UNIT 3: CO-ORDINATE GEOMETRY

CHAPTER 6

LINE (in two-dimensions)

Syllabus

- Review : Concepts of co-ordinate geometry, graphs of linear equations. Distance formula. Section formula (internal division). Area of a triangle.

Trend Analysis

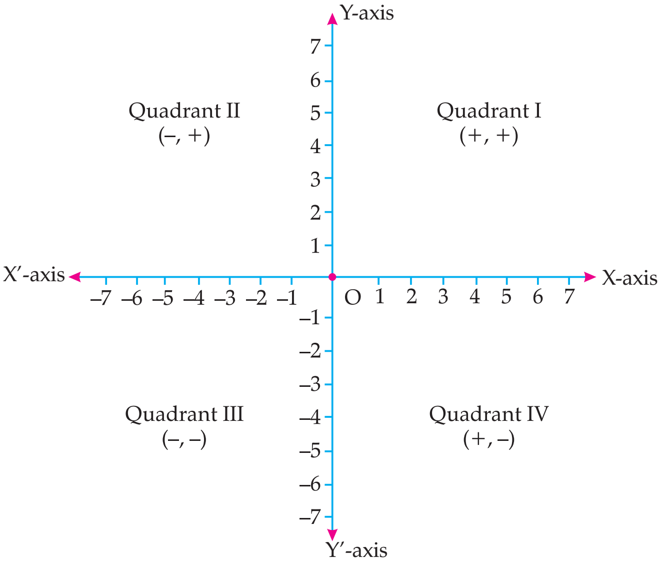
List of Concepts	2018		2019		2020	
	Delhi	Outside Delhi	Delhi	Outside Delhi	Delhi	Outside Delhi
Distance between two points and section formula	1 Q (2 M) 1 Q (3 M)		1 Q (1 M) 1 Q (3 M)	1 Q (3 M)	2 Q (1 M) 1 Q (3 M)	3 Q (1 M) 1 Q (3 M) 1 Q (4 M)
Area of a Triangle	1 Q (3 M)		2 Q (3 M)		1 Q (1 M) 1 Q (3 M)	1 Q (3 M)

TOPIC - 1

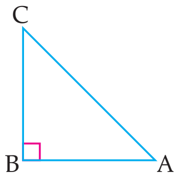
Distance between two points and Section formula

Revision Notes

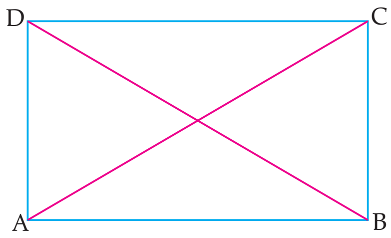
- Two perpendicular number lines intersecting at origin are called co-ordinate axes. The horizontal line is the X-axis (denoted by X'OX) and the vertical line is the Y-axis (denoted by Y'OY).



- The point of intersection of X-axis and Y-axis is called origin and denoted by O.
- Cartesian plane is a plane obtained by putting the co-ordinate axes perpendicular to each other in the plane. It is also called co-ordinate plane or XY-plane.
- The x-co-ordinate of a point is its perpendicular distance from Y-axis.
- The y-co-ordinate of a point is its perpendicular distance from X-axis.
- The point where the X-axis and the Y-axis intersect has co-ordinate point (0, 0).
- The abscissa of a point is the x-co-ordinate of the point.
- The ordinate of a point is the y-co-ordinate of the point.
- If the abscissa of a point is x and the ordinate of the point is y, then (x, y) is called the co-ordinates of the point.
- The axes divide the Cartesian plane into four parts called the quadrants (one fourth part), numbered I, II, III and IV anti-clockwise from OX.
- The co-ordinates of a point on the X-axis are of the form $(x, 0)$ and that of the point on Y-axis are $(0, y)$.
- Sign of co-ordinates depicts the quadrant in which it lies. The co-ordinates of a point are of the form (+, +) in the first quadrant, (–, +) in the second quadrant, (–, –) in the third quadrant and (+, –) in the fourth quadrant.
- Three points A, B and C are collinear if the distances AB, BC and CA are such that the sum of two distances is equal to the third.
- Three points A, B and C are the vertices of an equilateral triangle if $AB = BC = CA$.
- The points A, B and C are the vertices of an isosceles triangle if $AB = BC$ or $BC = CA$ or $CA = AB$.
- Three points A, B and C are the vertices of a right triangle, if $AB^2 + BC^2 = CA^2$.

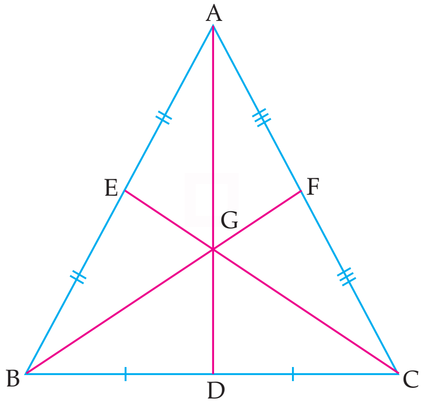


- For the given four points A, B, C and D :

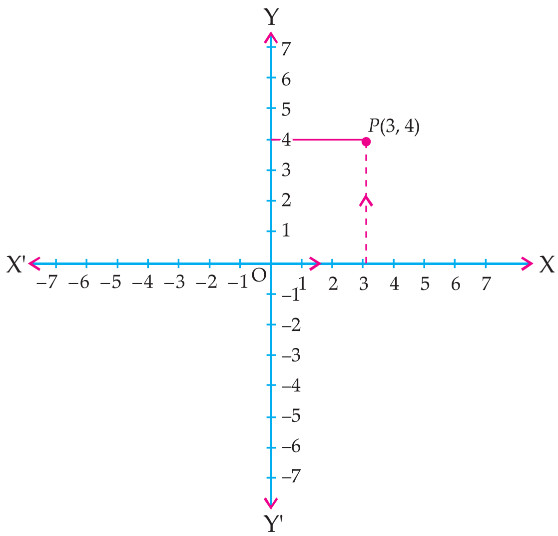


1. If $AB = BC = CD = DA$; $AC = BD$, then ABCD is a square.
2. If $AB = BC = CD = DA$; $AC \neq BD$, then ABCD is a rhombus.
3. If $AB = CD$, $BC = DA$; $AC = BD$, then ABCD is a rectangle.
4. If $AB = CD$, $BC = DA$; $AC \neq BD$, then ABCD is a parallelogram.

- Diagonals of a square, rhombus, rectangle and parallelogram always bisect each other.
- Diagonals of rhombus and square bisect each other at right angle.
- All given points are collinear, if the area of the obtained polygon is zero.
- Three given points are collinear, if the area of triangle is zero.
- Centroid is the point of intersection of the three medians of a triangle. In the figure, G is the centroid of a triangle ABC.



- Centroid divides each median of a triangle in a ratio of 2 : 1 from vertex to base of the side.
- If $x \neq y$, then $(x, y) \neq (y, x)$ and if $(x, y) = (y, x)$, then $x = y$.
- To plot a point P(3, 4) in the cartesian plane.
  (i) A distance of 3 units along X-axis.
  (ii) A distance of 4 units along Y-axis.



Know the Formulae

- The distance between two points *i.e.*, P(x_1, y_1) and Q(x_2, y_2) is

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

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

- Co-ordinates of point (x, y) which divides the line segment by joining the points (x_1, y_1) and (x_2, y_2) in the ratio $m : n$ internally are

$$x = \left(\frac{mx_2 + nx_1}{m+n}\right) \text{ and } y = \left(\frac{my_2 + ny_1}{m+n}\right)$$

- Co-ordinates of mid-point of the line segment by joining the points (x_1, y_1) and (x_2, y_2) are

$$x = \left(\frac{x_2 + x_1}{2}\right) \text{ and } y = \left(\frac{y_2 + y_1}{2}\right)$$

Know the Facts

- Co-ordinate geometry is the system of geometry where the position of points on the plane is described using an ordered pair of numbers.
- Cartesian plane was discovered by ***Rene Descartes***.
- The other name of co-ordinate geometry is Analytical Geometry.
- Co-ordinate Geometry acts as a bridge between the Algebra and Geometry.
- Medians of a triangle are concurrent. The point of concurrency is called the centroid.
- Trisection of a line segment means dividing it into 3 equal parts, so 2 points are required.
- Centroid of a triangle divides its median in the ratio of 2 : 1.

How is it done on the GREENBOARD?

Q.1. Find the point of trisection of the line segment joining the points (5, –6) and (–7, 5).

Solution

Step I: Diagrammatic representation.

Points of trisections divides line segment into three equal parts.

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

Step II: The ratio of AP : PQ : QB = 1 : 1 : 1

or, $\frac{AP}{PB} = \frac{1}{2}$ and $\frac{AQ}{QB} = \frac{2}{1}$

Step III: finding co-ordinates of P using section formula.

1 : 2

$$x_1 = \frac{1(-7)+2(5)}{1+2} = \frac{3}{3} = 1$$

$$y_1 = \frac{1(5)+2(-6)}{1+2} = \frac{-7}{3}$$

$\therefore$ $P(x_1, y_1)$ is $\left(1, \frac{-7}{3}\right)$.

Step IV: Finding co-ordinates of Q using section formula

2 : 1

$$x_2 = \frac{2(-7)+1(5)}{2+1} = \frac{-9}{3} = -3$$

$$y_2 = \frac{2(5)+1(-6)}{2+1} = \frac{4}{3}$$

$\therefore$ $Q(x_2, y_2)$ is $\left(-3, \frac{4}{3}\right)$.

Very Short Answer Type Questions — 1 mark each

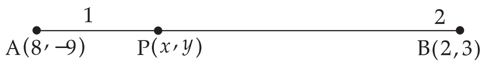
AI **Q. 1. In which quadrant lies the point which divides the line segment joining the points (8, – 9) and (2, 3) in ratio 1 : 2 internally ?**

U [CBSE SQP, 2020]

Sol. IV quadrant.

[CBSE SQP Marking Scheme, 2020]

Detailed Solution:



$m = 1, n = 2$

Given, $(x_1, y_1) = (8, -9)$

$(x_2, y_2) = (2, 3)$

$$(x, y) = \left[\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right] \quad \frac{1}{2}$$

$$(x, y) = \left[\frac{1\times 2 + 2\times 8}{1+2}, \frac{1\times 3 + 2\times(-9)}{1+2}\right]$$

$$(x, y) = \left[\frac{2+16}{3}, \frac{3-18}{3}\right]$$

$$(x, y) = \left[\frac{18}{3}, \frac{-15}{3}\right]$$

$$(x, y) = (6, -5)$$

Hence, the point (6, – 5) lies in IV quadrant. ½

AI **Q. 2. Find the distance between the points ($a\cos\theta + b\sin\theta$, 0) and (0, $a\sin\theta - b\cos\theta$).**

A [CBSE Delhi Set-I, 2020]

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

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

$$\therefore \quad \text{Distance} = \left|\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right| \quad \frac{1}{2}$$

$$= \left|\sqrt{(0 - a\cos\theta - b\sin\theta)^2 + (a\sin\theta - b\cos\theta - 0)^2}\right|$$

$$= \left|\sqrt{(-1)^2(a\cos\theta + b\sin\theta)^2 + (a\sin\theta - b\cos\theta)^2}\right|$$

$$= \left|\sqrt{\begin{array}{l} a^2\cos^2\theta + b^2\sin^2\theta + 2ab\cos\theta\sin\theta \\ + a^2\sin^2\theta + b^2\cos^2\theta - 2ab\sin\theta\cos\theta \end{array}}\right|$$

$$= \left|\sqrt{a^2(\sin^2\theta + \cos^2\theta) + b^2(\sin^2\theta + \cos^2\theta)}\right|$$

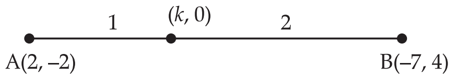
$$= \left|\sqrt{a^2\times 1 + b^2\times 1}\right|$$

$$= \left|\sqrt{a^2 + b^2}\right| \text{ unit} \quad \frac{1}{2}$$

AI **Q. 3. If the point P(k, 0) divides the line segment joining the points A(2, –2) and B(–7, 4) in the ratio 1 : 2, then find the value of k.**

A [CBSE Delhi Set-I, 2020]

Sol.



½

$$\therefore \quad k = \frac{1(-7) + 2(2)}{1+2}$$

$$\left[\because\ x = \frac{mx_2 + nx_1}{m+n}\right]$$

$$\Rightarrow \quad k = \frac{-7+4}{3}$$

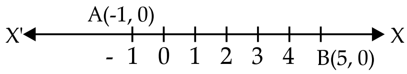
$$\Rightarrow \quad 3k = -3$$

$$\Rightarrow \quad k = -1. \quad \frac{1}{2}$$

AI **Q. 4. The point P on X-axis equidistant from the points A(–1, 0) and B(5, 0).**

A [CBSE OD Set-I, 2020]

Sol. Let the position of the point P on X-axis be (x, 0), then



$$PA^2 = PB^2$$

$$\Rightarrow \quad (x+1)^2 + (0)^2 = (5-x)^2 + (0)^2 \quad \frac{1}{2}$$

$$\Rightarrow \quad x^2 + 2x + 1 = 25 + x^2 - 10x$$

$$\Rightarrow \quad 2x + 10x = 25 - 1$$

$$\Rightarrow \quad 12x = 24$$

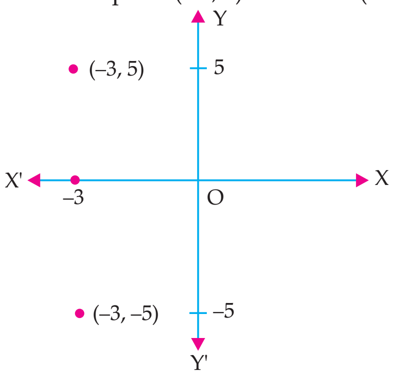
$$\Rightarrow \quad x = 2$$

Hence, the point P (x, 0) is (2, 0). ½

Q. 5. Find the co-ordinates of the point which is reflection of point (–3, 5) in X-axis.

A [CBSE OD Set-I, 2020]

Sol. By using the graph of coordinate plane, we have the reflection of point (– 3, 5) is x-axis is (– 3, – 5). ½



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Q. 6. If the point P(6, 2) divides the line segment joining A(6, 5) and B(4, y) in the ratio 3 : 1, then the value of y.

A [CBSE OD Set-I, 2020]

Sol. Here, $x_1 = 6, y_1 = 5$

and $x_2 = 4, y_2 = y$

Then $x = \dfrac{mx_2 + nx_1}{m+n}$ and $y = \dfrac{my_2 + ny_1}{m+n}$ ½

$\therefore \quad 2 = \dfrac{3 \times y + 1 \times 5}{3+1} = \dfrac{3y+5}{4}$

$\Rightarrow \quad 3y + 5 = 8$

$\Rightarrow \quad 3y = 8 - 5 = 3$

$\Rightarrow \quad y = 1.$ ½

AI Q. 7. Find the coordinates of a point A, where AB is diameter of a circle whose centre is (2, –3) and B is the point (1, 4). A [CBSE Delhi Set-I, II, III, 2019]

Sol. Let the point A be (x, y)

$\therefore \quad \dfrac{x+1}{2} = 2$ and $\dfrac{4+y}{2} = -3$ ½

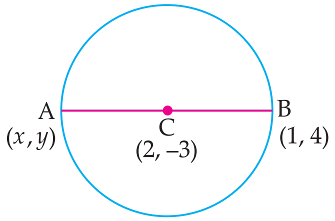
$\Rightarrow \quad x = 3$ and $y = -10$ ½

$\therefore$ Point A is (3, –10)

[CBSE Marking Scheme, 2019]

Detailed Solution:

Since, AB is the diameter, center C must be the mid point of the diameter AB.



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Let the co-ordinates of point A be (x, y).

x-coordinate of $C = \dfrac{x+1}{2}$

$\Rightarrow \quad 2 = \dfrac{x+1}{2}$

$\Rightarrow \quad 4 = x + 1$

$\Rightarrow \quad x = 3$

and y-coordinate of $C = \dfrac{y+4}{2}$

$\Rightarrow \quad -3 = \dfrac{y+4}{2}$

$\Rightarrow \quad -6 = y + 4$

$\Rightarrow \quad y = -10$

Hence, coordinates of point A is (3, –10). ½

Q. 8. The distance between point A(5, – 3) and B(13, m) is 10 units. Calculate the value of m.

[CBSE Delhi Board term, 2019]

Topper Answer, 2019

Sol. Given, A = 5, −3
B = 13, m

AB = 10 units
Using distance formula;

$\sqrt{(13-5)^2 + (m+3)^2} = 10$

On squaring;

$8^2 + (m+3)^2 = 100$

$\Rightarrow (m+3)^2 = 100 - 64$

$\Rightarrow \sqrt{(m+3)^2} = \sqrt{36}$

$\Rightarrow (m+3) = \pm 6$

Considering only positive value;

$m = 6 - 3$

$\Rightarrow \boxed{m = 3}$

1

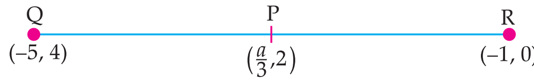
Q. 9. Find the value of a, for which point P $\left(\frac{a}{3}, 2\right)$ is the midpoint of the line segment joining the points Q(–5, 4) and R(–1, 0). A [CBSE SQP, 2018]

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

$$\frac{a}{3} = \frac{-6}{2} \Rightarrow a = -9 \qquad \mathbf{1}$$

[CBSE Marking Scheme, 2018]

Detailed Solution:



P is the mid-point of QR ½

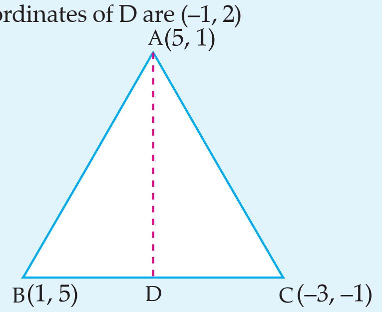
or, $$\frac{a}{3} = \frac{-5+(-1)}{2}$$

or, $$\frac{a}{3} = \frac{-6}{2}$$

or, $$a = -9. \qquad ½$$

Q. 10. A(5, 1), B(1, 5) and C(–3, –1) are the vertices of ΔABC. Find the length of median AD. U [CBSE Compt. Set-I,II,III, 2018]

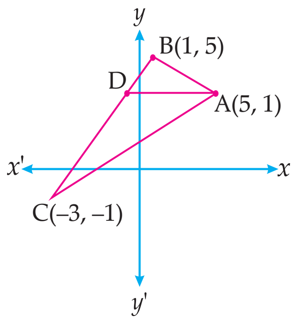
Sol. Coordinates of D are (–1, 2) ½



$$AD = \sqrt{(5+1)^2+(1-2)^2} = \sqrt{37} \text{ unit} \qquad ½$$

[CBSE Marking Scheme, 2018]

Detailed Solution:



Here D is the mid-point of BC.

Then, the coordinates of D

$$= \left(\frac{1-3}{2}, \frac{5-1}{2}\right) = (-1, 2) \qquad ½$$

$$\therefore \quad AD = \left|\sqrt{(5+1)^2+(1-2)^2}\right|$$

$$= \left|\sqrt{36+1}\right| = \left|\sqrt{37}\right|$$

Hence, the length of AD is $\sqrt{37}$ unit. ½

Q. 11. If the distance between the points (4, k) and (1, 0) is 5, then what can be the possible values of k ? U [Delhi Set I, II, III, 2017]

Sol. Using distance formula,

$$\left|\sqrt{(4-1)^2+(k-0)^2}\right| = 5 \qquad ½$$

or, $$3^2 + k^2 = 25$$

$$k = \pm 4 \qquad ½$$

[CBSE Marking Scheme, 2017]

Short Answer Type Questions-I — 2 marks each

AI **Q. 1. Find the point on X-axis which is equidistant from the points (2, – 2) and (– 4, 2).** U [CBSE SQP, 2020-21]

Sol. Let P(x, 0) be a point on x-axis

$$PA = PB \qquad ½$$

$$PA^2 = PB^2 \qquad ½$$

$$(x-2)^2 + (0+2)^2 = (x+4)^2 + (0-2)^2$$

$$x^2 + 4 - 4x + 4 = x^2 + 16 + 8x + 4$$

$$-4x + 4 = 8x + 16 \qquad ½$$

$$x = -1 \qquad ½$$

Hence co-ordinate of required point are (–1, 0).

AI **Q. 2. P(–2, 5) and Q(3, 2) are two points. Find the co-ordinates of the point R on PQ such that $PR = 2QR$.** A [CBSE SQP, 2020-21]

Sol. $$PR : QR = 2 : 1 \qquad ½$$

$$R(x, y) = \left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$$

$$R\left(\frac{1(-2)+2(3)}{2+1}, \frac{1(5)+2(2)}{2+1}\right) \qquad \mathbf{1}$$

$$R\left(\frac{4}{3}, 3\right). \qquad ½$$

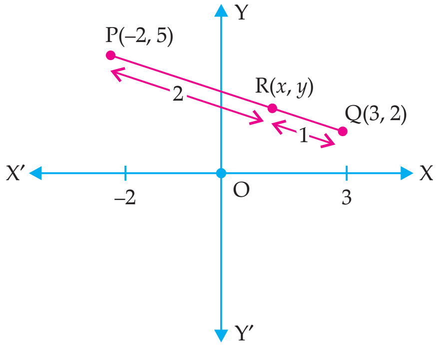
[CBSE Marking Scheme, 2020-21]

Detailed Solution:

Given two points : P(– 2, 5) and Q(3, 2)

Here, $x_1 = -2, x_2 = 3$

and $y_1 = 5, \quad y_2 = 2$



½

and also given, $PR = 2QR$

$$\Rightarrow \quad \frac{PR}{QR} = \frac{2}{1}$$

$$\Rightarrow \quad PR : QR = 2 : 1$$ ½

Then $R(x, y) = \left(\dfrac{mx_2 + nx_1}{m+n}, \dfrac{my_2 + ny_1}{m+n}\right)$

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

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

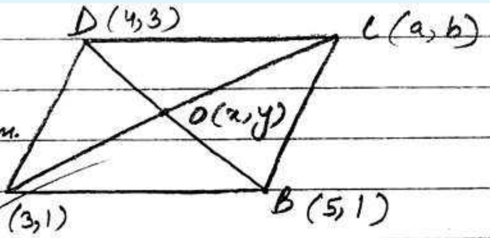
$$= \left(\frac{4}{3}, \frac{9}{3}\right) = \left(\frac{4}{3}, 3\right)$$

Q. 3. In parallelogram ABCD, A(3, 1), B(5, 1) C(*a*, *b*) and D(4, 3) are the vertices. Find vertex C(*a*, *b*).

A [CBSE Board Term, 2019]

Topper Answer, 2019

Sol.



Points A, B, C, D are vertices of a parallelogram.

We know that diagonals of a parallelogram bisect each other.

∴ O is the midpoint of both AC and BD.

Using section formula for mid-point.

on BD,

$x = \dfrac{4+5}{2}$, $y = \dfrac{3+1}{2}$

$\Rightarrow \quad x = \dfrac{9}{2}$, $y = 2$.

on AC

$x = \dfrac{3+a}{2}$, $y = \dfrac{b+1}{2}$

$\Rightarrow \quad \dfrac{9}{2} = \dfrac{3+a}{2}$, $y\ 2 = \dfrac{b+1}{2}$ $\Rightarrow$ $\boxed{a=6}$, $\boxed{b=3}$

$\Rightarrow \quad a = 6$, $b = 3$.

2

Q. 4. Find the coordinates of the point P which divides the join of A(–2, 5) and B(3, – 5) in the ratio 2 : 3.

A [CBSE SQP, 2018]

Sol. Let $x = \dfrac{6-6}{5} = 0$ **1**

$\therefore$ $y = \dfrac{-10+15}{5} = 1$ **1**

[CBSE Marking Scheme, 2018]

Detailed Solution:

P(x, y)

A (–2,5) ——— 2 : 3 ——— B (3,–5)

Since, $x = \dfrac{mx_2 + nx_1}{m+n}$ ½

and $y = \dfrac{my_2 + ny_1}{m+n}$ ½

$x = \dfrac{2\times 3+3\times(-2)}{2+3} = 0$ ½

and $y = \dfrac{2\times(-5)+3\times 5}{2+3} = \dfrac{5}{5} = 1$ ½

So, the point is (0, 1).

Q. 5. Find the ratio in which P(4, m) divides the line segment joining the points A(2, 3) and B(6, – 3). Hence find m. C + A [CBSE Delhi/OD Set-2018]

Sol. A (2,3) ——k—— P (4, m) ——1—— B (6,–3) ½

Let $AP : PB = k : 1$

$\dfrac{6k+2}{k+1} = 4$

$\Rightarrow$ $k = 1$, ratio is 1 : 1 **1**

Hence $m = \dfrac{-3+3}{2} = 0$ ½

[CBSE Marking Scheme, 2018]

Detailed Solution:

Topper Answer, 2018

Points A(2,3), B(6,–3) divided by P(4,m).

Let the ratio be k:1.

By sec. section formula,

$P(4,m) = \left(\dfrac{mx_2+nx_1}{m+n}, \dfrac{my_2+ny_1}{m+n}\right)$

$(4,m) = \left(\dfrac{6k+2}{k+1}, \dfrac{-3k+3}{k+1}\right)$

$\Rightarrow \dfrac{6k+2}{k+1} = 4$

$6k+2 = 4k+4$

$2k = 2$

$k = 1.$ $\rightarrow$ The ratio is 1:1.

now, $m = \dfrac{-3k+3}{k+1}$

$m = \dfrac{-3+3}{1+1}$

$m = 0.$ $\rightarrow$ $\boxed{\text{Value of m is 0, the point is P(4,0).}}$

2

AI **Q. 6. If $\left(1, \dfrac{p}{3}\right)$ is the mid point of the line segment joining the points (2, 0) and $\left(0, \dfrac{2}{9}\right)$, then show that the line $5x + 3y + 2 = 0$ passes through the point (– 1, $3p$).**

A [CBSE SQP, 2017]

Sol. Since $\left(1, \dfrac{p}{3}\right)$ is the mid point of the line segment joining the points (2, 0) and $\left(0, \dfrac{2}{9}\right)$.

$\therefore$ $\dfrac{p}{3} = \dfrac{0+\dfrac{2}{9}}{2} = \dfrac{2p}{3} = \dfrac{2}{9}$

$p = \dfrac{1}{3}$ **1**

Hence, the line $5x + 3y + 2 = 0$, passes through the point $(-1, 1)$ as $5(-1) + 3(1) + 2 = 0$. **1**

[CBSE Marking Scheme, 2017]

Q. 7. In what ratio does the point P(– 4, 6) divide the line segment joining the points A(– 6, 10) and B(3, – 8) ? A [Delhi Comptt. Set-I, II, III 2017]

Sol. Let $AP : PB = k : 1$ **½**

$\therefore \quad \dfrac{3k-6}{k+1} = -4$

or, $\quad 3k - 6 = -4k - 4$ **1**

or, $\quad 7k = 2$

$\quad k = \dfrac{2}{7}$

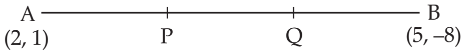
Hence, $\quad AP : PB = 2 : 7$ **½**

[CBSE Marking Scheme, 2017]

Q. 8. If the line segment joining the points A(2, 1) and B(5, – 8) is trisected at the points P and Q, find the coordinates P.

A [Outside Delhi Comptt. Set-I, III, 2017]

Sol.



Let P(x, y) divides AB in the ratio 1 : 2. **1**

$\therefore$ Using section formula

$$x = \frac{1\times5+2\times2}{1+2} = 3$$

and $$y = \frac{1\times-8+2\times1}{1+2} = -2$$ **1**

Hence coordinates of P are (3, – 2).

Q. 9. If the distances of P(x, y) from A(5, 1) and B(–1, 5) are equal, then prove that $3x = 2y$.

U [CBSE OD, Set-II, 2017, 2015]

Topper Answer, 2017

Sol.

PA = PB

$\therefore PA^2 = PB^2$

by distance formula,

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

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

$\cancel{25} - 10x + \cancel{x^2} + \cancel{1} - 2y + \cancel{y^2} = \cancel{1} + 2x + \cancel{x^2} + \cancel{25} - 10y + \cancel{y^2}$

$-10x - 2y = 2x - 10y$

$8y = 12x$

$\cancel{4}(2y) = \cancel{4}(3x)$

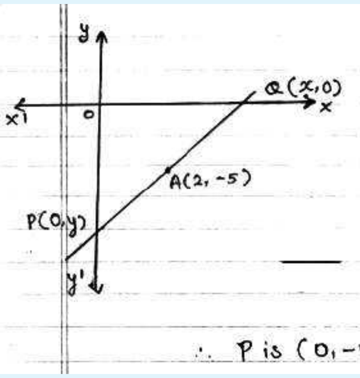
$\therefore 3x = 2y$

Hence, proved. **2**

Q. 10. 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 find the coordinates of P and Q. U [CBSE OD, Set-III, 2017]

Topper Answer, 2017

Sol.



let coordinate of P be (0, y) and of Q be (x, 0).

A (2, -5) is mid point of PQ.

by section formula,

$(2,-5) = \left(\dfrac{0+x}{2}, \dfrac{y+0}{2}\right)$

$2 = \dfrac{x}{2}$ and $-5 = \dfrac{y}{2}$

$\therefore x = 4$ and $y = -10$.

$\therefore$ P is (0, –10) and Q is (4, 0) **2**

Q. 11. The x-coordinate of a point P is twice its y-coordinate. If P is equidistant from Q(2, –5) and R(–3, 6), find the co-ordinates of P.

U [CBSE, Delhi Set I, II, III, 2016]

Sol. Let the point P be $(2y, y)$ **1**

Given, $PQ = PR$

or, $\left|\sqrt{(2y-2)^2+(y+5)^2}\right| = \left|\sqrt{(2y+3)^2+(y-6)^2}\right|$ ½

Solving to get $y = 8$

Hence, coordinates of point P are (16, 8). ½

[CBSE Marking Scheme, 2016]

Detailed Solution:

Let the point P be $(2y, y)$

Given, $PQ = PR$ **1**

or, $\left|\sqrt{(2y-2)^2+(y+5)^2}\right| = \left|\sqrt{(2y+3)^2+(y-6)^2}\right|$ ½

Squaring both sides

$4y^2 - 8y + 4 + y^2 + 25 + 10y$

$= 4y^2 + 12y + 9 + y^2 + 36 - 12y$

or, $2y = 16$ or $y = 8$

Hence, coordinates of point P are (16, 8). ½

Q. 12. Find the ratio in which Y-axis divides the line segment joining the points A(5, –6) and B(–1, –4). Also find the co-ordinates of the point of division. A [CBSE, Delhi Set I, II, III, 2016]

Sol. Let the point on y-axis be $(0, y)$ and $AP : PB = k : 1$. ½

Therefore $\dfrac{5-k}{k+1} = 0$ gives $k = 5$

Hence, required ratio is 5 : 1 ½

$$y = \frac{-4(5)-6}{6} = \frac{-13}{3}$$ ½

Hence, point on Y-axis is $\left(0, \dfrac{-13}{3}\right)$. ½

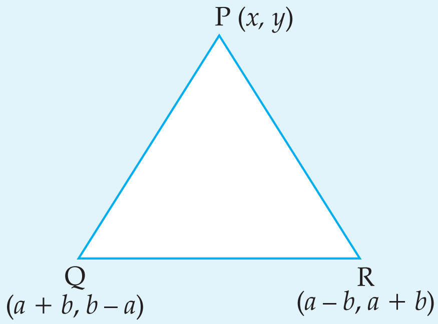
[CBSE Marking Scheme, 2016]

AI **Q. 13. If the point P(x, y) is equidistant from the points Q($a + b, b - a$) and R($a - b, a + b$), then prove that $bx = ay$.** [OD, Set I, II, III, 2016]

A [CBSE SQP, 2016]

Sol. $|PQ| = |PR|$

$$\left|\sqrt{[x-(a+b)]^2+[y-(b-a)]^2}\right| = \left|\sqrt{[x-(a-b)]^2+[y-(b+a)]^2}\right|$$



Squaring, we get

$[x - (a + b)]^2 + [y - (b - a)]^2$

or, $[x - a - b]^2 - [x - a + b]^2$

$= (y - a - b)^2 - (y - b + a)^2$

or, $(x - a - b + x - a + b)(x - a - b - x + a - b)$

$= (y - a - b + y - b + a)(y - a - b - y + b - a)$

or, $(2x - 2a)(-2b) = (2y - 2b)(-2a)$

or, $(x - a)b = (y - b)a$

or, $bx = ay$. **Hence proved. 1**

[CBSE Marking Scheme, 2016]

Q. 14. Prove that the point (3, 0), (6, 4) and (–1, 3) are the vertices of a right angled isosceles triangle.

U [CBSE, OD Set I, II, III, 2016]

Sol. Let A(3, 0), B(6, 4) and C(–1, 3)

$\therefore AB^2 = (3 - 6)^2 + (0 - 4)^2 = 9 + 16 = 25$ ½

$BC^2 = (6 + 1)^2 + (4 - 3)^2 = 49 + 1 = 50$ ½

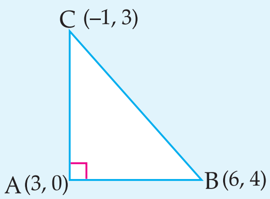
and $CA^2 = (-1 - 3)^2 + (3 - 0)^2 = 16 + 9 = 25$ ½

$AB^2 = CA^2$ or, $AB = CA$

$\therefore$ Triangle is isosceles.

$25 + 25 = 50$

Also, $AB^2 + CA^2 = BC^2$ ½



Since, Pythagoras theorem is verified, therefore triangle is a right angled triangle.

[CBSE Marking Scheme, 2016]

Q. 15. If the mid-point of the line segment joining A$\left[\dfrac{x}{2}, \dfrac{y+1}{2}\right]$ and B(x + 1, y – 3) is C(5, – 2), find x, y. U [CBSE Board Term-2, 2016]

Sol.

At mid-point of AB $= \left(\dfrac{\dfrac{x}{2}+x+1}{2}\right) = 5$

or, $x = 6$ **1**

$$\left(\dfrac{\dfrac{y+1}{2}+y-3}{2}\right) = -2$$

$$y + 1 + 2y - 6 = -8$$

or, $y = -1.$ **1**

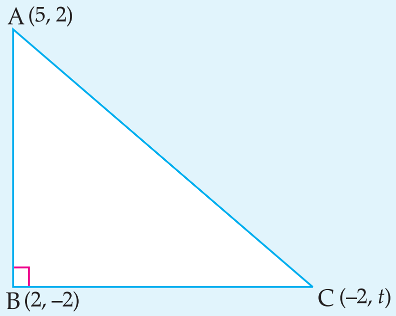
[CBSE Marking Scheme, 2016]

Q. 16. If A (5, 2), B (2, – 2) and C (–2, *t*) are the vertices of a right angled triangle with $\angle B$ = 90°, then find the value of *t*. U [CBSE Board, 2015]

Sol. $AB^2 = (2-5)^2 + (-2-2)^2 = 9 + 16 = 25$

$BC^2 = (-2-2)^2 + (t+2)^2 = 16 + (t+2)^2$

$AC^2 = (5+2)^2 + (2-t)^2 = 49 + (2-t)^2$ **1**



Since, ΔABC is a right angled triangle.

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

or, $49 + (2-t)^2 = 25 + 16 + (t+2)^2$

or, $49 + 4 - 4t + t^2 = 41 + t^2 + 4t + 4$

or, $53 - 4t = 45 + 4t$

or, $8t = 8$

$\therefore$ $t = 1$ **1**

[CBSE Marking Scheme, 2015]

Q. 17. Show that the points (a, a), $(-a, -a)$ and $(-\sqrt{3}a, \sqrt{3}a)$ are the vertices of an equilateral triangle. U [Foreign Set I, II, III, 2015]

Sol. Let A(a, a), B$(-a, -a)$ and C$(-\sqrt{3}\,a, \sqrt{3}\,a)$

Here, $AB = \left|\sqrt{(a+a)^2+(a+a)^2}\right| = 2\sqrt{2}a$ unit ½

$$BC = \left|\sqrt{(-a+\sqrt{3}\,a)^2+(-a-\sqrt{3}\,a)^2}\right|$$

$$= \left|\sqrt{a^2+3a^2-2\sqrt{3}a^2+a^2+2\sqrt{3}a^2+3a^2}\right|$$

$= \sqrt{8a^2} = 2\sqrt{2}a$ unit ½

and $AC = \left|\sqrt{(a+\sqrt{3}a)^2+(a-\sqrt{3}a)^2}\right|$ ½

$$\left|\sqrt{a^2+3a^2+2\sqrt{3}a^2+a^2+3a^2-2\sqrt{3}a^2}\right| = 8a^2$$

$$= 2\sqrt{2}a \text{ unit}$$

Since $AB = BC = AC$, therefore ABC is an equilateral triangle. ½

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-II

3 marks each

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

Sol. By using section formula,

A(2, 5) —3— C(–1, 2) —4— B(*x*, *y*) ½

$$-1 = \frac{mx_2+nx_1}{m+n}$$

$= \dfrac{3\times x+4\times 2}{3+4} = \dfrac{3x+8}{7}$ ½

$\Rightarrow$ $3x + 8 = -7$

$\Rightarrow$ $3x = -15$

$\Rightarrow$ $x = -5$ ½

and $2 = \dfrac{my_2+ny_1}{m+n}$

$= \dfrac{3\times y+4\times 5}{3+4} = \dfrac{3y+20}{7}$ ½

$\Rightarrow$ $3y + 20 = 14$

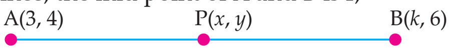
$\Rightarrow$ $3y = 14 - 20 = -6$

$\Rightarrow$ $y = -2$ ½

Hence, the coordinates of $B(x, y)$ is $(-5, -2)$. ½

AI **Q. 2. If the mid-point of the line segment joining the points A(3, 4) and B(k, 6) is P(x, y) and $x + y - 10 = 0$, find the value of k.** A + U **[CBSE, OD Set-I, 2020]**

Sol. Since, the mid point of A and B is P,



$$\frac{3+k}{2} = x$$

and $$y = \frac{4+6}{2} = \frac{10}{2} = 5 \qquad 1$$

Also, given, $x + y - 10 = 0$

Substituting the value of $x = \frac{3+k}{2}$ and $y = 5$, we get

$$\Rightarrow \quad \frac{3+k}{2} + 5 - 10 = 0 \qquad 1$$

$$\Rightarrow \quad \frac{3+k}{2} = 5$$

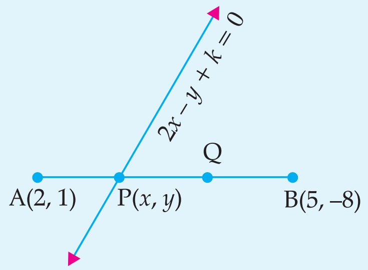
$$\Rightarrow \quad 3 + k = 10$$

$$\Rightarrow \quad k = 10 - 3 = 7.$$

Hence, the value of k is 7. 1

AI **Q. 3. The line segment joining the points A(2, 1) and B(5, –8) is trisected at the points P and Q such that P is nearer to A. If P also lies on the line given by $2x - y + k = 0$, find the value of k.** A **[CBSE Delhi Set-I, II, III, 2019]**

Sol. $AP : PB = 1 : 2$ ½



½

$$x = \frac{4+5}{3} = 3 \text{ and } y = \frac{2-8}{3} = -2 \qquad ½ + ½$$

Thus point P is (3, –2).

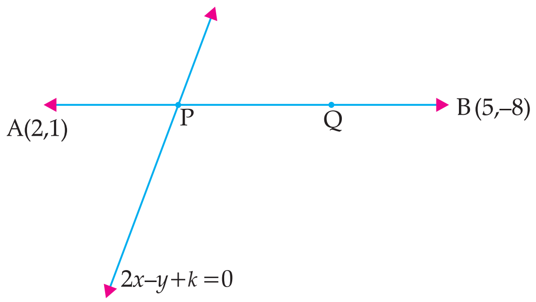
Point (3, –2) lies on $2x - y + k = 0$

$$\Rightarrow \quad 6 + 2 + k = 0$$

$$\Rightarrow \quad k = -8. \qquad 1$$

[CBSE Marking Scheme, 2019]

Detailed Solution:



The given points are A (2, 1) and B (5, –8).

Given, P and Q trisects the line segment AB

$$\therefore \quad AP = PQ = QB$$

$$PB = PQ + QB = AP + AP = 2AP$$

$$AP : PB = AP : 2AP = 1 : 2$$

$\therefore$ P divides the line segment AB in the ratio 1 : 2.

We know that, coordinates of the point dividing the line segment joining the points (x_1, y_1) and (x_2, y_2) in the ratio $m : n$ is given by $\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$.

$\therefore$ Coordinates of P

$$= \left(\frac{1\times5+2\times2}{1+2}, \frac{1\times(-8)+2\times1}{1+2}\right)$$

$$= \left(\frac{5+4}{3}, \frac{-8+2}{3}\right)$$

$$= \left(\frac{9}{3}, \frac{-6}{3}\right) = (3, -2)$$

Point P(3, –2) lies on the given line $2x - y + k = 0$

$$\therefore \quad 2 \times 3 - (-2) + k = 0$$

$$\Rightarrow \quad 6 + 2 + k = 0$$

$$\Rightarrow \quad 8 + k = 0$$

$$\Rightarrow \quad k = -8$$

Thus, the value of k is –8.

COMMONLY MADE ERROR

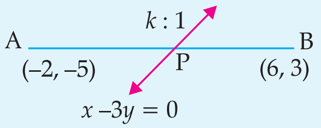
- Some Candidates use mid point formula instead of section formula to find the coordinates of P. Some candidates also make calculation errors.

ANSWERING TIP

- Understand the concept if a point divides a line segment in the ratio $m : n$ ($m \neq n$) then $m : n$ is not equal to $n : m$.

Q. 4. Find the ratio in which the line $x - 3y = 0$ divides the line segment joining the points (–2, – 5) and (6, 3). Find the coordinates of the point of intersection. A **[CBSE OD Set-I, II, III, 2019]**

Sol. Let the line $x - 3y = 0$ intersect the segment



joining A(–2, –5) and B(6, 3) in the ratio $k : 1$ ½

$$\therefore \text{ Coordinates of P are } \left(\frac{6k-2}{k+1}, \frac{3k-5}{k+1}\right) \qquad 1$$

$$\text{P lies on } x - 3y = 0 \Rightarrow \frac{6k-2}{k+1} = 3\left(\frac{3k-5}{k+1}\right)$$

$$\Rightarrow \quad k = \frac{13}{3}$$

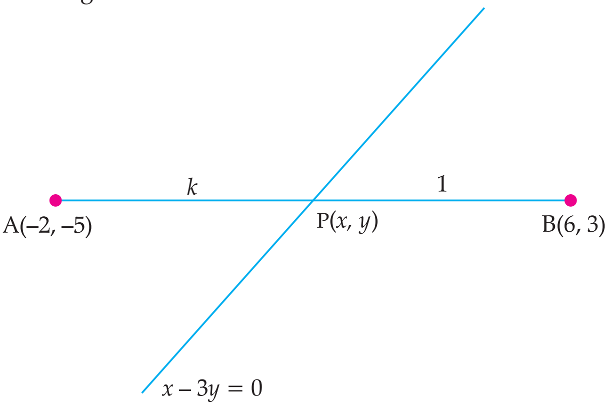
$\therefore$ Ratio is 13 : 3 **1**

$\Rightarrow$ Coordinates of P are $\left(\frac{9}{2}, \frac{3}{2}\right)$ ½

[CBSE Marking Scheme, 2019]

Detailed Solution:

Let the ratio in which line $x - 3y = 0$ divides the line segment is $k : 1$



Using section formula, we get

$$x = \frac{k \times 6 + 1 \times (-2)}{k+1}$$

$$= \frac{6k-2}{k+1} \quad \text{...(i) ½}$$

and
$$y = \frac{k \times 3 + 1 \times (-5)}{k+1}$$

$$= \frac{3k-5}{k+1} \quad \text{...(ii) ½}$$

The point P(x, y) lies on the line, hence satisfies the equation of the given line.

$$\Rightarrow \quad \frac{6k-2}{k+1} - 3\left(\frac{3k-5}{k+1}\right) = 0$$

$$\Rightarrow \quad 6k - 2 - 3(3k-5) = 0$$

$$\Rightarrow \quad 6k - 2 - 9k + 15 = 0$$

$$\Rightarrow \quad -3k + 13 = 0$$

$$\Rightarrow \quad k = \frac{13}{3}$$

Hence, the required ratio is 13 : 3 ½

Now, substituting value of k in x and y, we get

$$x = \frac{6 \times \left(\frac{13}{3}\right) - 2}{\frac{13}{3} + 1}$$

$$= \frac{78-6}{16}$$

$$= \frac{72}{16}$$

$$= \frac{9}{2} \quad ½$$

and
$$y = \frac{3\left(\frac{13}{3}\right) - 5}{\frac{13}{3} + 1}$$

$$= \frac{8 \times 3}{16}$$

$$= \frac{24}{16} = \frac{3}{2} \quad ½$$

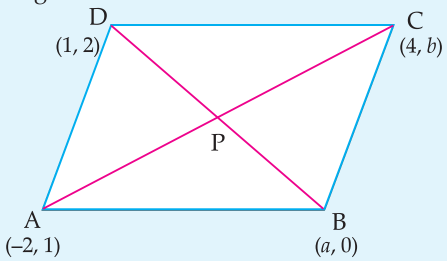
Hence, the coordinates of point of intersection

$$P(x, y) = \left(\frac{9}{2}, \frac{3}{2}\right) \quad ½$$

Q. 5. If A(– 2, 1), B(a, 0), C(4, b) and D(1, 2) are the vertices of a parallelogram ABCD, find the values of a and b. Hence find the lengths of its sides.

A **[CBSE Delhi/OD, 2018]**

Sol. Given, ABCD is a parallelogram and diagonals AC and BD bisect each other



1

Therefore mid point P of BD is same as mid point of AC ½

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

$$\Rightarrow \quad \frac{a+1}{2} = 1 \text{ and } \frac{b+1}{2} = 1$$

$\Rightarrow a = 1, b = 1$. Therefore, length of sides are $\sqrt{10}$ units each. ½ + **1**

[CBSE Marking Scheme, 2018]

Detailed Solution:

We know that diagonals of parallelogram bisect each other.

$\therefore$ Mid-point of diagonal AC

$$\left(\frac{-2+4}{2}, \frac{1+b}{2}\right) = \left(1, \frac{1+b}{2}\right) \quad ½$$

Mid-point of diagonal BD

$$\left(\frac{a+1}{2}, \frac{0+2}{2}\right) = \left(\frac{a+1}{2}, 1\right) \quad ½$$

Mid point of diagonal AC = mid point of diagonal BD

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

$$2 = a + 1 \quad \text{and} \quad 1 + b = 2$$

$$\therefore \quad a = 1 \quad \text{and} \quad b = 1 \quad ½$$

Again, $\quad AB = \left|\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right|$ ½

$$= \left|\sqrt{(1+2)^2+(0-1)^2}\right|$$

$$AB = \left|\sqrt{9+1}\right| = \sqrt{10} \text{ unit}$$

and $$BC = \left|\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}\right|$$

$$= \left|\sqrt{(4-1)^2+(1-0)^2}\right|$$

$$BC = \left|\sqrt{9+1}\right|$$

$$= \sqrt{10} \text{ unit}$$

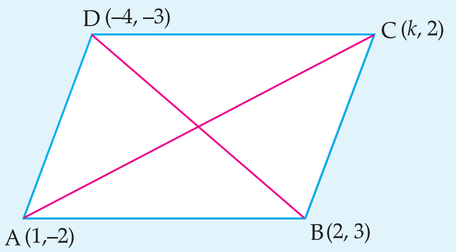
ABCD is a parallelogram (Given)

$\therefore$ $AB = CD = \sqrt{10}$ unit

and $BC = AD = \sqrt{10}$ unit **1**

Q. 6. The points A(1, – 2), B(2, 3), C(k, 2) and D(– 4, – 3) are the vertices of a parallelogram. Find the value of k. C + U [CBSE SQP, 2018]

Sol.



½

Diagonals of parallelogram bisect each other ½

$\Rightarrow$ midpoint of AC = midpoint of BD

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

$$\Rightarrow \frac{1+k}{2} = \frac{-2}{2}$$

$$\Rightarrow k = -3$$

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

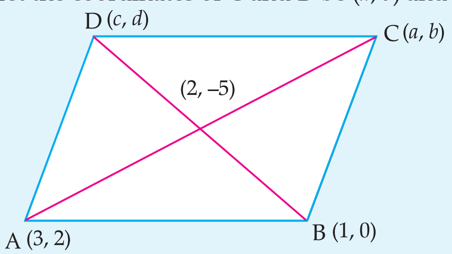
- Mostly candidates do not use the mid point formula. Generally they use distance formula.

ANSWERING TIP

- Candidates should use mid point formula by which they can get correct solution in lesser time.

Q. 7. If coordinates of two adjacent vertices of a parallelogram are (3, 2), (1, 0) and diagonals bisect each other at (2, – 5), find coordinates of the other two vertices. U [CBSE Comptt. Set I, II, III, 2018]

Sol. Let the coordinates of C and D be (a, b) and (c, d).



$\therefore$ $\dfrac{3+a}{2} = 2 \Rightarrow a = 1$ ½

and $\dfrac{2+b}{2} = -5 \Rightarrow b = -12$ ½

and $\dfrac{c+1}{2} = 2 \Rightarrow c = 3$ ½

and $\dfrac{d+0}{2} = -5 \Rightarrow d = -10$ ½

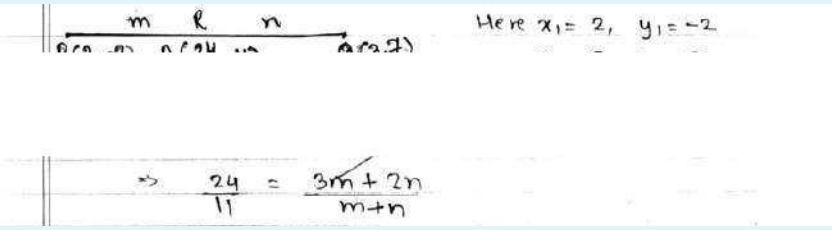
Coordinates of C and D are (1, – 12) and (3, – 10) **1**

[CBSE Marking Scheme, 2018]

Q. 8. In what ratio does the point $\left(\frac{24}{11}, y\right)$ divide the line segment joining the points P (2, – 2) and Q (3, 7) ? Also find the value of y. U [CBSE OD Set-I, III, 2017]

Topper Answer, 2017

Sol.



$24m + 24n = 33m + 22n$

$2n = 9m$

$\frac{2}{9} = \frac{m}{n}$

∴ The given ~~point~~ divides the line segment in ratio 2 : 9.

Taking $m = 2$ and $n = 9$,

$y = \frac{7m - 2n}{m+n}$ (from ①)

$y = \frac{7(2) - 2(9)}{2+9}$

$y = \frac{14 - 18}{11}$

$\boxed{y = \frac{-4}{11}}$ **3**

Q. 9. Find the co-ordinates of the points which divide the line segment joining the points (5, 7) and (8, 10) in 3 equal parts. **[Board SQP, 2016]**

A **[CBSE OD Comptt. Set-II, 2017]**

Sol. A (5, 7) —— P —— Q —— B (8, 10)

Let P(x, y) and Q(x_1, y_1) trisect AB.

∵ P divides AB in the ratio 1 : 2

∴ $x = \frac{1(8)+2(5)}{3} = 6,$ **1**

and $y = \frac{1(10)+2(7)}{3} = 8$

∴ P(6, 8)

And Q is the mid point of PB. **1**

$$x_1 = \frac{6+8}{2} = 7$$

$$y_1 = \frac{8+10}{2} = 9$$

∴ Q(7, 9) **1**

[CBSE Marking Scheme, 2017]

Q. 10. Show that ΔABC with vertices A(– 2, 0), B(0, 2) and C(2, 0) is similar to ΔDEF with vertices D(– 4, 0), E(0, 4) and F(4, 0).

A **[Board Foreign Set-I, II 2017; CBSE Delhi Set-I, II, III, 2017]**

Sol. Using distance formula

$$AB = \left|\sqrt{(0+2)^2+(2-0)^2}\right| = \left|\sqrt{4+4}\right|$$

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

$$BC = \left|\sqrt{(2-0)^2+(0-2)^2}\right| = \left|\sqrt{4+4}\right|$$

$$= 2\sqrt{2} \text{ units}$$ ½

$$CA = \left|\sqrt{(-2-2)^2+(0-0)^2}\right| = \left|\sqrt{16}\right|$$

$$= 4 \text{ units}$$

and $$DE = \left|\sqrt{(0+4)^2+(4-0)^2}\right| = \left|\sqrt{32}\right|$$

$$= 4\sqrt{2} \text{ units}$$ ½

$$EF = \left|\sqrt{(4-0)^2+(0-4)^2}\right| = \left|\sqrt{32}\right|$$

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

$$FD = \left|\sqrt{(-4-4)^2+(0-0)^2}\right| = \left|\sqrt{64}\right|$$

$$= 8 \text{ units}$$ ½

Since, ratio of the corresponding sides of two similar Δs is equal.

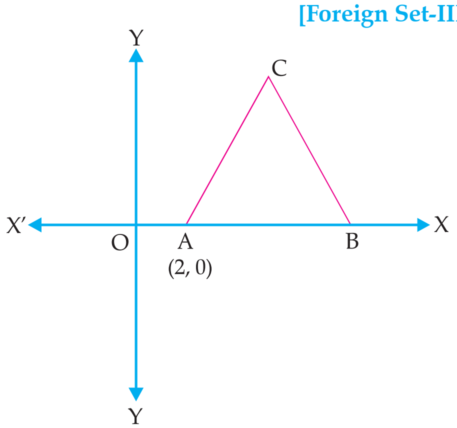
i.e., $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ ½

or, $\frac{2\sqrt{2}}{4\sqrt{2}} = \frac{2\sqrt{2}}{4\sqrt{2}} = \frac{4}{8} = \frac{1}{2}$ **1**

∴ $\Delta ABC \sim \Delta DEF$ **Hence Proved.**

[CBSE Marking Scheme, 2017]

Q. 11. In the given figure ΔABC is an equilateral triangle of side 3 units. Find the co-ordinates of the other two vertices. A **[Foreign Set-I, II, 2017]** **[Foreign Set-III, 2015]**



Sol. The co-ordinates of B are (5, 0) ($AB = 3$)

Let co-ordinates of C be (x, y) **1**

Since $\quad AC^2 = BC^2$

(sides of equilateral triangle)

$$(x-2)^2 + (y-0)^2 = (x-5)^2 + (y-0)^2$$

or, $\quad x^2 + 4 - 4x + y^2 = x^2 + 25 - 10x + y^2$

or, $\quad 6x = 21$

$$x = \frac{7}{2} \qquad \textbf{1}$$

And $(x-2)^2 + (y-0)^2 = 9$

or, $\quad \left(\frac{7}{2}-2\right)^2 + y^2 = 9$

or, $\quad \frac{9}{4} + y^2 = 9$ or, $y^2 = 9 - \frac{9}{4}$

or, $\quad y^2 = \frac{27}{4}$ or $y = \pm\frac{3\sqrt{3}}{2}$

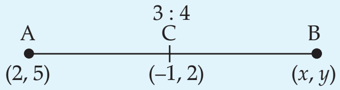
(+ve sign to be taken)

Hence, $C = \left(\frac{7}{2}, \frac{3\sqrt{3}}{2}\right)$. **1**

Q. 12. If the point C(–1, 2) divides internally the line segment joining the points A(2, 5) and B(*x*, *y*) in the ratio 3 : 4, find the value of $x^2 + y^2$.

A [Foreign Set I, II, III, 2016]

Sol.



Given that, $\quad \frac{AC}{CB} = \frac{3}{4}$

Applying section formula for x co-ordinate,

$$-1 = \frac{3x + 4(2)}{3+4}$$

or, $\quad -7 = 3x + 8$

or $\quad x = -5 \qquad$ **1**

Similarly for y co-ordinate,

$$2 = \frac{3y + 4(5)}{3+4}$$

$$14 = 3y + 20$$

or $\quad y = -2$

$\therefore$ (x, y) is $(-5, -2)$ **1**

Hence, $\quad x^2 + y^2 = (-5)^2 + (-2)^2$

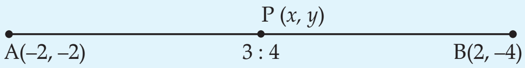
$= 25 + 4$

$= 29 \qquad$ **1**

[CBSE Marking Scheme, 2016]

Q. 13. If the co-ordinates of points A and B are (– 2, – 2) and (2, – 4) respectively, find the co-ordinates of P such that $AP = \frac{3}{7}AB$, where P lies on the line segment AB. U [CBSE OD, 2015, Set I, II, III, 2015]

Sol. $\quad AP = \frac{3}{7}AB$ or, $AP : PB = 3 : 4$ **1**



$\therefore$ Using the section formula **1**

$$x = \frac{mx_2 + nx_1}{m+n}$$

and $\quad y = \frac{my_2 + ny_1}{m+n}$

$$x = \frac{3 \times 2 + 4 \times -2}{3+4} = -\frac{2}{7}$$

and $\quad y = \frac{3 \times -4 + 4 \times -2}{3+4} = -\frac{20}{7} \qquad$ ½

Hence, $\quad P = \left(-\frac{2}{7}, -\frac{20}{7}\right) \qquad$ ½

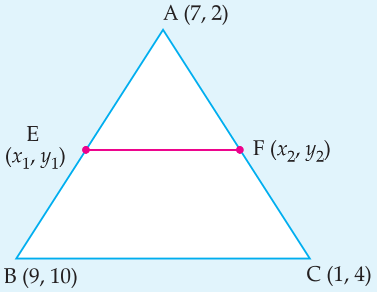
[CBSE Marking Scheme, 2015]

Q. 14. The co-ordinates of the vertices of ΔABC are A(7, 2), B(9, 10) and C(1, 4). If E and F are the mid-points of AB and AC respectively, prove that $EF = \frac{1}{2}BC$. A [CBSE Board Term-2, 2015]

Sol. Let the mid-points of AB and AC be $E(x_1, y_1)$ and $F(x_2, y_2)$

$\therefore$ Co-ordinates of point $E = \left(\frac{9+7}{2}, \frac{10+2}{2}\right)$

$$E(x_1, y_1) = (8, 6) \qquad ½$$



Co-ordinates of point $F = \left(\frac{7+1}{2}, \frac{2+4}{2}\right)$

$$(x_2, y_2) = (4, 3) \qquad ½$$

Length of $EF = \left|\sqrt{(8-4)^2 + (6-3)^2}\right|$

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

$= 5$ units ...(i) **1**

Length of $BC = \left|\sqrt{(9-1)^2 + (10-4)^2}\right|$

$= \left|\sqrt{(8)^2 + (6)^2}\right|$

$= 10$ units ...(ii)

From equations (i) and (ii), we get

$EF = \frac{1}{2}BC$. **Hence proved. 1**

[CBSE Marking Scheme, 2015]

Q. 15. Find the ratio in which the line segment joining the points A(3, –3) and B(–2, 7) is divided by X-axis. Also find the co-ordinates of point of division.

A [CBSE Delhi Term-2, 2015]

Sol. k P 1

A ←——————————→ B

(3, –3) (x, 0) (–2, 7)

Let the ratio be $k : 1$,

Using section formula, we get,

$$0 = \frac{1(-3)+k(7)}{1+k}$$

or, $$k = \frac{3}{7}$$

or, Ratio $= 3:7$ **1**

Also, $$x = \frac{m_2x_1+m_1x_2}{m_1+m_2}$$

$$= \frac{1(3)+k(-2)}{1+k} \qquad \mathbf{1}$$

$$x = \frac{3-2\times\frac{3}{7}}{1+\frac{3}{7}} = \frac{21-6}{7+3} = \frac{3}{2}$$

$\therefore$ Co-ordinates of point P are $\left(\frac{3}{2}, 0\right)$. **1**

[CBSE Marking Scheme, 2014]

Long Answer Type Questions — 5 marks each

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

A [CBSE OD Set-III, 2019]

Sol. Any point on Y-axis is P(0,y) **1**

Let P divides AB in k :1 **1**

$k : 1$

A(–1, –4) —— P(0, y) —— B(5, –6)

$$\Rightarrow \quad 0 = \frac{5k-1}{k+1} \Rightarrow k = \frac{1}{5} \text{ i.e., } 1:5 \qquad \mathbf{1}$$

$$\Rightarrow \quad y = \frac{-6k-4}{k+1} = \frac{-\frac{6}{5}-4}{\frac{1}{5}+1} = \frac{-26}{6} = \frac{-13}{3} \qquad \mathbf{1}$$

$\Rightarrow$ P is $\left(0, \frac{-13}{3}\right)$ [CBSE Marking Scheme, 2019] **1**

AI Q. 2. If P(9a – 2, – b) divides the line segment joining A(3a + 1, – 3) and B(8a, 5) in the ratio 3 : 1. Find the values of a and b.

A [CBSE SQP, 2016]

Sol. By section formula

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

and $$-b = \frac{3(5)+1(-3)}{3+1} \quad ...(ii) \quad \mathbf{1}$$

From (ii),

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

$$b = -3 \qquad \mathbf{1}$$

From (i), $$9a-2 = \frac{24a+3a+1}{4} \qquad \mathbf{1}$$

$$4(9a-2) = 27a+1$$

$$36a-8 = 27a+1$$

$$9a = 9$$

$$a = 1 \qquad \mathbf{1}$$

[CBSE Marking Scheme, 2016]

Q. 3. The base BC of an equilateral triangle ABC lies on y-axis. The co-ordinates of point C are (0, – 3). The origin is the mid-point of the base. Find the co-ordinates of the point A and B. Also find the co-ordinates of another point D such that BACD is a rhombus.

A [Foreign Set I, II, 2015]

Sol. Co-ordinates of point B are (0, 3) **½**

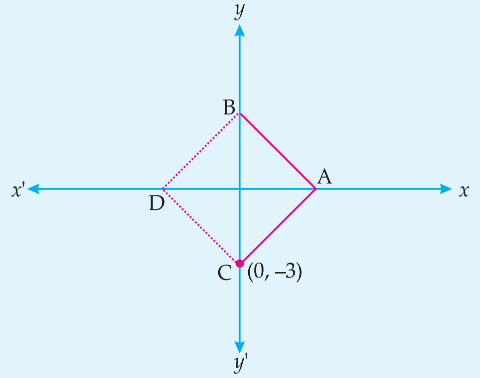
$\therefore$ BC = 6 unit

Let the co-ordinates of point A be (x, 0). **½**

or, $$AB = \left|\sqrt{x^2+9}\right|$$

$\because$ $$AB^2 = BC^2$$

$\therefore$ $$x^2 + 9 = 36 \qquad \mathbf{1}$$



1

or, $$x^2 = 27 \text{ or, } x = \pm 3\sqrt{3}$$

Co-ordinates of point $A = (3\sqrt{3}, 0)$ **1**

Since ABCD is a rhombus.

or, $$AB = AC = CD = DB$$

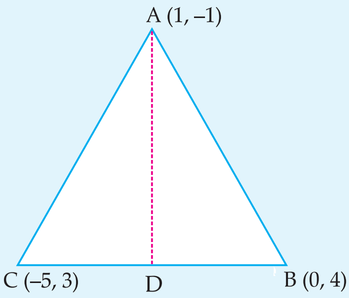
$\therefore$ Co-ordinates of point $D = (-3\sqrt{3}, 0)$. **1**

[CBSE Marking Scheme, 2015]

Q. 4. (1, –1), (0, 4) and (– 5, 3) are vertices of a triangle. Check whether it is a scalene triangle, isosceles triangle or an equilateral triangle. Also, find the length of its median joining the vertex (1, – 1) the mid-point of the opposite side.

A [CBSE, Term-2, 2015]

Sol.



Let the vertices of ΔABC be A(1, –1), B(0, 4) and C(–5, 3). **1**

$\therefore$ Using distance formula,

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

$$= \left|\sqrt{1+5^2}\right|$$

$$= \sqrt{26} \text{ unit} \qquad \tfrac{1}{2}$$

$$BC = \left|\sqrt{(-5-0)^2+(3-4)^2}\right|$$

$$= \left|\sqrt{25+1}\right| = \sqrt{26} \text{ unit} \qquad \tfrac{1}{2}$$

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

$$= \left|\sqrt{36+16}\right| = \sqrt{52}$$

$$= 2\sqrt{13} \text{ unit} \qquad \tfrac{1}{2}$$

or, $AB = BC \neq AC$

or, ΔABC is isosceles.

Now, using mid-point formula, the co-ordinates of mid-point of BC are

$$x = \frac{-5+0}{2} = -\frac{5}{2} \qquad \tfrac{1}{2}$$

$$y = \frac{3+4}{2} = \frac{7}{2}$$

or, $$D(x, y) = \left(-\frac{5}{2}, \frac{7}{2}\right) \qquad 1$$

$\therefore$ Length of median, AD

$$= \sqrt{\left(\frac{-5}{2}-1\right)^2+\left(\frac{7}{2}+1\right)^2}$$

$$= \sqrt{\left(\frac{-7}{2}\right)^2+\left(\frac{9}{2}\right)^2}$$

$$= \sqrt{\frac{130}{4}} = \frac{\sqrt{130}}{2} \text{ unit}$$

$\therefore$ Length of median AD is $\frac{\sqrt{130}}{2}$ units. **1**

[CBSE Marking Scheme, 2015]

TOPIC - 2
Area of Triangle

Revision Notes

- If A(x_1, y_1), B(x_2, y_2) and C(x_3, y_3) are vertices of a triangle, then the co-ordinates of centroid are

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

- If A(x_1, y_1), B(x_2, y_2) and C(x_3, y_3) are vertices of a triangle, then

$$\text{Area of } \Delta ABC = \frac{1}{2}\left|[x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)]\right|$$

- If the points are collinear, then the area of triangle is zero.

How is it done on the GREENBOARD?

Q.1. Find k, if the point A(2, 3), B(5, K) and C(7, 9) are collinear. U

Solution:

Step 1: If points A, B, and C are collinear then the area of triangle formed by them is zero.

Step 2: Area of triangle formed by the vertices (x_1, y_1), (x_2, y_2) and (x_3, y_3) is given by

$$A = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

Step 3: According to question,

$$0 = \frac{1}{2}[2(k - 9) + 5(9 - 3) + 7(3 - k)]$$

or, $2k - 18 + 45 - 15 + 21 - 7k = 0$

or, $-5k + 33 = 0$

or, $5k = 33$

or, $k = \frac{33}{5}$

Very Short Answer Type Questions — 1 mark each

AI **Q. 1. If the points A(3, 1), B(5, p) and C(7, – 5) are collinear, then find the value of p.**

A [CBSE Delhi Set-I, 2020]

Sol. Here, $x_1 = 3, x_2 = 5, x_3 = 7$ and $y_1 = 1, y_2 = p, y_3 = -5$

If points are collinear, then area of triangle = 0

$$\therefore \frac{1}{2}|[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]| = 0 \quad ½$$

$$\Rightarrow \frac{1}{2}|[3(p + 5) + 5(-5 - 1) + 7(1 - p)]| = 0$$

$$\Rightarrow \frac{1}{2}|[3p + 15 - 30 + 7 - 7p]| = 0$$

$$\Rightarrow -4p - 8 = 0$$

$$\Rightarrow -4p = 8$$

$$\Rightarrow p = -2. \quad ½$$

Q. 2. If the points (0, 0), (1, 2) and (x, y) are collinear, then find the relation between x and y. A

[CBSE Term-2, 2015, 2016]

Sol. The points are collinear, then area of triangle = 0

$$\therefore \frac{1}{2}|[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]| = 0$$

or, $$\frac{1}{2}|[0(2 - y) + 1(y - 0) + x(0 - 2)]| = 0$$

or, $$\frac{1}{2}|[y - 2x]| = 0$$

or, $$2x - y = 0$$

$$\therefore x = \frac{y}{2} \quad 1$$

[CBSE Marking Scheme, 2016]

Q. 3. If the points A(x, 2), B(– 3, – 4) and C(7, – 5) are collinear, then find the value of x.

U [Foreign Set-I, II, III, 2015]

Sol. Since, the points are collinear, then

Area of triangle = 0

$$\frac{1}{2}|[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]| = 0 \quad ½$$

$$\frac{1}{2}|[x(-4 + 5) + (-3)(-5 - 2) + 7(2 + 4)]| = 0$$

$$x + 21 + 42 = 0$$

$$x = -63 \quad ½$$

Short Answer Type Questions-I — 2 marks each

Q. 1. Show that the points A(0, 1), B(2, 3) and C(3, 4) are collinear. U [CBSE Term-2, 2016]

Sol. Area of the triangle formed by the given points A(0, 1), B(2, 3) and C(3, 4)

$$= \frac{1}{2} |0(3-4) + 2(4-1) + 3(1-3)| \quad \mathbf{1}$$

$$= \frac{1}{2} |0 + (2)(3) + (3)(-2)|$$

$$= \frac{1}{2} |6-6|$$

$$= \frac{1}{2} (0)$$

$$= 0$$

∴ The given points are collinear. **1**

[CBSE Marking Scheme, 2016]

Q. 2. Prove that the points (2, –2), (–2, 1) and (5, 2) are the vertices of a right angled triangle. Also find the area of this triangle. A [Foreign Set I, II, III, 2016]

Sol. Let the points be A(2, – 2), B(–2, 1) and C(5, 2).

Applying distance formula,

$$AB^2 = (2+2)^2 + (-2-1)^2$$
$$= 16 + 9$$
$$AB^2 = 25 \text{ or, } AB = 5$$

Similarly $\quad BC^2 = (-2-5)^2 + (1-2)^2$
$$= 49 + 1 = 50$$

or, $\quad BC^2 = 50 \text{ or, } BC = 5\sqrt{2}$

Also, $\quad AC^2 = (2-5)^2 + (-2-2)^2$
$$= 9 + 16$$
$$= 25$$

or, $\quad AC^2 = 25 \text{ or } AC = 5$

Clearly $\quad AB^2 + AC^2 = BC^2$ **1**
$$25 + 25 = 50$$

Hence, the triangle is right angled,

$$\text{Area of } \Delta ABC = \frac{1}{2} \times \text{Base} \times \text{Height}$$

$$= \frac{1}{2} \times 5 \times 5 = \frac{25}{2} \text{ sq units.} \quad \mathbf{1}$$

[CBSE Marking Scheme, 2016]

Q. 3. Find the relation between x and y, if the points $A(x, y)$, $B(-5, 7)$ and $C(-4, 5)$ are collinear. A [CBSE Term,-2, 2015]

Sol. If area covered by the given points is O, the points are collinear.

$$\text{Area of } \Delta ABC = 0$$

$$\frac{1}{2} |[x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)]| = 0 \quad ½$$

$$= \frac{1}{2} |[x(7-5) - 5(5-y) - 4(y-7)]| = 0 \quad \mathbf{1}$$

or, $\quad 2x - 25 + 5y - 4y + 28 = 0 \quad ½$

or, $\quad 2x + y + 3 = 0$

[CBSE Marking Scheme, 2015]

Short Answer Type Questions-II — 3 marks each

AI **Q. 1. Find the area of triangle PQR formed by the points P(– 5, 7), Q(– 4, –5) and R(4, 5).** A [CBSE Delhi Set-I, 2020]

Sol. Here $x_1 = -5$, $x_2 = -4$, $x_3 = 4$ and $y_1 = 7$, $y_2 = -5$, $y_3 = 5$ ½

$$\therefore \text{Area of } \Delta PQR = \frac{1}{2} |[x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)]| \quad ½$$

$$= \frac{1}{2} |[-5(-5-5) - 4(5-7) + 4(7+5)]| \quad ½$$

$$= \frac{1}{2} |[-5(-10) - 4(-2) + 4(12)]|$$

$$= \frac{1}{2} |[50 + 8 + 48]| \quad ½$$

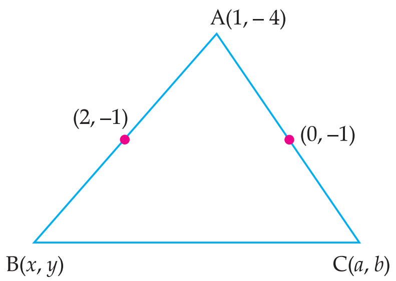
$$= \frac{1}{2} \times 106 = 53 \text{ sq units.} \quad ½$$

AI **Q. 2. Find the area of triangle ABC with A(1, –4) and the mid-points of sides through A being (2, –1) and (0, –1).** C + A [CBSE OD Set-I, 2020]

Sol. Let the coordinates of the points B and C be (x, y) and (a, b), then $\frac{x+1}{2} = 2$

$$\Rightarrow x = 4 - 1 = 3 \text{ and } \frac{y-4}{2} = -1$$

$$\Rightarrow y = -2 + 4 = 2 \quad \mathbf{1}$$



½

Similarly, $\quad \frac{a+1}{2} = 0 \Rightarrow a = -1$

and $\quad \frac{b-4}{2} = -1 \Rightarrow b = -2 + 4 = 2$

So, the coordinates of B and C are (3, 2) and (– 1, 2)

Here, $x_1 = 1$, $y_1 = -4$, $x_2 = 3$, $y_2 = 2$ and $x_3 = -1$, $y_3 = 2$ ½

$$\therefore \text{Area of } \Delta ABC = \frac{1}{2} [x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)]$$

$$= \frac{1}{2} [1(2-2) + 3(2+4) - 1(-4-2)]$$

$$= \frac{1}{2} [0 + 18 + 6]$$

$$= \frac{1}{2} \times 24$$

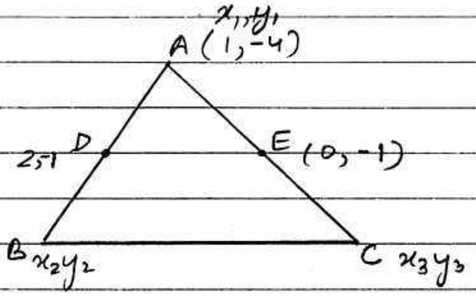
$$= 12 \text{ square units.} \quad \mathbf{1}$$

Detailed Solution:

Topper Answer, 2019

20. Given: Triangle ABC with $A(x_1, y_1) = A(1, -4)$

D and E are midpoints of AB and AC.



Let coordinates of B be (x_2, y_2) and that of C be (x_3, y_3).
Using section formula for mid-point;

$$\frac{1+x_2}{2} = 2 \quad , \quad \frac{-4+y_2}{2} = -1$$

$$\Rightarrow \quad x_2 = 3 \quad , \quad y_2 = 2$$

$$(x_2, y_2) = (3, 2)$$

Similarly, $$\frac{1+x_3}{2} = 0 \quad , \quad \frac{-4+y_3}{2} = -1$$

$$\Rightarrow \quad x_3 = -1 \quad , \quad y_3 = 2.$$

$\cancel{(x_3, y_3) = (-1, 2)}$ $\quad x_3, y_3 = -1, 2$

Area of triangle $= \frac{1}{2}\left| x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) \right|$ unit square

$$= \frac{1}{2}\left| 1(2-2) + 3(2+4) + (-1)(-4-2) \right| \text{ unit square}$$

$$= \frac{1}{2}\left| 1 \times 0 + 3 \times 6 + (-1 \times -6) \right| \text{ sq. units}$$

$$= \frac{1}{2}\left| 18 + 6 \right| \text{ sq. units} = 12 \text{ sq. units}$$

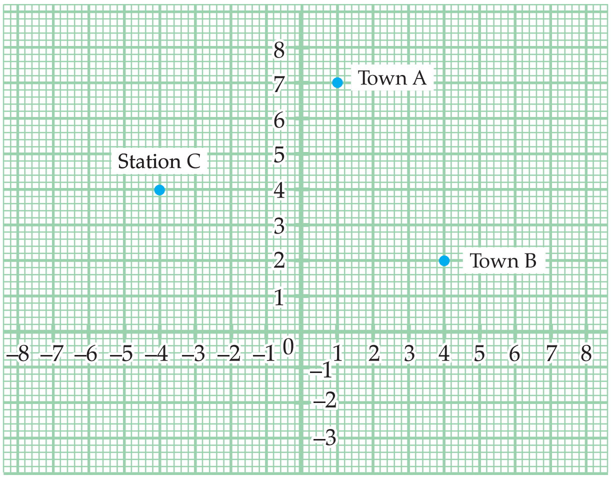
$\therefore$ Area of Δ = 12 sq. units

Q. 3. Two friends Seema and Aditya work in the same office at Delhi. In the Christmas vacations, both decided to go to their hometowns represented by Town A and Town B respectively in the figure given below. Town A and Town B are connected by trains from the same station C (in the given figure) in Delhi. Based on the given situation, answer the following questions :

(i) Who will travel more distance, Seema or Aditya, to reach to their hometown ?

(ii) Seema and Aditya planned to meet at a location D situated at a point D represented by the mid-point of the line joining the points represented by Town A and Town B. Find the coordinates of the point represented by the point D.

(iii) Find the area of the triangle formed by joining the points represented by A, B and C.



[CBSE SQP, 2020]

Sol. (i) A(1, 7), B(4, 2) C(– 4, 4)

Distance travelled by Seema = $\sqrt{34}$ units

Distance travelled by Aditya = $\sqrt{68}$ units **1**

(ii) Coordinates of D are $\left(\dfrac{1+4}{2}, \dfrac{7+2}{2}\right) = \left(\dfrac{5}{2}, \dfrac{9}{2}\right)$ **1**

(iii) ar (ΔABC) = $\dfrac{1}{2}$ |[1 (2 – 4) + 4 (4 – 7) – 4(7 – 2)]|

= 17 sq. units **1**

[CBSE SQP Marking Scheme, 2020]

Detailed Solution:

According to given graph,

The coordinates, where the station C is situated

= (– 4, 4)

The coordinates of Town A = (1, 7)

and the coordinates of Town B = (4, 2)

(i) Distance travelled by Seema from station C to their home town

$$A = \left|\sqrt{(1+4)^2+(7-4)^2}\right|$$

$$= \left|\sqrt{(5)^2+(3)^2}\right|$$

$$= \sqrt{34} \text{ unit}$$

Distance travelled by Aditya from C to B

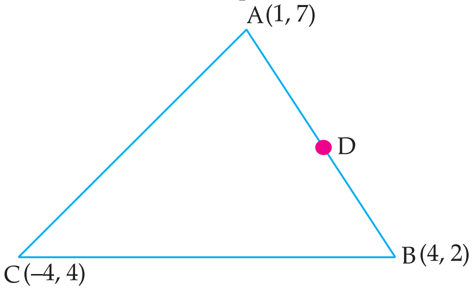
$$= \sqrt{(4+4)^2+(2-4)^2}$$

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

$$= \sqrt{68} \text{ unit}$$

Hence, Aditya travelled more distance. **1**

(ii) We have, D is the mid-point AB.



The coordinates of D = $\left(\dfrac{1+4}{2}, \dfrac{7+2}{2}\right)$

$= \left(\dfrac{5}{2}, \dfrac{9}{2}\right)$. **1**

(iii) Here, $x_1 = 1$, $y_1 = 7$, $x_2 = 4$, $y_2 = 2$, $x_3 = -4$ and $y_3 = 4$.

∴ Area of ΔABC

$$= \frac{1}{2}|[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]|$$

$$= \frac{1}{2}|[1(2-4)+4(4-7)+(-4)(7-2)]|$$

$$= \frac{1}{2}|[-2-12-20]|$$

$$= \frac{1}{2}\times|-34| = |-17|$$

ar ΔABC = 17 sq. units

Q. 4. If A(– 5, 7), B(– 4, – 5), C(– 1, – 6) and D(4, 5) are the vertices of a quadrilateral, find the area of the quadrilateral ABCD. A [CBSE Delhi/OD, 2018]

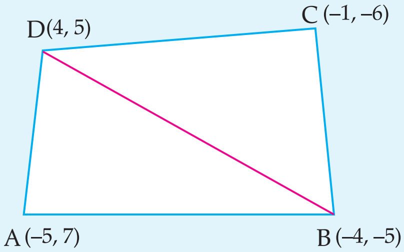
[CBSE Term-2, 2015]

Sol. Area of quad. ABCD = arΔABD + arΔBCD

Area of ΔABD= $\dfrac{1}{2}$ | (– 5) (– 5 – 5)

+ (– 4) (5 – 7) + (4) (7 + 5)|

= 53 sq. units **1**



Area of ar ΔBCD = $\dfrac{1}{2}$ |(–4) (– 6 – 5) + (–1)

(5 + 5) + 4 (– 5 + 6)|

= $\dfrac{1}{2}$ |44 – 10 + 4|

= 19 sq. units **1**

Hence, area of quad. $ABCD$ = 53 + 19

= 72 sq. units **1**

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

- Some candidates use correct formula for finding area of triangle but simplifying in error.

ANSWERING TIP

- For simplifying, be careful.

Detailed Solution:

Topper Answer, 2018

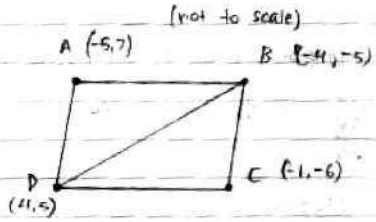
15) Vertices of quadrilateral ABCD:

(choice 2) A (−5, 7), B(−4, −5), C (−1, −6), D(4, 5)

3

Area of quad ABCD.

= area △ABD + area △BCD.



area △ ABD →

$= \frac{1}{2}[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]$ sq. units.

$= \frac{1}{2}[-5(-5-5)+(-4)(5-7)+4(7+5)]$

$= \frac{1}{2}[50+8+48]$

$= \frac{1}{2}[58+48]$.

$= \frac{1}{2} \times 106 = 53$ sq. units.

area △ BCD $= \frac{1}{2}[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]$.

$= \frac{1}{2}[-4(-6-5)+(-1)(5-5)+(4)(-5+6)]$.

$= \frac{1}{2}[44-10+4]$

$= \frac{1}{2} \times 38 = 19$ sq. units.

⇒ Area of quadrilateral = Area of two triangles = 53 + 19 = 72 sq. units.

$\boxed{\text{Area of quadrilateral ABCD is 72 sq. units}}$

3

Q. 5. Find the value of k for which the points $(3k-1, k-2)$ $(k, k-7)$ and $(k-1, -k-2)$ are collinear. [AI] [A] [CBSE SQP, 2018]

Sol. For collinearity of the points, area of the triangle formed by given points is zero.

$$\frac{1}{2}\{(3k-1)(k-7+k+2)+k(-k-2-k+2)$$

$$+(k-1)(k-2-k+7)\} = 0$$

$$\frac{1}{2}\{(3k-1)(2k-5)-2k^2+5k-5\} = 0 \qquad 1$$

$$4k^2-12k = 0 \qquad 1$$

$$k = 0, 3 \qquad 1$$

If $k = 0$ then two points are coincide

$\therefore \qquad k = 3.$

[CBSE Marking Scheme, 2018]

Q. 6. If the area of triangle with vertices $(x, 3)$, $(4, 4)$ and $(3, 5)$ is 4 square units, find x. [U] [CBSE SQP, 2018]

Sol. Given, $\quad Ar(ABC) = 4$

$$\frac{1}{2}|[x(4-5)+4(5-3)+3(3-4)]| = 4 \qquad 1\tfrac{1}{2}$$

$$(-x+5) = 8$$

$$-x+5 = 8$$

$$x = -3 \qquad 1$$

If $\quad -(-x+5) = 8$

$$x = 13 \qquad \tfrac{1}{2}$$

[CBSE Marking Scheme, 2018]

Q. 7. If the points A(0, 1), B(6, 3) and C(x, 5) are the vertices of a triangle, find the value of x such that area of $\Delta ABC = 10$. [U] [CBSE S.A.II 2016] [CBSE Compt. Set-I, II, III-2018]

Sol. Given, area of $\Delta ABC = 10$

$$\therefore \frac{1}{2}|[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]| = 10 \qquad \tfrac{1}{2}$$

Here, $x_1 = 0, y_1 = 1, x_2 = 6, y_2 = 3, x_3 = x$ and $y_3 = 5$ $\tfrac{1}{2}$

Then, $\frac{1}{2}\,|[0(3-5)+6(5-1)+x(1-3)]| = 10$ ½

$\Rightarrow$ If $\frac{1}{2}\,|[0+24+(-2)x]| = 10$ ½

$\Rightarrow\ -(-2x+24) = 20$	$-2x+24 = 20$
$\Rightarrow\ 2x = 20+24$	$-2x = -4$
$\Rightarrow\ x = 22$	$x = +2.$ **1**

Q. 8. Find the area of the triangle formed by joining the mid-points of the sides of a triangle, whose co-ordinates of vertices are (0, – 1), (2, 1) and (0, 3). A [CBSE OD Comptt. Set I, III, 2017]

Sol. Let the vertices of given triangle be A(0, – 1), B(2, 1) and C(0, 3). **1**

Then, the coordinates of mid-points are P(1, 0), Q(1, 2) and R(0, 1). **1**

Area of ΔPQR,

$$= \frac{1}{2}\left|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)\right|$$

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

$$= \frac{1}{2}\left|1+1+0\right|$$

= 1 sq. unit **1**

Q. 9. The area of a triangle is 5 sq. units. Two of its vertices are (2, 1) and (3, – 2). If the third vertex is $\left(\frac{7}{2}, y\right)$, find the value of y. A [CBSE, Delhi Set II, 2017]

Sol. Given, ar ΔABC = 5 sq. untis

or, $\frac{1}{2}\left|2(-2-y)+3(y-1)+\frac{7}{2}(1+2)\right| = 5$ **1½**

or, $\frac{1}{2}\left|-4-2y+3y-3+\frac{21}{2}\right| = 5$

or, $\left|y+\frac{7}{2}\right| = 10$ **1**

or, $y = 10-\frac{7}{2} = \frac{13}{2}$

If $y+\frac{7}{2} = -10$ or $y = -10-\frac{7}{2} = -\frac{27}{2}$

Hence, the value of $y = \frac{13}{2}$ or $-\frac{27}{2}$ ½

[CBSE Marking Scheme, 2017]

Q. 10. If $a \neq b \neq 0$, prove that the points (a, a^2), (b, b^2) and (0, 0) will not be collinear. U [CBSE, Delhi Set I, II, III, 2017]

Sol. If the area covered by the given points is zero, then the points are collinear.

$$\therefore \quad \text{Area} = \frac{1}{2}\left[a(b^2-0)+b(0-a^2)+0(a^2-b^2)\right]$$

$$= \frac{1}{2}\left[ab^2-a^2b+0\right] \quad \mathbf{2}$$

$$= \frac{1}{2}\left[ab(b-a)\right] \neq 0$$

$(a \neq b \neq 0)$ **1**

Hence, the given points are not collinear.

[CBSE Marking Scheme, 2017]

Q. 11. The points A(4, – 2), B(7, 2), C(0, 9) and D(– 3, 5) form a parallelogram. Find the length of altitude of the parallelogram on the base AB. U [CBSE SQP, 2017]

Sol. Let the height of parallelogram taking AB as base be h.

$$\therefore \quad AB = \left|\sqrt{(7-4)^2+(2+2)^2}\right|$$

$$= \left|\sqrt{3^2+4^2}\right| = \left|\sqrt{9+16}\right| \quad \mathbf{1}$$

= 5 units.

Ar ΔABC

$$= \frac{1}{2}\left|x_1(y_2-y_3)+x_2(y_3-y_2)+x_3(y_1-y_2)\right|$$

$$= \frac{1}{2}\left|4(2-9)+7(9+2)+0(-2-2)\right|$$

$$= \frac{1}{2}\,|-28+77\,|$$

$$= \frac{1}{2}\times 49 = \frac{49}{2} \text{ sq. units} \quad \mathbf{1}$$

Now, $\frac{1}{2}\times AB\times h = \frac{49}{2}$

or, $5 \times h = 49$

or, $h = \frac{49}{5} = 9{\cdot}8$ units. **1**

[CBSE Marking Scheme, 2017]

Long Answer Type Questions — 5 marks each

Q. 1. If the points A(k + 1, 2k), B(3k, 2k + 3) and C(5k – 1, 5k) are collinear, then find the value of k.

A [CBSE OD, Set-II, 2017]

Topper Answer, 2017

The points A, B and C are collinear.

∴ A(ΔABC) = 0.

Using area formula,

$x_1 = k+1$, $x_2 = 3k$, $x_3 = 5k-1$

$y_1 = 2k$, $y_2 = 2k+3$, $y_3 = 5k$.

Using area formula,

$x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) = 0.$

$(k+1)(2k+3-5k) + 3k(5k-2k) + (5k-1)(2k-2k-3) = 0$

$(k+1)(3-3k) + 3k(3k) + (5k-1)(-3) = 0.$

$3(1+k)(1-k) + 3(k)(3k) - 3(5k-1) = 0.$

$3[1-k^2 + 3k^2 - 5k+1] = 0.$

$2k^2 - 5k + 2 = 0$

$2k^2 - 4k - k + 2 = 0$

$2k(k-2) - 1(k-2) = 0$

$(2k-1)(k-2) = 0.$

$(k-2) = 0$ or $(2k-1) = 0$

$\boxed{\therefore k = 2 \text{ or } \frac{1}{2}}$

5

Q. 2. If the co-ordinates of two points are A(3, 4), B(5, – 2) and a point P(x, 5) is such that PA = PB, then find the area of ΔPAB.

A [CBSE OD Comptt. Set-I, 2017]

Sol. Given $PA = PB$ or $PA^2 = PB^2$, using distance formula, 1

$$(x-3)^2 + (5-4)^2 = (x-5)^2 + (5+2)^2 \quad 1$$

On solving, we get, $x = 16$ 1

∴ ar ΔPAB

$$= \frac{1}{2}[16(4+2)+3(-2-5)+5(5-4)] \quad 1$$

$$= \frac{1}{2}[96-21+5] = 40$$

Hence, area of triangle = 40 sq. units 1

[CBSE Marking Scheme, 2017]

Detailed Solution:

The coordinates of P, A and B are (x, 5), (3, 4) and (5, – 2) respectively, then

$$PA = PB \text{ (given)} \quad ½$$

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

$$\Rightarrow \left|\sqrt{(x-3)^2+1}\right| = \left|\sqrt{(x-5)^2+49}\right|$$

(By using distance formula) ½

Squaring on both sides, we get

$$(x-3)^2 + 1 = (x-5)^2 + 49 \quad 1$$

$$\Rightarrow (x-3)^2 - (x-5)^2 = 48$$

$$\Rightarrow [(x-3) + (x-5)][(x-3) - (x-5)] = 48 \quad [\because a^2-b^2 = (a+b)(a-b)]$$

$$\Rightarrow (2x-8)(2) = 48 \quad 1$$

$$\Rightarrow 2x - 8 = 24$$

$$\Rightarrow 2x = 32$$

$$\Rightarrow x = 16 \quad 1$$

Now, the point P(x, 5) is P(16, 5) ½

$$\therefore \text{Area of } \Delta PAB = \frac{1}{2}|16(4+2)+3(-2-5)+5(5-4)|$$

$$= \frac{1}{2}|96-21+5| = 40 \quad ½$$

Hence, area of ΔPAB = 40 sq. units. 1

AI **Q. 3. The co-ordinates of the points A, B and C are (6, 3), (–3, 5) and (4, – 2) respectively. P(x, y) is any point in the plane. Show that $\dfrac{\text{ar}(\Delta PBC)}{\text{ar}(\Delta ABC)} = \left|\dfrac{x+y-2}{7}\right|$**

A **[Foreign Set I, 2016]**

Sol. P(x, y), B(–3, 5), C(4, –2)

$$\therefore \quad ar(\Delta PBC) = \frac{1}{2}|x(7) + 3(2+y) + 4(y-5)|$$

$$= \frac{1}{2}|7x + 7y - 14| \qquad 1\tfrac{1}{2}$$

$$ar(\Delta ABC) = \frac{1}{2}|6 \times 7 - 3(-5) + 4(3-5)|$$

$$= \left|\frac{49}{2}\right| \qquad 1\tfrac{1}{2}$$

$$\therefore \quad \left|\frac{\text{ar}(\Delta PBC)}{\text{ar}(\Delta ABC)}\right| = \left|\frac{\frac{1}{2}(7x+7y-14)}{\frac{49}{2}}\right| \qquad 1$$

$$= \left|\frac{7(x+y-2)}{49}\right|$$

$$= \left|\frac{x+y-2}{7}\right| \qquad 1$$

[CBSE Marking Scheme, 2016]

AI **Q. 4. Prove that the area of a triangle with vertices (t, t – 2), (t + 2, t + 2) and (t + 3, t) is independent of t.** U **[CBSE,Delhi Set I, II, III, 2016]**

Sol. Area of the triangle $= \dfrac{1}{2}\,|t(t+2-t) + (t+2)$

$(t - t + 2) + (t+3)(t - 2 - t - 2)|$ **2**

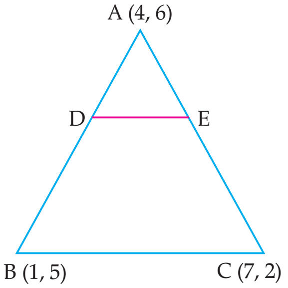
$= \dfrac{1}{2}[2t + 2t + 4 - 4t - 12]$ **1**

$= 4$ sq. units. **1**

which is independent of t. **1**

[CBSE Marking Scheme, 2016]

Q. 5. In the given figure, the vertices of ΔABC are A(4, 6), B(1, 5) and C(7, 2). A line-segment DE is drawn to intersect sides AB and AC at D and E respectively such that $\dfrac{AD}{AB} = \dfrac{AE}{AC} = \dfrac{1}{3}$. Calculate the area of ΔADE and compare it with area of ΔABC.



A **[CBSE, OD Set I, II, III, 2016]**

[CBSE Delhi Board, 2015]

Sol. Area of a triangle having vertices (x_1, y_1), (x_2, y_2) and (x_3, y_3) is given by,

$$\Delta = \frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)| \qquad \tfrac{1}{2}$$

$$\text{ar } \Delta ABC = \frac{1}{2}|4(5-2) + 1(2-6) + 7(6-5)| \qquad \tfrac{1}{2}$$

$$\text{ar } \Delta ABC = \frac{1}{2}|12 + (-4) + 7|$$

$$\text{ar } \Delta ABC = \frac{15}{2} \text{ sq. units.} \qquad 1$$

In ΔADE and ΔABC,

$$\frac{AD}{AB} = \frac{AE}{EC} = \frac{1}{3} \qquad \tfrac{1}{2}$$

and $\angle DAE = \angle BAC$ (Common)

Hence $\Delta ADE \sim \Delta ABC$ (By AAA)

or, $$\frac{\text{Area } \Delta ADE}{\text{Area } \Delta ABC} = \left(\frac{AD}{AB}\right)^2 = \left(\frac{1}{3}\right)^2 = \frac{1}{9} \qquad \tfrac{1}{2}$$

or, $$\frac{\text{Ar } \Delta ADE}{\left(\frac{15}{2}\right)} = \frac{1}{9}$$

or, $$\text{Area } \Delta ADE = \frac{15}{2 \times 9} = \frac{5}{6} \text{ sq. units.} \qquad 1$$

$$\text{Area } ADE : \text{Area } ABC = \frac{5}{6} : \frac{15}{2} = 1 : 9 \qquad 1$$

Q. 6. Find the values of k so that the area of the triangle with vertices (1, – 1), (– 4, 2k) and (– k, – 5) is 24 sq. units. A **[CBSE Board, 2015]**

Sol. Area of triangle $= \dfrac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

or, $24 = \dfrac{1}{2}|1(2k+5) - 4(-5+1) - k(-1-2k)|$ **2**

or, $48 = 2k + 5 + 16 + k + 2k^2$ **1**

or, $2k^2 + 3k - 27 = 0$ **1**

or, $(k-3)(2k+9) = 0$

or, $k = 3,\ k = \dfrac{-9}{2}$ **1**

[CBSE Marking Scheme, 2015]

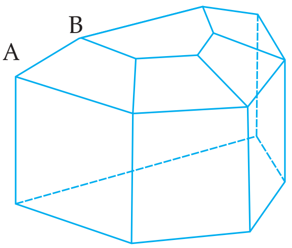
Visual Case Based Questions

4 marks each

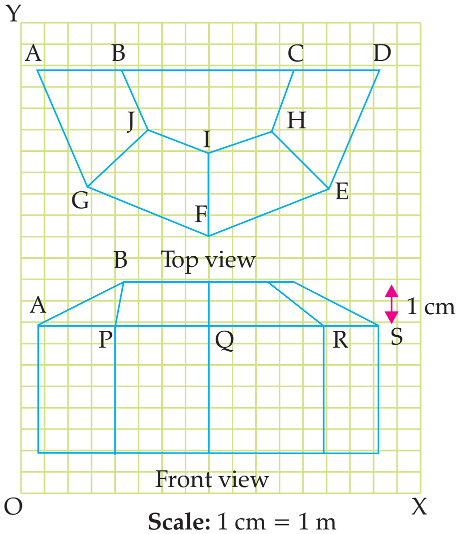
Note: Attempt any four sub parts from each question. Each sub part carries 1 mark each

AI **Q. 1. The diagram show the plans for a sun room. It will be built onto the wall of a house. The four walls of the sun room are square clear glass panels. The roof is made using,**

- **Four clear glass panels, trapezium in shape, all of the same size**
- **One tinted glass panel, half a regular octagon in shape**



Not to scale



Scale: 1 cm = 1 m

A [CBSE SQP, 2020-21]

(i) Refer to Top View, find the mid-point of the segment joining the points J(6, 17) and I(9, 16).

(a) $\dfrac{33}{2}, \dfrac{15}{2}$ (b) $\dfrac{3}{2}, \dfrac{1}{2}$

(c) $\dfrac{15}{2}, \dfrac{33}{2}$ (d) $\dfrac{1}{2}, \dfrac{3}{2}$

Sol. Correct option: **(c)**.

Explanation: Mid-point of J(6, 17) and I(9, 16) is

$$x = \frac{6+9}{2} \text{ and } y = \frac{17+16}{2}$$

$$x = \frac{15}{2} \text{ and } y = \frac{33}{2}$$ 1

(ii) Refer to front View, the distance of the point P from the y-axis is:

(a) 4 (b) 15

(c) 19 (d) 25

Sol. Correct option: **(a)**.

Explanation: The distance of the point P from the Y-axis = 4. [CBSE Marking Scheme, 2020] **1**

(iii) Refer to front view, the distance between the points A and S is

(a) 4 (b) 8

(c) 14 (d) 20

Sol. Correct option: **(c)**.

Explanation: A's coordinates = (1, 8)

S's coordinates = (15, 8)

Then, $AS = \left|\sqrt{(15-1)^2+(8-8)^2}\right|$

$= \sqrt{(14)^2}$

$= 14.$ 1

[CBSE Marking Scheme, 2020]

(iv) Refer to front view, find the co-ordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally.

(a) (8.5, 2.0) (b) (2.0, 9.5)

(c) (3.0, 7.5) (d) (2.0, 8.5)

Sol. Correct option: **(d)**.

Explanation: (2.0, 8.5)

[CBSE Marking Scheme, 2020]

Detailed Solution:

The coordinates of A = (1, 8)

The coordinates of B = (4, 10)

Also, $m = 1$ and $n = 3$

Then, $(x, y) = \left(\dfrac{1\times4+3\times1}{1+3}, \dfrac{1\times10+3\times8}{1+3}\right)$

$= \left(\dfrac{7}{4}, \dfrac{34}{4}\right)$

$= (1.75, 8.5)$ 1

(v) Refer to front view, if a point (x, y) is equidistant from the Q(9, 8) and S(17, 8), then

(a) $x + y = 13$ (b) $x - 13 = 0$

(c) $y - 13 = 0$ (d) $x - y = 13$

Sol. Correct option: **(b)**.

Explanation: $x - 13 = 0.$ 1

[CBSE Marking Scheme, 2020]

Detailed Solution:

Let point be P(x, y)

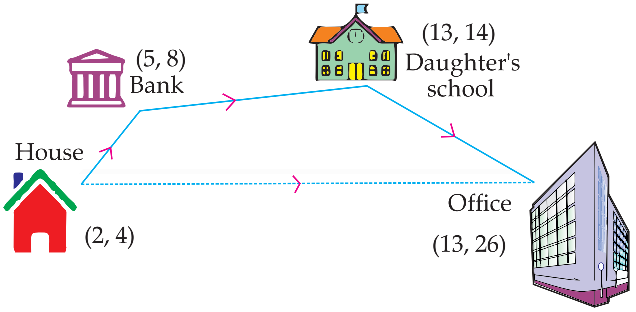
$$PQ^2 = PS^2$$

or, $(x-9)^2 + (y-8)^2 = (x-17)^2 + (y-8)^2$

or, $x - 13 = 0$ **1**

Q. 2. Ayush Starts walking from his house to office. Instead of going to the office directly, he goes to a bank first, from there to his daughter's school and then reaches the office.

(Assume that all distances covered are in straight lines). If the house is situated at (2, 4), bank at (5, 8), school at (13, 14) and office at (13, 26) and coordinates are in km.



(i) What is the distance between house and bank ?

(a) 5 km **(b) 10 km**

(c) 12 km **(d) 27 km**

Sol. Correct option: **(b)**.

Explanation: We know that,

Distance between two points (x_1, y_1) and (x_2, y_2).

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

Now, distance between house and bank,

$$= \left|\sqrt{(5-2)^2 + (8-4)^2}\right|$$

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

$$= \left|\sqrt{9+16}\right|$$

$$= \left|\sqrt{25}\right|$$

$$= 5 \text{ km}$$ **1**

(ii) What is the distance between Daughter's School and bank ?

(a) 5 km **(b) 10 km**

(c) 12 km **(d) 27 km**

Sol. Correct option: **(b)**.

Explanation: Distance between bank and daughter's school,

$$= \left|\sqrt{(13-5)^2 + (14-8)^2}\right|$$

$$= \left|\sqrt{(8)^2 + (6)^2}\right|$$

$$= \left|\sqrt{64+36}\right|$$

$$= \left|\sqrt{100}\right|$$

$$= 10 \text{ km}$$ **1**

(iii) What is the distance between house and office?

(a) 24.6 km **(b) 26.4 km**

(c) 24 km **(d) 26 km**

Sol. Correct option: **(b)**.

Explanation: Distance between house to office,

$$= \left|\sqrt{(13-2)^2 + (26-4)^2}\right|$$

$$= \left|\sqrt{(11)^2 + (22)^2}\right|$$

$$= \left|\sqrt{121+484}\right|$$

$$= \left|\sqrt{605}\right|$$

$$= 24.59$$

$$= 24.6 \text{ km}$$ **1**

(iv) What is the total distance travelled by Ayush to reach the office ?

(a) 5 km **(b) 10 km**

(c) 12 km **(d) 27 km**

Sol. Correct option: **(b)**.

Explanation: Distance between daughter's school and office,

$$= \left|\sqrt{(13-13)^2 + (26-14)^2}\right|$$

$$= \left|\sqrt{0 + (12)^2}\right|$$

$$= 12 \text{ km}$$ **½**

Total distance (House + Bank + School + Office) travelled = 5 + 10 + 12 = 27 km **½**

(v) What is the extra distance travelled by Ayush ?

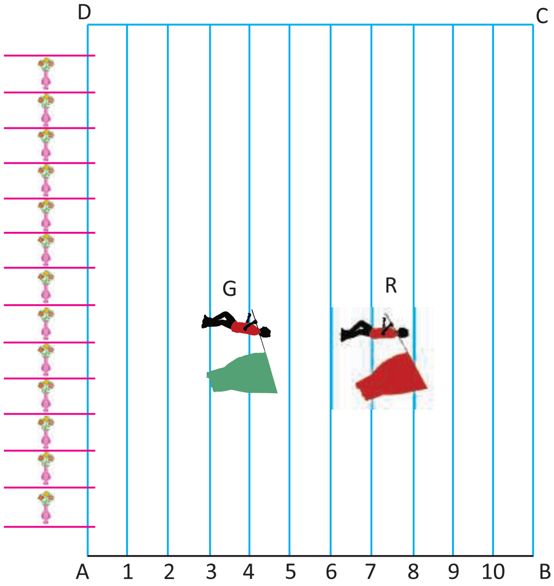
(a) 2 km **(b) 2.2 km**

(c) 2.4 km **(d) none of these**

Sol. Correct option: **(b)**.

Explanation: Extra distance travelled by Ayush in reaching his office = 27 – 24.6 = 2.4 km. **1**

Q. 3. 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 1/4th the distance AD on the 2nd line and posts a green flag. Preet runs 1/5th distance AD on the eighth line and posts a red flag.



(i) Find the position of green flag

(a) (2, 25) (b) (2, 0.25)

(c) (25, 2) (d) (0, –25)

Sol. Correct option: **(a).**

(ii) Find the position of red flag

(a) (8, 0) (b) (20, 8)

(c) (8, 20) (d) (8, 0.2)

Sol. Correct option: **(c).**

(iii) What is the distance between both the flags ?

(a) $\sqrt{41}$ (b) $\sqrt{11}$

(b) $\sqrt{61}$ (c) $\sqrt{51}$

Sol. Correct option: **(c).**

Explanation: Position of Green flag = (2, 25)

Position of Red flag = (8, 20)

Distance between both the flags

$$\sqrt{(8-2)^2+(20-25)^2} = \sqrt{6^2+(-5)^2}$$
$$= \sqrt{36+25}$$
$$= \sqrt{61}$$

(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)

Sol. Correct option: **(a).**

Explanation: Position of blue flag

Mid-point of line segment joining the green and red flags

$$= \left(\frac{2+8}{2}, \frac{25+20}{2}\right)$$
$$= (5, 22.5)$$

(v) If Joy has to post a flag at one-fourth 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)

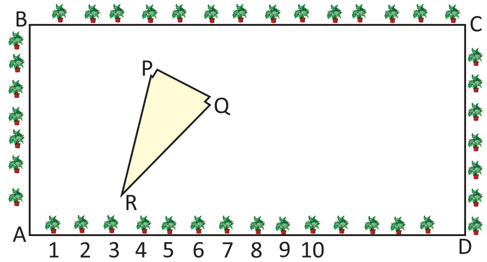
Sol. Correct option: **(a).**

Explanation: Position of Joy's flag

= Mid-point of line segment joining green and blue flags

$$= \left[\frac{2+5}{2}, \frac{25+22.5}{2}\right]$$
$$= [3.5, 23.75] \sim [3.5, 24]$$

Q. 4. The class X students school in krishnagar have been allotted a rectangular plot of land for their gardening activity. Saplings of Gulmohar are planted on the boundary at a distance of 1 m from each other. There is triangular grassy lawn in the plot as shown in the figure. The students are to sow seeds of flowering plants on the remaining area of the plot.



(i) Taking A as origin, find the coordinates of P.

(a) (4, 6) (b) (6, 4)

(c) (0, 6) (d) (4, 0)

Sol. Correct option: **(a).**

(ii) What will be the coordinates of R, if C is the origin ?

(a) (8, 6) (b) (3, 10)

(c) (10, 3) (d) (0, 6)

Sol. Correct option: **(c).**

(iii) What will be the coordinates of Q, if C is the origin ?

(a) (6, 13) (b) (–6, 13)

(c) (–13, 6) (d) (13, 6)

Sol. Correct option: **(d).**

(iv) Calculate the area of the triangles if A is the origin.

(a) 4.5 (b) 6

(c) 8 (d) 6.25

Sol. Correct option: **(a).**

Explanation: Coordinates of P = (4, 6)

Coordinates of Q = (3, 2)

Coordinates of R = (6, 5)

$$\text{Area of triangle } PQR = \frac{1}{2}[x_1(y_2-y_2) + x_2(y_3-y_1) + x_3(y_1-y_2)]$$
$$= \frac{1}{2}[4(-3) + 3(-1) + 6(4)]$$
$$= \frac{1}{2}[-12 + (-3) + 24]$$

$= \frac{1}{2}[-12 + 21]$

$= \frac{1}{2}[9]$

$= 4.5$ sq. units.

(v) Calculate the area of the triangles if C is the origin.

(a) **8** **(b)** **5**

(c) **6.25** **(d)** **4.5**

Sol. Correct option: **(d).**

SELF ASSESSMENT TEST - 3

Maximum Time: 1 hour **MM: 25**

Q. 1. To locate a point Q on line segment AB such that $BQ = \frac{5}{7} \times AB$. What is the ratio of line segment in which AB is divided ?

A [CBSE, Board Term-2, 2013] 1

Q. 2. Find the mid-point of P(– 5, 0) and Q (5, 0).

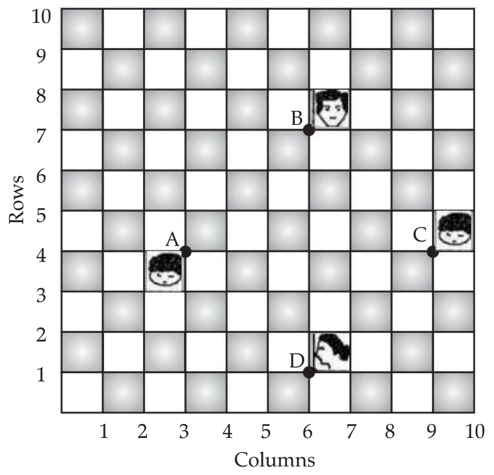
Q. 3. If the distance between the points (4, p) and (1, 0) is 5, then the value of p. R 1

Q. 4. AOBC is a rectangle whose three vertices are A(0, 3), O(0, 0) and B(5, 0). Find the length of its diagonal. U 1

Q. 5. Find the ratio in which the line segment joining the points (6, 4) and (1, – 7) is divided by the x-axis. 1

Q. 6. VISUAL CASE STUDY BASED QUESTIONS:

In a room, 4 friends are seated at the points A, B, C and D as shown in figure. Reeta and Meeta walk into the room and after observing for a few minutes Reeta asks Meeta.



Q. 1. What is the position of A ?

(a) (4, 3) (b) (3, 3)

(c) (3, 4) (d) None of these

Q. 2. What is the middle position of B and C ?

(a) $\left(\frac{15}{2}, \frac{11}{2}\right)$ (b) $\left(\frac{2}{15}, \frac{11}{2}\right)$

(c) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (d) None of these

Q. 3. What is the position of D ?

(a) (6, 0) (b) (0, 6)

(c) (6, 1) (d) (1, 6)

Q. 4. What is the distance between A and B ?

(a) $3\sqrt{2}$ unit (b) $2\sqrt{3}$ unit

(c) $2\sqrt{2}$ unit (c) $3\sqrt{3}$ unit

Q. 5. What is the distance between C and D

(a) $\sqrt{2}$ unit (b) $2\sqrt{2}$ unit

(c) $3\sqrt{2}$ unit (c) $4\sqrt{2}$ unit

Q. 7. If P(2, – 1), Q(3, 4), R(– 2, 3) and S(– 3, – 2) be four points in a plane, show that PQRS is a rhombus but not a square. A [CBSE Term-2, 2012] 2

Q. 8. If (a, b) is the mid-point of the segment joining the points A(10, – 6) and B(k, 4) and $a - 2b = 18$, find the value of k and the distance AB.

C + A [CBSE Term-2, 2012] 2

Q. 9. The co-ordinates of vertices of ΔABC are A(1, – 1), B(– 4, 6) and C(– 3, – 5). Draw the figure and prove that ΔABC is a scalene triangle. Find its area also.

A [CBSE Term-2, 2014] 3

Q. 10. If (3, 2) and (–3, 2) are two vertices of an equilateral triangle which contains the origin, find the third vertex. A [CBSE, Term-2, 2012] 3

Q. 11. A(4, – 6), B(3, – 2) and C(5, 2) are the vertices of a ΔABC and AD is its median. Prove that the median AD divides ΔABC into two triangles of equal areas. A [CBSE O.D. 2014] 5