COORDINATE GEOMETRY

RECTANGULAR COORDINATE AXES

Let XOX' be a horizontal straight line and YOY' be a vertical straight line drawn through a point O in the plane of the paper. Then

the line XOX' is called x-axis

the line YOY' is called y-axis

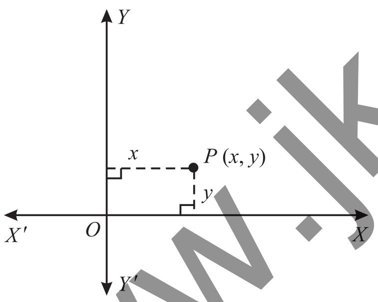
plane of paper is called xy-plane or cartesian plane.

x-axis and y-axis together are called co-ordinate axes or axis of reference.

The point O is called the origin.

Cartesian Coordinates

Position of any point in a cartesian plane can be described by their cartesian coordinates. The ordered pair of perpendicular distances first from y-axis and second from x-axis of a point P is called cartesian coordinates of P.



If the cartesian coordinates of point P are (x, y), then x is called abscissa or x-coordinate of P and y is called the ordinate or y-coordinate of point P.

SIGN CONVENTIONS IN THE *xy*-PLANE

(i) All the distances are measured from origin (o).

(ii) All the distances measured along or parallel to x-axis but right side of origin are taken as $+ve$.

(iii) All the distances measured along or parallel to x-axis but left side of origin are taken as $-ve$.

(iv) All the distances measured along or parallel to y-axis but above the origin are taken as $+ve$.

(v) All the distances measure along or parallel to y-axis but below the origin are taken as $-ve$.

According to the Above Sign Conventions

(i) Coordinate of origin is $(0, 0)$

(ii) Coordinate of any point on the x-axis but right side of origin is of the form $(x, 0)$, where $x > 0$.

(iii) Coordinate of any point on the x-axis but left side of origin is of the form $(-x, 0)$, where $x > 0$.

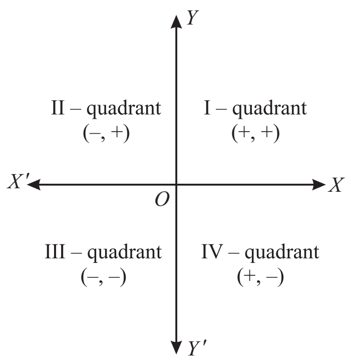
(iv) Coordinate of any point on the y-axis but above the origin is of the form $(0, y)$, where $y > 0$.

(v) Coordinate of any point on the y-axis but below the origin is of the form $(0, -y)$, where $y > 0$.

QUADRANTS OF xy-PLANE AND SIGN OF x AND y-COORDINATE OF A POINT IN DIFFERENT QUADRANTS

x and y-axis divide the xy-plane in four parts. Each part is called a quadrant.

The four quadrants are written as I-quadrant (XOY), II-quadrant (YOX'), III-quadrant ($X'OY'$) and IV-quadrant ($Y'OX$). Each of these quadrants shows the specific quadrant of the xy-plane as shown below:



(i) Any of the four quadrants does not includes any part of x or y-axis.

(ii) In the first quadrant both x and y-coordinates of any point are $+ve$.

(iii) In second quadrant x-coordinate of any point is $-ve$ but y-coordinate of any point is $+ve$.

(iv) In third quadrant, both x and y-coordinates of any point are $-ve$.

(v) In fourth quadrant, x-coordinate of any point is $+ve$ but y-coordinate of any point is $-ve$ as shown in the above diagram.

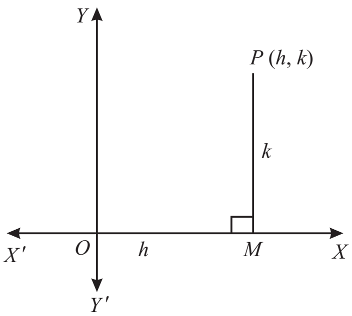
PLOTTING A POINT WHOSE COORDINATES ARE KNOWN

The point can be plotted by measuring its proper distances from both the axes. Thus, any point P whose coordinates are (h, k) can be plotted as follows:

(i) Measure OM equal to h (i.e. x-coordinate of point P) along the x-axis.

(ii) Now perpendicular to OM equal to k.

Mark point P above M such that PM is parallel to y-axis and $PM = k$ (i.e. y-coordinate of point P)



In this chapter, now we shall study to find the distance between two given points, section formula, mid-point formula, slope of a line, angles between two straight lines and equation of a line in different forms etc.

DISTANCE FORMULA

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

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

Distance of point $P(x, y)$ from the origin $= \left|\sqrt{x^2 + y^2}\right|$

Illustration 1: If distance between the point (x, 2) and (3, 4) is 2, then find the value of x.

Solution:

$$2 = \left|\sqrt{(x-3)^2 + (2-4)^2}\right| \Rightarrow 2 = \left|\sqrt{(x-3)^2 + 4}\right|$$

Squaring both sides

$$4 = (x-3)^2 + 4 \Rightarrow x - 3 = 0 \Rightarrow x = 3$$

Illustration 2: Find the distance between each of the following points :

$A(-6, -1)$ and $B(-6, 11)$

Solution: Here the points are $A(-6, -1)$ and $B(-6, 11)$

By using distance formula, we have

$$AB = \sqrt{\{-6-(-6)\}^2 + \{11-(-1)\}^2} = \sqrt{0^2 + 12^2} = 12$$

Hence, $AB = 12$ units.

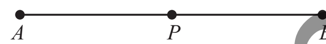
SECTION FORMULA

Co-ordinates of a point which divides the line segment joining two points $P(x_1, y_1)$ and $Q(x^2, y^2)$ in the ratio $m_1 : m_2$ are :

(i) $\left(\dfrac{m_1x_2 + m_2x_1}{m_1 + m_2}, \dfrac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$, for internal division.

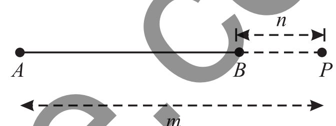
P divides AB internally in the ratio $m : n$

If $m_1 = m_2$, then the point P will be the mid point of PQ whose co-ordinates $= \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$



P is the mid-point of AB

(ii) $\left(\dfrac{m_1x_2 - m_2x_1}{m_1 - m_2}, \dfrac{m_1y_2 - m_2y_1}{m_1 - m_2}\right)$, for external division



P divides AB externally in the ratio $m : n$

(iii) When we need to find the ratio in which a point on a line segment divides it, we suppose the required ratio as $k : 1$ or $m/n : 1$.

Note:

(i) Co-ordinates of any point on the line segment joining two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ are

$\left(\dfrac{x_1 + \lambda x_2}{1 + \lambda}, \dfrac{y_1 + \lambda y_2}{1 + \lambda}\right), (\lambda \neq -1)$

(ii) **Division by axes:** Line segment joining the points (x_1, y_1) and (x^2, y^2) is divided by

(a) x-axis in the ratio $-y_1 / y_2$

(b) y-axis in the ratio $-x / x_2$

If ratio is positive division internally and if ratio is negative division is externally.

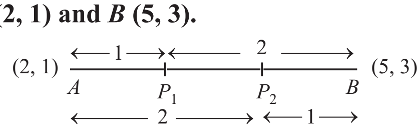
(iii) **Division by a line:** Line $ax + by + c = 0$ divides the line joining the points (x_1, y_1) and (x_2, y_2) in the ratio $\left(-\dfrac{ax_1 + by_1 + c}{ax_2 + by_2 + c}\right)$.

Illustration 3: Find the ratio in which the line $3x + 4y = 7$ divides the line segment joining the points (1, 2) and (– 2, 1).

Solution: Ratio $= -\dfrac{3(1) + 4(2) - 7}{3(-2) + 4(1) - 7} = -\dfrac{4}{-9} = \dfrac{4}{9} = 4 : 9$.

Illustration 4: Find the points of trisection of line joining the points A (2, 1) and B (5, 3).

Solution:



$$P_1(x, y) = \left(\frac{1 \times 5 + 2 \times 2}{1 + 2}, \frac{1 \times 3 + 2 \times 1}{1 + 2}\right) = \left(3, \frac{5}{3}\right)$$

$$P_2(x, y) = \left(\frac{2 \times 5 + 1 \times 2}{2 + 1}, \frac{2 \times 3 + 1 \times 1}{2 + 1}\right) = \left(4, \frac{7}{3}\right).$$

Illustration 5: Prove that points *A* (1, 1), *B* (– 2, 7) and *C* (3, – 3) are collinear.

Solution: $AB = \left|\sqrt{(1+2)^2 + (1-7)^2}\right| = \left|\sqrt{9+36}\right| = 3\sqrt{5}$

$$BC = \left|\sqrt{(-2-3)^2 + (7+3)^2}\right| = \left|\sqrt{25+100}\right| = 5\sqrt{5}$$

$$CA = \left|\sqrt{(3-1)^2 + (-3-1)^2}\right| = \left|\sqrt{4+16}\right| = 2\sqrt{5}$$

Clearly, $BC = AB + AC$. Hence A, B, C are collinear.

Illustration 6: Find the ratio in which the join of (– 4, 3) and (5, –2) is divided by (i) *x*-axis (ii) *y*-axis.

Solution:

(i) *x*-axis divides the join of (x_1, y_1) and (x_2, y_2) in the ratio of $-y_1 : y_2 = -3 : -2 = 3 : 2$.

(ii) *y*-axis divides, in the ratio of $-x_1 : x_2 \Rightarrow 4 : 5$.

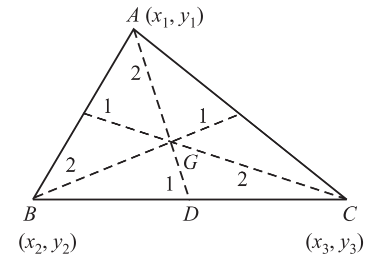
COORDINATES OF SOME PARTICULAR POINTS

Let $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are vertices of any triangle *ABC*, then

Centroid

Centroid is the point of intersection of the medians of a triangle. Centroid divides each median in the ratio of 2 : 1.

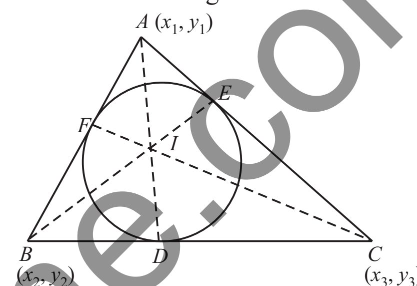
A median is a line segment joining the mid point of a side to its opposite vertex of a triangle.



Co-ordinates of centroid, $G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$

Incentre

Incentre is the point of intersection of internal bisectors of the angles of a triangle. Also incentre is the centre of the circle touching all the sides of a triangle.



Co-ordinates of incentre,

$$I = \left(\frac{ax_1 + bx_2 + cx_3}{a + b + c}, \frac{ay_1 + by_2 + cy_3}{a + b + c}\right),$$

where a, b, c are length of the sides opposite to vertices A, B, C respectively of triangle *ABC*.

(i) Angle bisector divides the opposite sides in the ratio of the sides included in the angle. For example $\frac{BD}{DC} = \frac{AB}{AC} = \frac{c}{b}$.

(ii) Incentre divides the angle bisectors *AD*, *BE* and *CF* in the ratio $(b + c) : a$, $(c + a) : b$ and $(a + b) : c$ respectively.

Practice Exercise

Level - I

1. If distance between the point $(x, 2)$ and $(3, 4)$ is 2, then the value of $x =$
(a) 0 (b) 2
(c) 3 (d) 4

2. Find the mid-point of the line-segment joining two points (3, 4) and (5, 12).
(a) (–4, 8) (b) (0, 8)
(c) (4, 8) (d) (4, 0)

3. The mid-point of the line segment joining the points (– 2, 4) and (6, 10) is
(a) (2, 5) (b) (2, 7)
(c) (3, 7) (d) (3, 8)

4. The points A (–4, – 1), B (–2, –4), C (4, 0) and D (2, 3) are the vertices of a
(a) Parallelogram (b) Rectangle
(c) Rhombus (d) Square

5. The line $x + y = 4$ divides the line joining the points (–1, 1) and (5, 7) in the ratio
(a) 2 : 1 (b) 1 : 2
(c) 1 : 2 externally (d) None of these

6. If A (3, 5), B (–3, – 4), C (7, 10) are the vertices of a parallelogram taken in the order, then the co-ordinates of the fourth vertex are
(a) (10, 19) (b) (15, 10)
(c) (19, 10) (d) (15, 19)

7. The centroid of a triangle, whose vertices are (2, 1), (5, 2) and (3, 4) is
(a) $\left(\frac{8}{3}, \frac{7}{3}\right)$ (b) $\left(\frac{10}{3}, \frac{7}{3}\right)$
(c) $\left(-\frac{10}{3}, \frac{7}{3}\right)$ (d) $\left(\frac{10}{3}, -\frac{7}{3}\right)$

8. The incentre of the triangle with vertices $(1, \sqrt{3})$, $(0, 0)$ and $(2, 0)$ is
(a) $\left(1, \frac{\sqrt{3}}{2}\right)$ (b) $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$
(c) $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$ (d) $\left(1, \frac{1}{\sqrt{3}}\right)$

9. The centroid of the triangle whose vertices are (3, 10), (7, 7), (–2, 1) is
(a) (8/3, 6) (b) (6, 8/3)
(c) (–4, –7/3) (d) None of these

10. The coordinates of the centroid G of a triangle with vertices at (3, 7), (5, 5) and (–3, 2) is
(a) (10/3, 14/3) (b) (10/3, 10/3)
(c) (5/3 14/3) (d) (11/3, 10/3)

11. The coordinates of a point which divides the join of (5, –5) and (2, – 3) in the ratio 4 : 3, externally, are:
(a) (3, 4) (b) (–7, 3)
(c) (– 7, 9) (d) (8, 3)

12. Distance between $P(x, y)$ and Q (3, –6) is 10 units and x is positive integer, then $x =$
(a) 3 (b) 9
(c) 7 (d) 11

13. The vertices of a parallelogram in order are $A(1, 2)$, $B(4, y)$, $C(x, 6)$, $D(3, 6)$, then $(x, y) =$
(a) (6, 3) (b) (3, 6)
(c) (5, 6) (d) (1, 4)

14. The point which divides the line segment joining the points (7, –6) and (3, 4) in ratio 1 : 2 internally lies in the
(a) I quadrant (b) II quadrant
(c) III quadrant (d) IV quadrant

15. How many squares are possible if two of the vertices of a quadrilateral are (1, 0) and (2, 0)?
(a) 1 (b) 2
(c) 3 (d) 4

16. In what ratio is the line segment made by the points (7, 3) and (– 4, 5) divided by the y-axis?
(a) 2 : 3 (b) 4 : 7
(c) 3 : 5 (d) 7 : 4

17. If the coordinates of the mid-point of the line segment joining the points (2, 1) and (1, – 3) is (x, y), then the relation between x and y can be best described by
(a) $3x + 2y = 5$ (b) $6x + y = 8$
(c) $5x - 2y = 4$ (d) $2x - 5y = 4$

18. Points (4, –1), (6, 0), (7, 2) and (5, 1) are joined to be a vertex of a quadrilateral. What will be the structure?
(a) Rhombus (b) Parallelogram
(c) Square (d) Rectangle

19. Find the third vertex of the triangle whose two vertices are (–3, 1) and (0, –2) and the centroid is the origin.
(a) (2, 3) (b) $\left(\frac{-4}{3}, \frac{14}{3}\right)$
(c) (3, 1) (d) (6, 4)

20. If the origin gets shifted to (2, 2), then what will be the new coordinates of the point (4, –2)?
(a) (– 2, 4) (b) (2, 4)
(c) (4, 2) (d) (2, – 4)

21. If the point $R(1, -2)$ divides externally the line segment joining $P(2, 5)$ and Q in the ratio 3 : 4, what will be the coordinates of Q ?

(a) $(-3, 6)$ (b) $(2, -4)$
(c) $(3, 6)$ (d) $(1, 2)$

22. C is the mid-point of PQ, if P is $(4, x)$, C is $(y, -1)$ and Q is $(-2, 4)$, then x and y respectively are

(a) – 6 and 1 (b) – 6 and 2
(c) 6 and – 1 (d) 6 and – 2

23. A quadrilateral has the vertices at the points (–4, 2), (2, 6), (8, 5) and (9, –7). Show that the mid-points of the sides of this quadrilateral are the vertices of a parallelogram.

(a) Rectangle (b) Square
(c) Parallelogram (d) Rhombus

24. Find the ratio in which the point $(2, y)$ divides the join of (– 4, 3) and (6, 3) and hence find the value of y

(a) $2 : 3, y = 3$ (b) $3 : 2, y = 4$
(c) $3 : 2, y = 3$ (d) $3 : 2, y = 2$

25. 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

26. The ratio in which the line $2x + y - 4 = 0$ divides the line segment joining the points $A(2, -2)$ and $B(3, 7)$ is

(a) 3 : 7 (b) 4 : 7
(c) 2 : 9 (d) 4 : 9

27. Which of the following points is the nearest to the origin?

(a) $(0, -6)$ (b) $(-8, 0)$
(c) $(-3, -4)$ (d) $(7, 0)$

28. If the points (1, 1), (–1, –1) and $(-\sqrt{3}, k)$ are vertices of a equilateral triangle then the value of k will be :

(a) 1 (b) –1
(c) $\sqrt{3}$ (d) $-\sqrt{3}$

29. The points (3,0), (– 3, 0), $(0, -3\sqrt{3})$ are the vertices of

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

30. Ratio in which the line $3x + 4y = 7$ divides the line segment joining the points (1, 2) and (–2, 1) is

(a) 3 : 5 (b) 4 : 6
(c) 4 : 9 (d) None of these

31. If the area of a triangle with vertices (– 3, 0), (3, 0) and $(0, k)$ is 9 sq unit, then what is the value of k?

(a) 3 (b) 6
(c) 9 (d) 12

32. The line $y = 0$ divides the line joining the points (3, –5) and (– 4, 7) in the ratio

(a) 3 : 4 (b) 4 : 5
(c) 5 : 7 (d) 7 : 9

33. The line passing through the points (– 2, 8) and (5, 7)

[*SSC-Sub. Ins.-2012*]

(a) does not cut any axes (b) cuts x-axis only
(c) cuts y-axis only (d) cuts both the axes

Level - II

1. The fourth vertex of a rectangle whose other vertices are (4, 1) (7, 4) and (13, –2) is

(a) (10, –5) (b) (10, 5)
(c) (–10, 5) (d) (–10, –5)

2. The coordinates of vertices A and B of an equilateral triangle ABC are (– 4, 0) and (4, 0) respectively. Which of the following could be coordinates of C

(a) $(0, 2\sqrt{3})$ (b) $(0, 4)$
(c) $(0, 4\sqrt{3})$ (d) $(0, 3)$

3. The three vertices of a parallelogram are A (3, – 4), B (–2, 1) and C (–6, 5). Which of the following cannot be the fourth one

(a) (–1, 0) (b) (7, –8)
(c) (1, –5) (d) All of these

4. The mid-points of sides of a triangle are (2, 1), (– 1, – 3) and (4, 5). Then the coordinates of its vertices are:

(a) (7,9), (– 3, – 7), (1, 1) (b) (– 3, – 7), (1, 1), (2, 3)
(c) (1, 1), (2, 3), (– 5, 8) (d) None of these

5. The point whose abscissa is equal to its ordinate and which is equidistant from the points (1, 0) and (0, 3) is

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

6. If the point dividing internally the line segment joining the points (a, b) and (5, 7) in the ratio 2 : 1 be (4, 6), then

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

7. The distance of point of intersection of $2X - 3Y + 13 = 0$ and $3X + 7Y - 15 = 0$ from (4, – 5), will be

(a) 10 units (b) 12 units
(c) 11 units (d) None of these

8. A (– 2, 4) and B (– 5, – 3) are two points. The coordinates of a point P on Y axis such that $PA = PB$, are

(a) (3, 4) (b) (0, 9)
(c) (9, 0) (d) (0, – 1)

9. The centroid of a triangle formed by $(7, p)$, $(q, -6)$, (9, 10) is (6, 3). Then $p + q$

(a) 6 (b) 5
(c) 7 (d) 8

10. If the three vertices of a rectangle taken in order are the points (2, –2), (8, 4) and (5, 7). The coordinates of the fourth vertex is

(a) (1, 1) (b) (1, –1)

(c) (–1, 1) (d) None of these

11. If $P(1, 2)$, $Q(4, 6)$, $R(5, 7)$ and $S(a, b)$ are the vertices of a parallelogram $PQRS$, then

(a) $a = 2, b = 4$ (b) $a = 3, b = 4$

(c) $a = 2, b = 3$ (d) $a = 3, b = 5$

12. Find the coordinates of the points that trisect the line segment joining (1, – 2) and (–3, 4)

(a) $\left(\frac{-1}{3}, 0\right)$ (b) $\left(\frac{-5}{3}, 2\right)$

(c) Both (a) and (b) (d) None of these

13. If the mid-point of the line joining (3, 4) and (p, 7) is (x, y) and $2x + 2y + 1 = 0$, then what will be the value of p?

(a) 15 (b) $\frac{-17}{2}$

(c) –15 (d) $\frac{17}{2}$

14. Two vertices of a triangle are (5, –1) and (–2, 3). If the orthocentre of the triangle is the origin, what will be the coordinates of the third point?

(a) (4, 7) (b) (– 4, 7)

(c) (– 4, – 7) (d) (4, – 7)

15. A point P is equidistant from A (3, 1) and B (5, 3) and its abscissa is twice its ordinate, then its co-ordinates are.

(a) (2, 1) (b) (1, 2)

(c) (4, 2) (d) (2, 4)

16. If (–1, –1) and (3, –1) are two opposite corners of a square, the other two corners are

(a) (2, 0), (– 2, 2) (b) (2, –2), (0, 2)

(c) (3,0), (4, – 2) (d) None of these

17. What is the perimeter of the triangle with vertices $A(-4, 2)$, $B(0, -1)$ and $C(3, 3)$?

(a) $7 + 3\sqrt{2}$ (b) $10 + 5\sqrt{2}$

(c) $11 + 6\sqrt{2}$ (d) $5 + \sqrt{2}$

18. The area (in sq. unit) of the triangle formed by the three graphs of the equations $x = 4$, $y = 3$, and $3x + 4y = 12$, is [*SSC CGL-2012*]

(a) 12 (b) 10

(c) 6 (d) 8

19. The radius of the circumcircle of the triangle made by x-axis, y-axis and $4x + 3y = 12$ is [*SSC CGL-2012*]

(a) 2 unit (b) 2.5 unit

(c) 3 unit (d) 4 unit

20. The total area (in sq. unit) of the triangles formed by the graph of $4x + 5y = 40$, x-axis, y-axis and $x = 5$ and $y = 4$ is [*SSC CGL-2014*]

(a) 10 (b) 20

(c) 30 (d) 40

Level-I

1. **(c)** $2=\sqrt{(x-3)^2+(2-4)^2} \Rightarrow 2=\sqrt{(x-3)^2+4}$
Squaring both sides
$4=(x-3)^2+4 \Rightarrow x-3=0 \Rightarrow x=3$

2. **(c)** Let $A(3, 4)$ and $B(5, 12)$ be the given points.
Let $C(x, y)$ be the mid-point of AB. Using mid-point formula, we have, $x=\frac{3+5}{2}=4$ and $y=\frac{4+12}{2}=8$
$\therefore$ $C(4, 8)$ are the co-ordinates of the mid-point of the line segment joining two points (3, 4) and (5, 12).

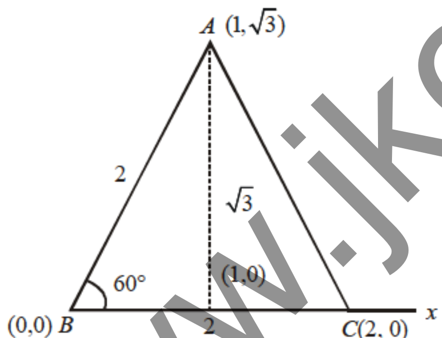
3. **(b)** **4.** **(b)**

5. **(b)** Ratio $=-\left(\frac{-1+1-4}{5+7-4}\right)=\frac{1}{2}$

6. **(d)** Mid point of A (3, 5) and C (7, 10) = $M\left(5, \frac{15}{2}\right)$
$\therefore$ Mid points of $BD = M\left(5, \frac{15}{2}\right)$
$B(-5, -4)$ and $D(x, y)$
$\therefore \frac{-5+x}{2}=5, \quad x=10+5=15$
$\frac{-4+y}{2}=\frac{15}{2}, \; y=15+4=19$
Co-ordinates of fourth vertex $D=(15, 19)$

7. **(b)** $x=\frac{2+5+3}{3}=\frac{10}{3}$ and $y=\frac{1+2+4}{3}=\frac{7}{3}$

8. **(d)** Clearly, the triangle is equilateral.



So, the incentre is the same as the centroid.
$\therefore$ Incentre $=\left(\frac{1+0+2}{3}, \frac{\sqrt{3}+0+0}{3}\right)=\left(1, \frac{1}{\sqrt{3}}\right)$

9. **(a)** Centroid $=\left(\frac{3+7-2}{3}, \frac{10+7+1}{3}\right)=\left(\frac{8}{3}, 6\right)$

10. **(c)** Let G be (X, Y), then $X=\{3+5+(-3)\}/3=5/3$
$Y=(7+5+2)/3=14/3 \Rightarrow G$ is $(5/3, 14/3)$

11. **(b)** Let the ratio be 4 : 3 or 4/3 : 1.
Now $X=\frac{\frac{4}{3}\times 2-5}{\frac{4}{3}-1}=\frac{\frac{8}{3}-5}{\frac{1}{3}}=\frac{-\frac{7}{3}}{\frac{1}{3}}=-7$
$Y=\frac{\frac{4}{3}x-3+5}{\frac{4}{3}-1}=\frac{\frac{1}{1}}{\frac{1}{3}}=3$. Hence $(-7, 3)$

12. **(b)**

13. **(a)** Mid-point of AC is $\left(\frac{1+x}{2}, \frac{2+6}{2}\right)$ *i.e.,* $\left(\frac{1+x}{2}, 4\right)$;
Mid-point of BD is $\left(\frac{4+3}{2}, \frac{y+5}{2}\right)$
Since for a | | gm, diagonals bisect each other
$\therefore \frac{1+x}{2}=\frac{7}{2}$ and $\frac{y+5}{2}=4 \Rightarrow x=6, y=3$

14. **(d)** **15.** **(c)** **16.** **(d)** **17.** **(b)** **18.** **(a)**
19. **(c)** **20.** **(d)** **21.** **(c)** **22.** **(a)** **23.** **(c)**

24. **(c)** Let the required ratio be $k:1$
Then, $2=\frac{6k-4\times 1}{k+1} \Rightarrow k=\frac{3}{2}$
$\therefore$ The required ratio is $\frac{3}{2}::1 \Rightarrow 3:2$
Also, $y=\frac{3\times 3+2\times 3}{3+2}=3$

25. **(d)** **26.** **(d)** **27.** **(c)**

28. **(c)** The equilateral Δ has its sides equal.
Hence the distance between the vertices should be equal.
$a=\sqrt{2^2+2^2}=\sqrt{(\sqrt{3}+1)^2+k(k-1)^2} \Rightarrow k=\sqrt{3}$

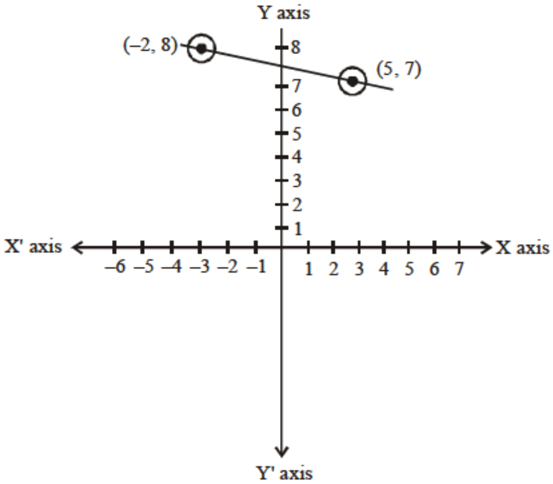
29. **(a)** Find the three lengths separately
$AB=6, \; BC=\sqrt{3^2+(3\sqrt{3})^2}=6$,
$AC=\sqrt{3^2+(3\sqrt{3})^2}=6$
Hence, the point are the vertices of equilateral triangle.

30. **(c)** $-\frac{3(1)+4(2)-7}{3(-2)+4(1)-7}=-\frac{4}{-9}=\frac{4}{9}$

31. **(a)** Let the vertices of the ΔABC be
$A(-3,0)$, $B(3,0)$ and $C(0,k)$.
Given, area is 9
$\Rightarrow \; 9=\frac{1}{2}\{-3(-k)+1(3k)\}$
$\Rightarrow \; 18=3k+3k$
$\Rightarrow \; k=\frac{18}{6}=3$

32. **(c)** Let $P(x, y)$ be the point of division that divides the line joining $(3, -5)$ and $(-4, 7)$ in the ratio of $k:1$
Now, $y=\frac{7k-5}{k+1}$ .... (i)
Since, P lies on $y=0$ or x-axis then, from eq. (i)
$0=\frac{7k-5}{k+1} \Rightarrow 7k=5 \Rightarrow k=\frac{5}{7}$

33. (c)



As indicated in the graph, the line passing through the points cuts Y-axis only.

Level-II

1. (a) **2. (c)** **3. (d)**

4. (a) $\frac{X_1+X_2}{2}=2$, $\frac{X_2+X_3}{2}=-1$, $\frac{X_3+X_1}{2}=4$

$\Rightarrow \quad X_1=7,\ X_2=-3,\ X_3=1$

Similarly, y_1, y_2, y_3 can be found

5. (b) Let the point be (X, X), so according to the condition

$(X-1)^2+(X-0)^2=(X-0)^2+(X-3)^2$

$\Rightarrow \quad 2X+1=-6X+9 \Rightarrow X=2$

Hence the point is (2, 2)

6. (c) $\frac{2\times 5+1\,(a)}{2+1}=4 \Rightarrow a=2$

and $\frac{2\times 7+1\,(b)}{2+1}=6 \Rightarrow b=4$

7. (b) The point of intersection will be obtained by simultaneously solving the two equations and then by the distance formula, distance can be found.

8. (d) Take points P one by one and see which one (0, – 1) satisfies.

9. (c) By the given condition $\frac{7+q+9}{3}=6$

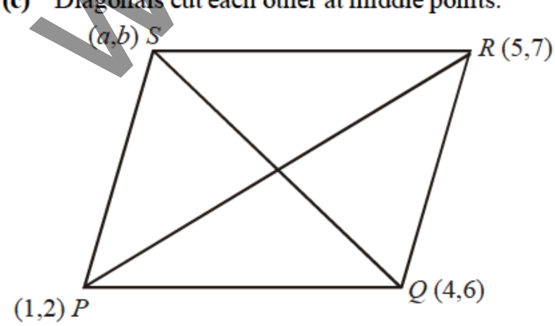
and $\frac{p-6+10}{3}=3$

$\Rightarrow \quad q=2$ and $p=5 \quad \therefore p+q=5+2=7$

10. (c) Let fourth vertex be (x, y), then $\frac{x+8}{2}=\frac{2+5}{2}$

and $\frac{y+4}{2}=\frac{-2+7}{2} \Rightarrow x=-1,\ y=1$

11. (c) Diagonals cut each other at middle points.



Hence, $\frac{a+4}{2}=\frac{1+5}{2} \Rightarrow a=2$

$\frac{b+6}{2}=\frac{2+7}{2} \Rightarrow b=3$

12. (c) **13. (c)** **14. (c)**

15. (c) Let the point be $P\,(2X, X)$. The choices we are left with are (1, 2) and (2, 4).

$AP=\sqrt{(3-2X)^2+(1-X)^2}$,

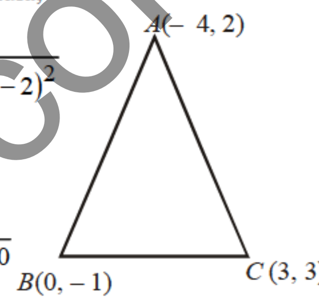
$BP=\sqrt{(5-2X)^2+(3-X)^2}$

$AP=BP$. (only (4, 2) satisfies)

16. (d) We have the mid-point of diagonal = (1, – 1) which should be the mid point of the other two points as well and which is not satisfied by any given alternative.

17. (b) By using distance formula,

We have,



$AB=\sqrt{(0+4)^2+(-1-2)^2}$

$=\sqrt{16+9}=5$

$BC=\sqrt{9+16}=5$

$CA=\sqrt{49+(1)^2}=\sqrt{50}$

$=5\sqrt{2}$

Hence, required perimeter $=AB+BC+CA$

$=10+5\sqrt{2}$

18. (c) $x=4$ ...(1)

$y=3$ ...(2)

$3x+4y=12$ ...(3)

Putting $x=0$ in 3rd equation we get $y=3$

Putting $y=0$ in 3rd equation we get $x=4$

The triangle will be formed by joining the points (3, 0) and (0, 4).

So, base = 3 and altitude = 4

Area $=\frac{1}{2}\times b\times h \Rightarrow \frac{1}{2}\times 3\times 4=6$

19. (b) Putting $x=0$ in $4x+3y=12$ we get $y=4$

Putting $y=0$ in $4x+3y=12$ we get $x=3$

The triangle so formed is right angle triangle with points (0, 0) (4, 0) (0, 3)

So diameter is the hypotenus of triangle $=\sqrt{16+9}$

= 5 unit

radius = 2.5 unit

20. (a)

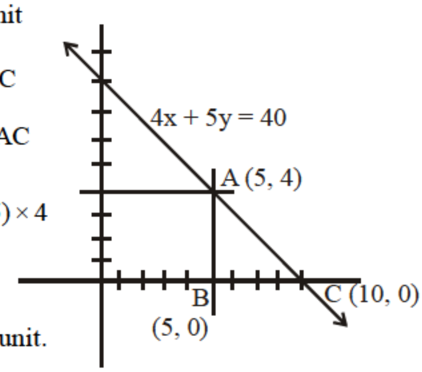
Area of ΔABC

$=\frac{1}{2}\times BC\times AC$

$=\frac{1}{2}\times(10-5)\times 4$

$=\frac{1}{2}\times 5\times 4$

Area = 10 sq unit.

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