PREREQUISITES

(2-D GEOMETRY)

DISTANCE BETWEEN TWO POINTS

(i) The distance between two points A(x_1, y_1) and B(x_2, y_2)

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

(ii)The distance from origin O to the point A(x_1, y_1) is OA = $\sqrt{x_1^2 + y_1^2}$

(iii) The distance between two points A(x_1, 0) and B(x_2, 0) lying on the X - axis

is $AB = \sqrt{(x_1 - x_2)^2 + (0 - 0)^2} = \sqrt{(x_1 - x_2)^2} = |x_1 - x_2|$

(iv) The distance between two points C(0, y_1) and D(0, y_2) lying on the Y-axis is $CD = |y_1 - y_2|$

SECTION FORMULA

(i)The point P which divides the line segment joining the points A(x_1, y_1), B(x_2, y_2) in the ratio m : n internally is given by

$$P = \left(\frac{mx_2 + nx_1}{m + n}, \frac{my_2 + ny_1}{m + n}\right) \quad (m + n \neq 0)$$

(ii)If P divides in the ratio m:n externally then P = $\left(\frac{mx_2 - nx_1}{m - n}, \frac{my_2 - ny_1}{m - n}\right) \quad (m \neq n)$

Note: If the ratio m : n is positive then P divides internally and if the ratio is negative P divides externally.

MID POINT

The mid point of the line segment joining A(x_1, y_1) and B(x_2, y_2) is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

POINTS OF TRISECTION

The points which divide the line segment $\overline{AB}$ in the ratio 1 : 2 and 2 : 1 (internally) are called the points of trisection of $\overline{AB}$.

AREA OF A TRIANGLE

The area of the triangle formed by the points $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$ is

$$\text{Area}=\frac{1}{2}\left|(x_1y_2-x_2y_1)+(x_2y_3-x_3y_2)+(x_3y_1-x_1y_3)\right|$$

$$\text{i.e., Area of ABC} = \frac{1}{2}\left|\sum(x_1y_2-x_2y_1)\right|$$

Note:1. The area of the triangle formed by the points (x_1, y_1) (x_2, y_2).(x_3, y_3) is the positive value of the determinant $\frac{1}{2}\begin{vmatrix} x_1-x_2 & y_1-y_2 \\ x_2-x_3 & y_2-y_3 \end{vmatrix}$.

2. The area of the triangle formed by the points (x_1,y_1) (x_2, y_2) and the origin is $\frac{1}{2}\left|x_1y_2-x_2y_1\right|$

AREA OF A QUADRILATERAL

The area of the quadrilateral formed by the points (x_1, y_1), (x_2,y_2), (x_3, y_3), (x_4, y_4) taken in that order is

$$\frac{1}{2}\left|x_1y_2-x_2y_1+x_2y_3-x_3y_2+x_3y_4-x_4y_3+x_4y_1-x_1y_4\right|$$

Note 1: The area of the quadrilateral formed by the points (x_1, y_1), (x_2, y_2), (x_3, y_3),(x_4, y_4) taken in order is

$$\text{Area} = \frac{1}{2}\begin{vmatrix} x_1-x_3 & y_1-y_3 \\ x_2-x_4 & y_2-y_4 \end{vmatrix}$$

CENTRES OF A TRIANGLE

Median : In a triangle, the line segment joining a vertex and the mid point of its opposite side is called a median of the triangle. The medians of a triangle are concurrent.

The point of concurrence of the medians of a triangle is called the centroid (or) centre of gravity of the triangle. It is denoted by G.

IN CENTRE OF A TRIANGLE

Internal bisector : The line which bisects the internal angle of a triangle is called an internal angle bisector of the triangle.

The point of concurrence of internal bisectors of the angles of a triangle is called the incentre of the triangle. It is denoted by I.

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

EXCENTRES OF A TRIANGLE:

The point of concurrence of internal bisector of angle A and external bisectors of angles B, C of ABC is called the ex-centre opposite to vertex A. It is denoted by I_1. The excentres of ABC opposite to the vertices B, C are respectively denoted by I_2, I_3.

I_1 = Excentre opposite to A $=\left(\frac{-ax_1+bx_2+cx_3}{-a+b+c}, \frac{-ay_1+by_2+cy_3}{-a+b+c}\right)$

I_2 = Excentre oppposite to B $=\left(\frac{ax_1-bx_2+cx_3}{a-b+c}, \frac{ay_1-by_2+cy_3}{a-b+c}\right)$

I_3 = Excentre opposite to C $=\left(\frac{ax_1+bx_2-cx_3}{a+b-c}, \frac{ay_1+by_2-cy_3}{a+b-c}\right)$

ORTHO CENTRE OF A TRIANGLE

Altitude**:** The line passing through vertex and perpendicular to opposite side of a triangle is called an altitude of the triangle. Altitudes of a triangle are concurrent. The point of concurrence is called the ortho centre of the triangle. It is denoted by “O” or ‘H’.

Circum centre of a Triangle:

Perpendicular bisector: The line passing through mid point of a side and perpendicular to the side is called the perpendicular bisector of the side.

The perpendicular bisectors of the sides of a triangle are concurrent. The point of concurrence is called **the** circum centre or the triangle. It is denoted by S.

EXERCISE

I. Find the distance between the following pairs of points. i) (4, 5), (5, 4) ii) (–3, 1), (3, 2) iii) $(a\cos a, a\sin a)$, $(a\cos b, a\sin b)$

Sol.

i) Let A = (4, 5), B = (5, 4) $\Rightarrow AB=\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$

$\Rightarrow$AB = $\sqrt{(4-5)^2+(5-4)^2} = \sqrt{1+1} = \sqrt{2}$

ii) Let A = (–3, 1), B = (3, 2) $\Rightarrow$ AB = $\sqrt{(3+3)^2+(2-1)^2} = \sqrt{36+1} = \sqrt{37}$

iii) Let A=$(a\cos a, a\sin a)$, B=$(a\cos b, a\sin b)$

AB $=\sqrt{(a\cos\alpha - a\cos\beta)^2+(a\sin\alpha - a\sin\beta)^2}$ $=\sqrt{a^2\left[2-2\cos(\alpha-\beta)\right]}=\sqrt{2a^2\left[1-\cos(\alpha-\beta)\right]}$

$$=\sqrt{4a^2\sin^2\left(\frac{\alpha-\beta}{2}\right)}=2\left|a\sin\left(\frac{\alpha-\beta}{2}\right)\right|$$

2. Find the value of 'a' if the distance between the points (a, 2), (3, 4) is $2\sqrt{2}$.

Sol. P (a, 2), Q (3, 4) are the given points.

PQ = $2\sqrt{2}$ $\Rightarrow$ PQ^2 = 8

$\Rightarrow (a-3)^2 + (2-4)^2 = 8$

$\Rightarrow (a-3)^2 = 8 - 4 = 4$

$\Rightarrow a - 3 = \pm 2 \Rightarrow a = 3 \pm 2 = 5$ or 1.

3. Find the point on the x-axis, which is equidistant from (7, 6) and (–3, 4).

Sol. Let A(7, 6), B(–3, 4)

Let P(x, 0) be the point on x-axis which is equidistant from A and B.

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

$\Rightarrow (x-7)^2 + (0-6)^2 = (x+3)^2 + (0-4)^2$

$\Rightarrow x^2 - 14x + 49 + 36 = x^2 + 6x + 9 + 16$

$\Rightarrow -14x + 85 = 6x + 25 \Rightarrow 20x = 60 \Rightarrow x = 3$

The required point is P (3, 0).

4. Find the relation between x and y, if the point (x,y) is to be equidistant from (6,–1) and (2,3).

Sol. P(x, y), A (6, –1), B (2, 3) are the given points.

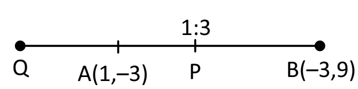
PA = PB $\Rightarrow$ PA^2 = PB^2

$\Rightarrow (x-6)^2 + (y+1)^2 = (x-2)^2 + (y-3)^2$

$\Rightarrow x^2 - 12x + 36 + y^2 + 2y + 1 = x^2 - 4x + 4 + y^2 - 6y + 9$

$\Rightarrow 8y = 8x - 24 \Rightarrow y = x - 3$

5. Find the points which divide the line segment joining A (1, –3) and B (–3, 9) in the ratio 1: 3 (i) internally and (ii) externally.



Sol. (i) Given points are A(1, –3) and B(–3, 9)

Let P be the point dividing AB internally in the ratio 1: 3.

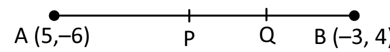
Then coordinates of P are

$$\left(\frac{1(-3)+3\cdot 1}{1+3},\frac{1\cdot 9+3(-3)}{1+3}\right)=\left(\frac{3-3}{4},\frac{9-9}{4}\right)=(0,0)$$

Let Q be the point dividing AB externally in the ratio 1 : 3. Then coordinates of Q are

$$\left(\frac{(1)(-3)-3\cdot 1}{1-3},\frac{1.9-3(-3)}{1-3}\right) \qquad =\left(\frac{-3-3}{-2},\frac{9+9}{-2}\right)=(3,-9)$$

6. Find the points of trisection of the line segment joining (5, –6) and (–3, 4).



Sol. Gvein points are A (5, –6), B (–3, 4)

Let P and Q be the points of trisection of AB.

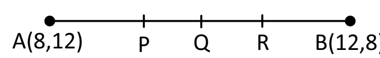
Let P divides AB in the ratio 1: 2 then Coordinates of P are $\left(\frac{1(-3)+2(5)}{1+2},\frac{1(4)+2(-6)}{1+2}\right)$

$$=\left(\frac{-3+10}{3},\frac{4-12}{3}\right)=\left(\frac{7}{3},\frac{-8}{3}\right)$$

Let Q divides AB in the ratio 2 : 1, then Coordinates of Q are $\left(\frac{2(-3)+1(5)}{2+1},\frac{2(4)+1(-6)}{2+1}\right)$

$$=\left(\frac{-6+5}{3},\frac{8-6}{3}\right)=\left(\frac{-1}{3},\frac{2}{3}\right)$$

7. Find the points which divide the line segment joining (8, 12) and (12, 8) into four equal parts.



Sol. Given points A(8, 12), B(12, 8).

Let P, Q, R be the points dividing AB into four equal parts.

Let P divides AB in the ratio 1: 3, then

Coordinates of P are $\left(\frac{1(12)+3(8)}{1+3},\frac{1(8)+3(12)}{1+3}\right)=(9,\ 11)$

Q divides AB in the ratio 1: 1

Coordinates of Q are $\left(\frac{8+12}{1+1},\frac{12+8}{2}\right)=\left(\frac{20}{2},\frac{20}{2}\right)=(10,10)$

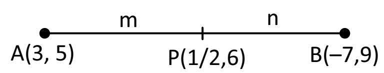
R divides AB in the ratio 3: 1, then Coordinates of R are:

$$\left(\frac{3(12)+1(8)}{3+1},\frac{3(8)+1(12)}{3+1}\right)=(11,9)$$

P (9, 11), Q (10, 10), R (11, 9) are the required points.

8. Find the ratio in which the point (1/2, 6) divides the line segment joining (3, 5) and (–7, 9).

Sol. Let A (3, 5), B (–7, 9), P (1/2, 6). P divides AB in the ratio m: n.

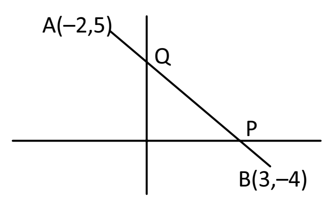


$$\frac{AP}{PB} = \frac{m}{n} = \frac{x - x_1}{x_2 - x} = \frac{\frac{1}{2} - 3}{-7 - \frac{1}{2}} = \frac{-\frac{5}{2}}{-\frac{15}{2}} = \frac{1}{3}$$

$\therefore$ P divides AB in the ratio 1 : 3.

9. In what ratio do the coordinate axes divide the line segment joining (–2, 5) and (3, –4).

Sol. A(–2, 5), B(3, –4) are the given points. AB meets the X-axis in P and Y-axis in Q.



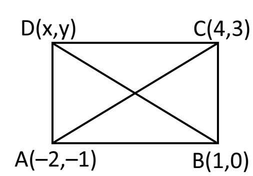
Ratio in which X-axis divides AB = $-y_1 : y_2$ i.e., = –5 : –4 = 5 : 4

Ratio in which Y-axis divides AB = $-x_1 : x_2$ i.e., = 2 : 3

10. If (–2, –1), (1, 0) and (4, 3) are three successive vertices of a parallelogram, find the fourth vertex.

Sol. Vertices of a parallelogram are A (–2, –1), B (1, 0), C (4, 3)

Let 4th vertex be D(x, y)



Diagonals AC and BD bisect each other.

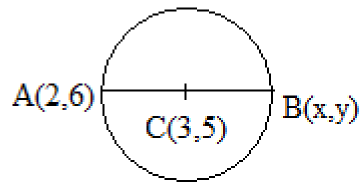
Midpoint of AC = Midpoint of BD

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

$\Rightarrow \frac{y}{2} = \frac{2}{2} \Rightarrow y = 2.$ Therefore, Coordinates of D are (1, 2).

11. A (2, 6) is one of the extremities of a diameter of a circle with centre (3, 5), find the other point.

Sol. A (2, 6), B(x, y) are the ends of the diameter.



And C(3, 5) is the centre.

Now C is the mid point of AB. $\therefore \left(\frac{2+x}{2}, \frac{6+y}{2}\right) = (3, 5)$

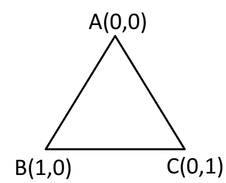
$\frac{2+x}{2} = 3 \Rightarrow 2+x = 6 \Rightarrow x = 4$ and $\frac{6+y}{2} = 5 \Rightarrow 6+y = 10 \Rightarrow y = 4$

Coordinates of the other point B are (4, 4).

12. Find the area of the triangle formed by the following points.

i) (0, 0), (1, 0), (0, 1) ii) (5, 2), (–9, –3), (–3, –5)

Sol. i) A(0, 0), B(1, 0), C(0, 1) are the vertices of the triangle.

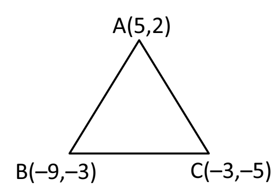


Area of ΔOAB is $= \frac{1}{2}|x_1y_2 - x_2y_1|$

$= \frac{1}{2}|1.1 - 0.0| = \frac{1}{2}$ sq.units

ii) A(5, 2), B(–9, –3), C(–3, –5) are the vertices of the triangle.

$= \frac{1}{2}\begin{vmatrix} x_2 - x_1 & y_2 - y_1 \\ x_3 - x_1 & y_3 - y_1 \end{vmatrix} = \frac{1}{2}\begin{vmatrix} -9-5 & -3-2 \\ -3-5 & -5-2 \end{vmatrix}$



$= \frac{1}{2}\begin{vmatrix} -14 & -5 \\ -8 & -7 \end{vmatrix}$

$= \frac{1}{2}|98 - 40| = \frac{58}{2} = 29$ sq.units

13. Show that the following points are collinear.

i) (0, –2), (–1, 1), (–2, 4) ii) (–1, 7), (3, –5), (4, –8)

Sol. i) A(0, –2), B(–1, 1), C(–2, 4) are the given points.

Area of $\Delta ABC = \frac{1}{2}|0(1-4) - 1(4+2) - 2(-2-1)| = \frac{1}{2}|0 - 6 + 6| = 0$

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

ii) A(–1, 7), B(3, –5), C(4, –8)

Area of ΔABC = $\frac{1}{2}\left|-1(-5+8)+3(-8-7)+4(7+5)\right|$ = $\frac{1}{2}\left|-3-45+48\right|=0$

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

14. Find the value of k, if the points (k, –1), (2, 1) and (4, 5) are collinear.

Sol. A(k, –1), B(2, 1), C(4, 5) are the given points.

A, B, C are collinear $\Rightarrow$ ΔABC = 0

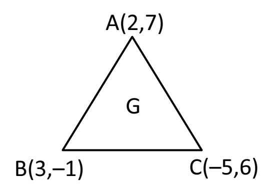
$\frac{1}{2}\left|k(1-5)+2(5+1)+4(-1-1)\right|=0$

$\left|-4k+12-8\right|=0 \Rightarrow \left|-4k+4\right|=0$

$\Rightarrow 4k=4 \Rightarrow k=1$

15. **Find the centroid of the triangle whose vertices are (2, 7), (3, –1), (–5, 6).**

Sol. A(2, 7), B(3, –1), C(–5, 6) are the vertices of the triangle.



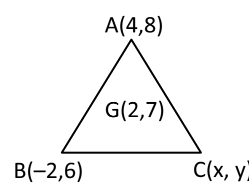
Let G be the centroid of ΔABC.

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

$=\left(\frac{2+3-5}{3},\frac{7-1+6}{3}\right)=\left(0,\frac{12}{3}\right)=(0,4)$

16. A(4, 8), B(–2, 6) are two vertices of a triangle ABC. Find the coordinates of C if the centroid of the triangle is (2, 7).

Sol. Let C(x, y) be the third vertex. Given vertices are A(4, 8), B(–2, 6) and centroid of the triangle ABC is G(2,7)



$\Rightarrow G=\left(\frac{4-2+x}{3},\frac{8+6+y}{3}\right)$

$\Rightarrow\left(\frac{x+2}{3},\frac{y+14}{3}\right)=(2,7)$

$\Rightarrow \frac{x+2}{3}=2 \Rightarrow x+2=6 \Rightarrow x=4$ and

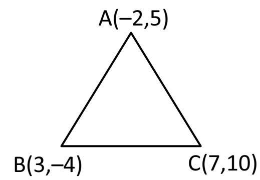
$\frac{y+14}{3}=7 \Rightarrow y+14=21 \Rightarrow y=7$

Third vertex of C is (4, 7).

II.

1. **Show that the following points taken in order from the figure mentioned against the points**.

i) (–2, 5), (3, –4), (7, 10) : right angled isosceles triangle.



Sol. A(–2, 5), B(3, –4), C(7, 10) are the given points.

$$AB^2 = (-2-3)^2 + (5+4)^2 = 25+81 = 106$$

$$BC^2 = (3-7)^2 + (-4-10)^2 = 16+196 = 212$$

$$CA^2 = (7+2)^2 + (10-5)^2 = 81+25 = 106$$

$$AB^2 = CA^2 \Rightarrow AB = CA \qquad \ldots(1)$$

$$AB^2 + CA^2 = 106 + 106 = 212 = BC^2$$

$$AB^2 + AC^2 = BC^2 \qquad \ldots(2)$$

$\therefore$ By (1) and (2), A, B, C are the vertices of a right angled isosceles triangle.

ii) (1,3), (3,–1), (–5,–5): right angled triangle.

Sol. A(1,3), B(3,–1), C(–5,–5) are the given points

$$AB^2 = (1-3)^2 + (3+1)^2 = 4+16 = 20$$

$$BC^2 = (3+5)^2 + (-1+5)^2 = 64+16 = 80$$

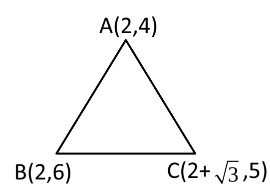
$$AC^2 = (1+5)^2 + (3+5)^2 = 36+64 = 100$$

From the above values

$$AB^2 + BC^2 = 20 + 80 = 100 = AC^2$$

$\therefore$ ABC is a right angled triangle.

iii) (2, 4), (2, 6), $(2+\sqrt{3}, 5)$: equilateral triangle.



Sol. A(2, 4), B(2, 6), C$(2+\sqrt{3}, 5)$ are the given points.

$$AB^2 = (2-2)^2 + (4-6)^2 = 0+4 = 4$$

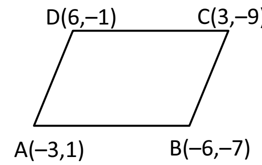
$$BC^2 = (2-2-\sqrt{3})^2 + (6-5)^2 = 3+1 = 4$$

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

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

$\therefore$ ABC is an equilateral triangle.

iv) (–3, 1), (–6, –7), (3, –9), (6, –1): parallelogram.



Sol. Let A(–3, 1), B(–6, –7), C(3, –9), D(6, –1)

$$\Rightarrow \begin{array}{l} AB^2 = (-3+6)^2 + (1+7)^2 = 9+64 = 73 \\ BC^2 = (-6-3)^2 + (-7+9)^2 = 81+4 = 85 \end{array}$$

$$CD^2 = (3-6)^2 + (-9+1)^2 = 9+64 = 73$$

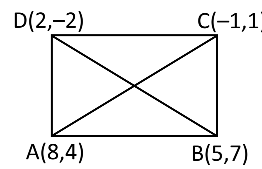
$$DA^2 = (6+3)^2 + (-1-1)^2 = 81+4 = 85$$

$AB^2 = CD^2$ and $BC^2 = DA^2$

$\therefore$ AB = CD and BC = DA

$\Rightarrow$ ABCD is a parallelogram.

v) (8, 4), (5, 7), (–1, 1), (2, –2): rectangle.



Sol. Let A(8, 4), B(5, 7), C(–1, 1), D(2, –2)

$$AB^2 = (8-5)^2 + (4-7)^2 = 9+9 = 18$$

$$BC^2 = (5+1)^2 + (7-1)^2 = 36+36 = 72$$

$$CD^2 = (-1-2)^2 + (1+2)^2 = 9+9 = 18$$

$$DA^2 = (2-8)^2 + (-2-4)^2 = 36+36 = 72$$

$AB^2 = CD^2 \Rightarrow AB = CD$

$BC^2 = DA^2 \Rightarrow BC = AD$

$$AC^2 = (8+1)^2 + (4-1)^2 = 81+9 = 90$$

$$BD^2 = (5-2)^2 + (7+2)^2 = 9+81 = 90$$

$$AC^2 = BD^2 \Rightarrow AC = BD$$

$\therefore$ ABCD is a rectangle.

vi) (3, –2), (7, 6), (–1, 2), (–5, –6): rhombus.

Sol. Let A**(3, –2), B(7, 6), C(–1, 2), D(–5, –6)**

$$AB^2 = (3-7)^2 + (-2-6)^2 = 16+64 = 80$$

$$BC^2 = (7+1)^2 + (6-2)^2 = 64+16 = 80$$

$$CD^2 = (-1+5)^2 + (2+6)^2 = 16+64 = 80$$

$$DA^2 = (-5-3)^2 + (-6+2)^2 = 64+16 = 80$$

AB = BC = CD = DA

$$AC^2 = \left(3+1\right)^2 + \left(-2-2\right)^2 = 16+16 = 32$$

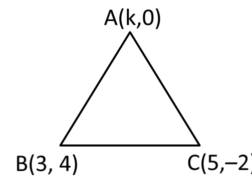
$$BD^2 = \left(7+5\right)^2 + \left(6+6\right)^2 = 144+144 = 288$$

$AC \neq BD$

$\therefore$ ABCD is a rhombus.

2. Find the value of k, if the area of the triangle formed by (k, 0), (3, 4) and (5, –2) is 10.

Sol. Let A(k, 0), B(3, 4) and C(5, –2)



$$\text{Area of } \Delta ABC = \frac{1}{2}\left|K(4+2)+3(-2-0)+5(0-4)\right| = 10$$

$$\left|6k-6-20\right| = 20 \Rightarrow 6k-26 = \pm 20$$

$$\Rightarrow 6k = 46 \text{ or } 6 \Rightarrow k = 1 \text{ or } \frac{46}{6} = \frac{23}{3}$$

3. Find the value of k if (k, 2 – 2k), (–k + 1, 2k), (–4 – k, 6 – 2k) are collinear.

Sol. A(k, 2 – 2k), B(–k + 1, 2k), C(–4 – k, 6 – 2k) are the given points.

A, B, C are collinear ΔABC = 0

$$\frac{1}{2}|\,k(2k-6+2k)+(-k+1)(6-2k-2+2k)+(-4-k)(2-2k-2k)\,| = 0$$

$$\Rightarrow k(4k-6)+4(-k+1)+(-4-k)(2-4k) = 0$$

$$\Rightarrow 4k^2-6k-4k+4-8+16k-2k+4k^2 = 0$$

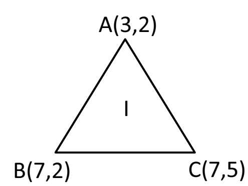
$$\Rightarrow 8k^2+4k-4 = 0 \Rightarrow 2k^2+k-1 = 0$$

$$\Rightarrow 2k^2+2k-k-1 = 0 \Rightarrow 2k(k+1)-1(k+1) = 0 \Rightarrow (k+1)(2k-1) = 0 \Rightarrow k = -1 \text{ or } 1/2$$

III.

1. Find the in-centre of the triangle whose vertices are A(3, 2), B(7, 2), C(7, 5).

Sol. Vertices are A(3, 2), B(7, 2), C(7, 5)



Sides of the triangle are

$$a = BC = \sqrt{(7-7)^2+(2-5)^2} = \sqrt{0+9} = 3$$

$$b = CA = \sqrt{(7-3)^2+(5-2)^2} = \sqrt{16+9} = 5$$

$$c = AB = \sqrt{(3-7)^2+(2-2)^2} = \sqrt{16+0} = 4$$

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

$$= \left(\frac{3\cdot 3+5\cdot 7+4\cdot 7}{3+5+4}, \frac{3\cdot 2+5\cdot 2+4\cdot 5}{3+5+4}\right)$$

$$= \left(\frac{9+35+28}{12}, \frac{6+10+20}{12}\right)$$

$$= \left(\frac{72}{12}, \frac{36}{12}\right) = (6, 3)$$

PROBLEMS FOR PRACTICE

1. **Find the area of the triangle formed by the points (1, 2), (3, –4) and (–2, 0).**

Ans**. 11**

2. **Find the area of the triangle formed by the points (9, –7), (2, 4) and (0, 0).**

Ans. 25

3. **Find the value of x, if the area of the triangle formed by (10, 2), (–3, –4) and (x, 1) is 5.**

Ans. 19/2 or 37/6

4. **Show that the triangle formed by the points (4, 4), (3, 5) and (–1, –1) is a right angled triangle.**

5. **The centroid of the triangle ABC is (2, 7). The points B and C lie on X, Y axes respectively and A= (4, 8). Find B and C.**

Ans. B (2, 0), C (0, 13)

6. **Find the in-centre of the triangle formed by the points A(7, 9), B(3, –7) and C(–3, 3).**

ANS. $\left(13-8\sqrt{2}, 2\sqrt{2}-1\right)$