. Three points  $A, B, C$  are collinear, if and only if  $AB + BC = AC$  but here  $AB + BC > AC$

$\therefore A, B, C$  are not collinear.

Hence, Assertion is false but Reason is true.

55.  $\therefore AB + BC > AC$  and  $AB + AC > BC$

$\therefore ABC$  is a triangle



$\therefore$  Sum of the two sides is greater than third side]

$$\text{Also, } BC^2 = AB^2 + AC^2$$

$$[\because (\sqrt{208})^2 = (\sqrt{200})^2 + (\sqrt{8})^2]$$

$\therefore ABC$  is a right angled triangle.

Assertion is true Reason is true but is not the correct explanation of Assertion.

56. Let  $A(3, 2), B(-2, -3)$  and  $C(2, 3)$ .

$$\therefore AB = \sqrt{(-2-3)^2 + (-3-2)^2} = \sqrt{50} \text{ units}$$

$$BC = \sqrt{(-2-2)^2 + (-3-3)^2} = \sqrt{52} \text{ units}$$



$$\text{and } CA = \sqrt{(2-3)^2 + (3-2)^2} = \sqrt{2} \text{ units}$$

$$\therefore BC^2 = AB^2 + CA^2$$

$\Rightarrow \triangle ABC$  is a right triangle.

Let  $A'(3, 6)$ ,  $B'(-3, 4)$  and  $P(x, y)$

Since,  $P$  is equidistant from  $A'$  and  $B'$ , then

$$PA' = PB'$$

$$\Rightarrow PA'^2 = PB'^2$$

$$\Rightarrow (x-3)^2 + (y-6)^2 = (x+3)^2 + (y-4)^2$$

$$\begin{aligned} \Rightarrow x^2 - 6x + 9 + y^2 - 12y + 36 \\ = x^2 + 6x + 9 + y^2 - 8y + 16 \end{aligned}$$

$$\Rightarrow 12x + 4y = 20$$

$$\Rightarrow 3x + y = 5$$

Both the statements are true but the Reason is not correct explanation of the Assertion.

57. In quadrilateral  $ABCD$

$$AB = BC = CD = DA \text{ and } AC = BD$$

Now all sides of quadrilateral are equal and diagonals  $AC = BD$

$\therefore$  Quadrilateral is a square.

Assertion is true Reason is true and is the correct explanation of Assertion.

58. Here,  $x_1 = 10 \cos 30^\circ$ ,  $y_1 = 0$  and  $x_2 = 0$ ,

$$y_2 = 10 \cos 60^\circ$$

$\therefore$  Distance between the points

$$= \sqrt{(0 - 10 \cos 30^\circ)^2 + (10 \cos 60^\circ - 0)^2}$$

$$= \sqrt{\left(-10 \times \frac{\sqrt{3}}{2}\right)^2 + \left(10 \times \frac{1}{2}\right)^2}$$

$$\left[ \because \cos 30^\circ = \frac{\sqrt{3}}{2} \text{ and } \cos 60^\circ = \frac{1}{2} \right]$$

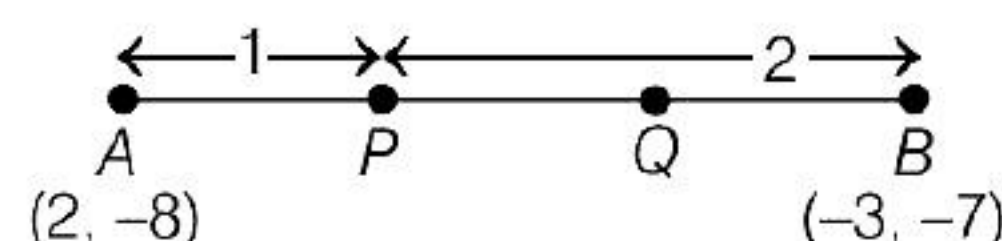
$$= \sqrt{\frac{300}{4} + \frac{100}{4}}$$

$$= \sqrt{\frac{400}{4}} = \sqrt{100} = 10 \text{ units}$$

Hence, Assertion is true but Reason is false

as the mid-point is  $\left(\frac{a+c}{2}, \frac{b+d}{2}\right)$ .

59.



$$AP : PB = 1 : 2$$

$$\begin{aligned} \therefore \text{Coordinates of } P &= \left( \frac{-3 + 4}{3}, \frac{-7 - 16}{3} \right) \\ &= \left( \frac{1}{3}, \frac{-23}{3} \right) \end{aligned}$$

$$\text{Also, } AQ : QB = 2 : 1$$

$$\begin{aligned} \therefore \text{Coordinates of } Q &= \left( \frac{-6 + 2}{3}, \frac{-14 - 8}{3} \right) \\ &= \left( \frac{-4}{3}, \frac{-22}{3} \right) \end{aligned}$$

Hence, Assertion is true but Reason is false

60. Both the statements are true but the Reason is not the correct explanation of the Assertion.

61. (i) In the figure, the coordinates of points are  $P(4, 6)$ ,  $Q(4, 2)$  and  $R(8, 2)$ .

Given, Malika's house is at  $P(4, 6)$  and Karishma's house at  $Q(4, 2)$

$\therefore$  Required distance =  $PQ$

$$= \sqrt{(2-6)^2 + (4-4)^2}$$

$$= \sqrt{16 + 0} = 4 \text{ units}$$

(ii) Given, Karishma's house is at  $Q(4, 2)$  and temple is at  $R(8, 2)$

$\therefore$  Required distance =  $QR$

$$= \sqrt{(2-2)^2 + (8-4)^2}$$

$$= \sqrt{0 + 16}$$

$$= 4 \text{ units}$$

(iii) Given, Malika's house is at  $P(4, 6)$  and temple is at  $R(8, 2)$

$\therefore$  Required distance =  $PR$

$$= \sqrt{(2-6)^2 + (8-4)^2}$$

$$= \sqrt{16 + 16}$$

$$= \sqrt{32}$$

$$= 4\sqrt{2} \text{ units}$$



(iv) As,  $PQ = QR = 4$  units

and  $PR = 4\sqrt{2}$  units

i.e.,  $PQ = QR \neq PR$

Hence,  $\Delta PQR$  is an isosceles triangle.

(v) Given, School is at  $O(0, 0)$  and Malika's house is at  $P(4, 6)$

$\therefore$  Required distance =  $OP$

$$= \sqrt{(6-0)^2 + (4-0)^2}$$

$$= \sqrt{36 + 16}$$

$$= \sqrt{52} = 2\sqrt{13} \text{ units}$$

62. (i) As we have,

$$OP = 5 \text{ km}$$

$$\therefore OP = \sqrt{(4)^2 + (y)^2}$$

$$25 = 16 + y^2 \quad [\because OP = 5]$$

$$y^2 = 9$$

$$y = 3$$

(ii) As we have  $PQ = 13 \text{ km}$

$$PQ = \sqrt{(15-3)^2 + (x-4)^2}$$

$$169 = 144 + (x-4)^2$$

$$(x-4)^2 = 25$$

$$x-4 = 5$$

$$x = 9$$

(iii) Given, Coordinates of  $P$  and  $Q$  are  $P(4, 3)$  and  $Q(9, 15)$

As,  $M$  is the mid point

$$\therefore M\left(\frac{4+9}{2}, \frac{3+15}{2}\right) = \left(\frac{13}{2}, \frac{18}{2}\right) = (6.5, 9)$$

(iv) Let  $P$  divides  $OQ$  in the ratio  $K : 1$

$$\therefore 3 = \frac{K \times 15 + 1 \times 0}{K + 1}$$

$$3K + 3 = 15K$$

$$12K = 3$$

$$K = \frac{1}{4} \quad \text{i.e., } 1 : 4$$

(v) Since,  $M$  is the mid-point of Noida and Delhi or  $PM = MQ$

Hence, Anmol should try his luck moving towards Delhi.

63. (i) It can be observed that Niharika posted the green flag at  $\frac{1}{4}$ th distance of AD i.e.

$$\frac{1}{4} \times 100 = 25 \text{ m from the starting point of 2nd line.}$$

Therefore, the coordinates of this point  $G$  is  $(2, 25)$ .

(ii) Preet posted red flag at  $\frac{1}{5}$ th distance of AD,

$$\text{i.e., } \frac{1}{5} \times 100 = 20 \text{ m from the starting point of 8th line.}$$

Therefore, the coordinates of this point  $R$  is  $(8, 20)$ .

(iii) Distance between these flags =  $GR$

$$= \sqrt{(8-2)^2 + (25-20)^2}$$

$$= \sqrt{(6)^2 + (5)^2}$$

$$= \sqrt{36 + 25}$$

$$= \sqrt{61} \text{ m}$$

(iv) The point at which Rashmi should post her blue flag is the mid-point of the line joining these points.

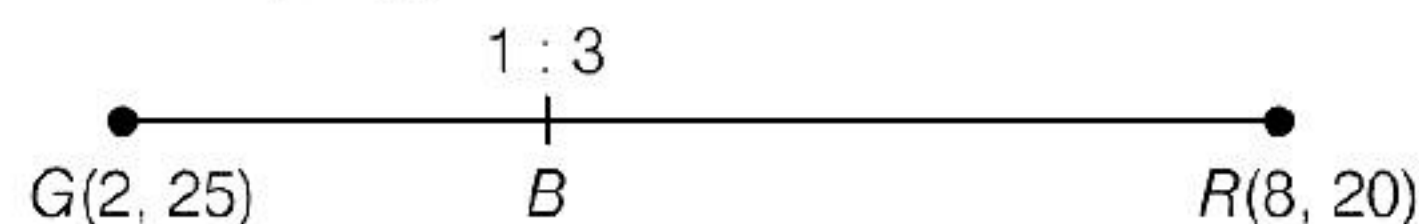
Let this point be  $A(x, y)$ .

$$x = \frac{2+8}{2}, y = \frac{25+20}{2}$$

$$x = \frac{10}{2} = 5, y = \frac{45}{2} = 22.5$$

Hence,  $A(x, y) = (5, 22.5)$

(v) Let the point at which Joy post his flag be  $B(x, y)$ .





$$\text{Then, } x = \frac{1 \times 8 + 3 \times 2}{1 + 3},$$

$$y = \frac{1 \times 20 + 3 \times 25}{1 + 3}$$

$$x = \frac{14}{4} = 3.5,$$

$$y = \frac{95}{4} = 23.75 \approx 24$$

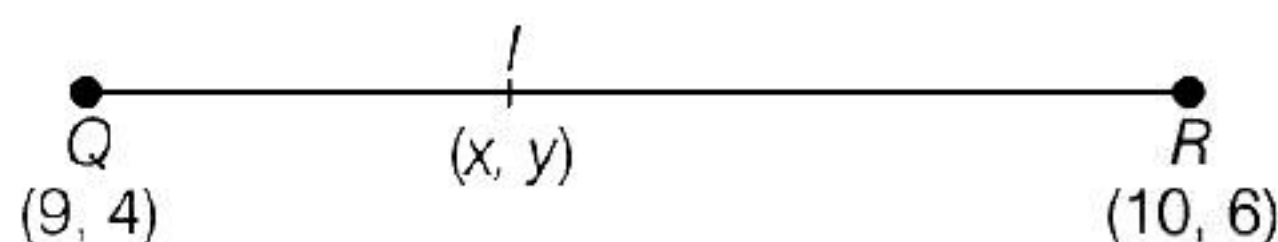
Hence,  $B(x, y) = (3.5, 24)$

64. (i) Given, coordinates of  $P(6, -2)$  and  $R(10, 6)$

$\therefore$  Required distance

$$\begin{aligned} &= \sqrt{(6 - (-2))^2 + (10 - 6)^2} \\ &= \sqrt{64 + 16} = \sqrt{80} \\ &= 4\sqrt{5} \text{ units} \end{aligned}$$

- (ii) Let the coordinates of  $I$  be  $(x, y)$



By section formula,

$$x = \frac{1 \times 10 + 2 \times 9}{1 + 2} = \frac{10 + 18}{3} = \frac{28}{3}$$

$$y = \frac{1 \times 6 + 2 \times 4}{1 + 2} = \frac{6 + 8}{3} = \frac{14}{3}$$

Hence, the coordinates of  $I$  is

$$\left( \frac{28}{3}, \frac{14}{3} \right)$$

- (iii) Given, coordinates of  $P(6, -2)$  and  $R(10, 6)$ .

mid-point of

$$\begin{aligned} PR &= \left( \frac{6 + 10}{2}, \frac{-2 + 6}{2} \right) \\ &= \left( \frac{16}{2}, \frac{4}{2} \right) = (8, 2) \end{aligned}$$

- (iv) Let  $Q$  divides the segment  $PR$  in the ratio  $K : 1$

$$\text{Then, } 9 = \frac{K \times 10 + 1 \times 6}{K + 1}$$

$$9 = \frac{10K + 6}{K + 1}$$

$$9K + 9 = 10K + 6$$

$$K = 3$$

Hence, the ratio will be  $3 : 1$

- (v) As,  $Q$  divides  $PR$  in the ratio  $3 : 1$

Hence,  $P, Q, R$  lies on a straight line.

65. (i) Here,  $A(0, 6), B(6, 6), C(1, 1)$

$\therefore$  Coordinates of centroid of  $\triangle ABC$

$$\begin{aligned} &= \left( \frac{0 + 6 + 1}{3}, \frac{6 + 6 + 1}{3} \right) \\ &= \left( \frac{7}{3}, \frac{13}{3} \right) \end{aligned}$$

- (ii) Given, Coordinates of  $A$  and  $B$  are  $(0, 6)$  and  $(6, 6)$ .

$$\begin{aligned} \text{Mid-point of } AB &= \left( \frac{0 + 6}{2}, \frac{6 + 6}{2} \right) \\ &= \left( \frac{6}{2}, \frac{12}{2} \right) = (3, 6) \end{aligned}$$

- (iii) Given, Coordinates of  $B$  and  $C$  are  $(6, 6)$  and  $(1, 1)$

$$\begin{aligned} \text{Mid-point of } BC &= \left( \frac{6 + 1}{2}, \frac{6 + 1}{2} \right) \\ &= \left( \frac{7}{2}, \frac{7}{2} \right) \end{aligned}$$

- (iv) Given, Coordinates of  $A$  and  $C$  are  $(0, 6)$  and  $(1, 1)$

$$\begin{aligned} \text{Mid-point of } AC &= \left( \frac{0 + 1}{2}, \frac{6 + 1}{2} \right) \\ &= \left( \frac{1}{2}, \frac{7}{2} \right) \end{aligned}$$

- (v) Coordinates of  $S, T$ , and  $U$  are as  $S(3, 6), T\left(\frac{7}{2}, \frac{7}{2}\right)$  and  $U\left(\frac{1}{2}, \frac{7}{2}\right)$

As we know, the centroid of triangle formed by joining the mid-points of sides of given triangle is same as that of the given triangle

$$\text{Hence, centroid of } \triangle STU = \left( \frac{7}{3}, \frac{13}{3} \right)$$