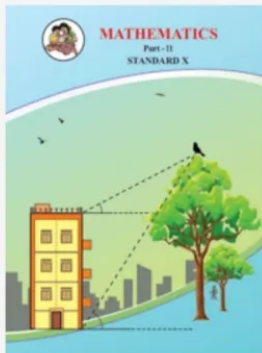


Maharashtra Board Solutions for Class 10-Maths (Part 2): Chapter 5- Co-ordinate Geometry

BOOK SOLUTIONS
CLASS 10
MATHEMATICS PART 2
CHAPTER 5
Co-ordinate Geometry









Maharashtra Board Solutions→

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Maharashtra Board Solutions for Class 10-Maths (Part 2): Chapter 5- Co-ordinate Geometry

Class 10: Maths Chapter 5 solutions. Complete Class 10 Maths Chapter 5 Notes.

Maharashtra Board Solutions for Class 10-Maths (Part 2): Chapter 5- Co-ordinate Geometry

Maharashtra Board 10th Maths Chapter 5, Class 10 Maths Chapter 5 solutions

Practice Set 5.1

Question 1. Find the distance between each of the following pairs of points.

- i. A (2, 3), B (4,1)
- ii. P (-5, 7), Q (-1, 3)
- iii. R (0, -3), S (0,52)
- iv. L (5, -8), M (-7, -3)
- v. T (-3, 6), R (9, -10)
- vi. W(-72,4), X(11, 4)

Solution:

i. Let A (x_1 , y_1) and B (x_2 , y_2) be the given points.

$$\therefore x_1 = 2, y_1 = 3, x_2 = 4, y_2 = 1$$

By distance formula,

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$$\begin{aligned}d(A, B) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(4 - 2)^2 + (1 - 3)^2} = \sqrt{2^2 + (-2)^2} \\&= \sqrt{4 + 4} = \sqrt{8}\end{aligned}$$

$$\therefore d(A, B) = 2\sqrt{2} \text{ units}$$

$\therefore$ The distance between the points A and B is $2\sqrt{2}$ units.

ii. Let P (x_1, y_1) and Q (x_2, y_2) be the given points.

$$\therefore x_1 = -5, y_1 = 7, x_2 = -1, y_2 = 3$$

By distance formula,

$$\begin{aligned}d(P, Q) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{[-1 - (-5)]^2 + (3 - 7)^2} \\&= \sqrt{(-1 + 5)^2 + (3 - 7)^2} \\&= \sqrt{4^2 + (-4)^2} \\&= \sqrt{16 + 16} \\&= \sqrt{32}\end{aligned}$$

$$\therefore d(P, Q) = 4\sqrt{2} \text{ units}$$

$\therefore$ The distance between the points P and Q is $4\sqrt{2}$ units.

iii. Let R (x_1, y_1) and S (x_2, y_2) be the given points.

$$\therefore x_1 = 0, y_1 = -3, x_2 = 0, y_2 = 5$$

By distance formula,

$$\begin{aligned}d(R, S) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(0 - 0)^2 + \left(\frac{5}{2} - (-3)\right)^2} \\&= \sqrt{\left(\frac{5}{2} + 3\right)^2} \\&= \sqrt{\left(\frac{5 + 6}{2}\right)^2} \\&= \sqrt{\left(\frac{11}{2}\right)^2} \\d(R, S) &= \frac{11}{2} \text{ units}\end{aligned}$$

$\therefore d(R, S) = 112$ units

$\therefore$ The distance between the points R and S is 112 units.

iv. Let L (x_1, y_1) and M (x_2, y_2) be the given points.

$\therefore x_1 = 5, y_1 = -8, x_2 = -7, y_2 = -3$

By distance formula,

$$\begin{aligned}d(L, M) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(-7 - 5)^2 + [-3 - (-8)]^2} \\&= \sqrt{(-7 - 5)^2 + (-3 + 8)^2} \\&= \sqrt{(-12)^2 + (5)^2} \\&= \sqrt{144 + 25} \\&= \sqrt{169}\end{aligned}$$

$\therefore d(L, M) = 13$ units

$\therefore$ The distance between the points L and M is 13 units.

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v. Let T (x_1, y_1) and R (x_2, y_2) be the given points.

$$\therefore x_1 = -3, y_1 = 6, x_2 = 9, y_2 = -10$$

By distance formula,

$$\begin{aligned} d(T, R) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{[9 - (-3)]^2 + (-10 - 6)^2} \\ &= \sqrt{(9 + 3)^2 + (-10 - 6)^2} \\ &= \sqrt{12^2 + (-16)^2} \\ &= \sqrt{144 + 256} \\ &= \sqrt{400} \end{aligned}$$

$$\therefore d(T, R) = 20 \text{ units}$$

$\therefore$ The distance between the points T and R 20 units.

vi. Let W (x_1, y_1) and X (x_2, y_2) be the given points.

$$x_1 = -\frac{7}{2}, y_1 = 4, x_2 = 11, y_2 = 4$$

By distance formula,

$$\begin{aligned} d(W, X) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{\left[11 - \left(-\frac{7}{2}\right)\right]^2 + (4 - 4)^2} \\ &= \sqrt{\left(11 + \frac{7}{2}\right)^2} \\ &= \sqrt{\left(\frac{22 + 7}{2}\right)^2} \\ &= \sqrt{\left(\frac{29}{2}\right)^2} \end{aligned}$$

$$\therefore d(W, X) = 292 \text{ units}$$

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∴ The distance between the points W and X is 292 units.

Practice Set 5.1 Geometry 10th Question 2. Determine whether the points are collinear.

i. A (1, -3), B (2, -5), C (-4, 7)

ii. L (-2, 3), M (1, -3), N (5, 4)

iii. R (0, 3), D (2, 1), S (3, -1)

iv. P (-2, 3), Q (1, 2), R (4, 1)

Solution:

i. By distance formula,

$$\begin{aligned}d(A, B) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(2 - 1)^2 + [-5 - (-3)]^2} \\&= \sqrt{(2 - 1)^2 + (-5 + 3)^2} \\&= \sqrt{1^2 + (-2)^2} \\&= \sqrt{1 + 4} \\d(A, B) &= \sqrt{5} \quad \dots(i)\end{aligned}$$

$$\begin{aligned}d(B, C) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(-4 - 2)^2 + [7 - (-5)]^2} \\&= \sqrt{(-4 - 2)^2 + (7 + 5)^2} \\&= \sqrt{(-6)^2 + 12^2} \\&= \sqrt{36 + 144} \\&= \sqrt{180}\end{aligned}$$

$$\therefore d(B, C) = 6\sqrt{5} \quad \dots(ii)$$

$$\begin{aligned}d(A, C) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(-4 - 1)^2 + [7 - (-3)]^2} \\&= \sqrt{(-4 - 1)^2 + (7 + 3)^2} \\&= \sqrt{(-5)^2 + 10^2} = \sqrt{25 + 100} \\&= \sqrt{125}\end{aligned}$$

$$\therefore d(A, B) = 5\sqrt{5} \quad \dots(i)$$

On adding (i) and (iii),

$$d(A, B) + d(A, C) = 5\sqrt{5} + 5\sqrt{5} = 10\sqrt{5}$$

$$\therefore d(A, B) + d(A, C) = d(B, C) \quad \dots [\text{From (ii)}]$$

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

ii. By distance formula,

$$\begin{aligned}d(L, M) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{[1 - (-2)]^2 + (-3 - 3)^2} \\&= \sqrt{(1+2)^2 + (-3-3)^2} \\&= \sqrt{3^2 + (-6)^2} \\&= \sqrt{9+36}\end{aligned}$$

$$\therefore d(L, M) = \sqrt{45} = 3\sqrt{5} \quad \dots(i)$$

$$\begin{aligned}d(M, N) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(5-1)^2 + [4 - (-3)]^2} \\&= \sqrt{(5-1)^2 + (4+3)^2} \\&= \sqrt{4^2 + 7^2} \\&= \sqrt{16+49}\end{aligned}$$

$$\therefore d(M, N) = \sqrt{65} \quad \dots(ii)$$

$$\begin{aligned}d(L, N) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{[5 - (-2)]^2 + (4 - 3)^2} \\&= \sqrt{(5+2)^2 + (4-3)^2} \\&= \sqrt{7^2 + 1^2} \\&= \sqrt{49+1}\end{aligned}$$

$$\therefore d(L, N) = \sqrt{50} = 5\sqrt{2} \quad \dots(iii)$$

On adding (i) and (iii),

$$d(L, M) + d(L, N) = 3\sqrt{5} + 5\sqrt{2} \neq \sqrt{65}$$

$\therefore d(L, M) + d(L, N) \neq d(M, N) \dots$ [From (ii)]

$\therefore$ Points L, M and N are not collinear.

iii. By distance formula,

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$$\begin{aligned}d(R, D) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(2 - 0)^2 + (1 - 3)^2} \\&= \sqrt{2^2 + (-2)^2} \\&= \sqrt{4 + 4}\end{aligned}$$

$$\therefore d(R, D) = \sqrt{8} \quad \dots(i)$$

$$\begin{aligned}d(D, S) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(3 - 2)^2 + (-1 - 1)^2} \\&= \sqrt{1^2 + (-2)^2} \\&= \sqrt{1 + 4}\end{aligned}$$

$$\therefore d(D, S) = \sqrt{5} \quad \dots(ii)$$

$$\begin{aligned}d(R, S) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(3 - 0)^2 + (-1 - 3)^2} \\&= \sqrt{3^2 + (-4)^2} \\&= \sqrt{9 + 16}\end{aligned}$$

$$\therefore d(R, S) = \sqrt{25} = 5 \quad \dots(iii)$$

On adding (i) and (ii),

$$\therefore d(R, D) + d(D, S) = 8 - \sqrt{} + 5 - \sqrt{} \neq 5$$

$$\therefore d(R, D) + d(D, S) \neq d(R, S) \dots [\text{From (iii)}]$$

$\therefore$ Points R, D and S are not collinear.

iv. By distance formula,

$$\begin{aligned}d(P, Q) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{[1 - (-2)]^2 + (2 - 3)^2} \\&= \sqrt{(1 + 2)^2 + (2 - 3)^2} \\&= \sqrt{3^2 + (-1)^2} \\&= \sqrt{9 + 1}\end{aligned}$$

$$\therefore d(P, Q) = \sqrt{10} \quad \dots(i)$$

$$\begin{aligned}d(Q, R) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(4 - 1)^2 + (1 - 2)^2} \\&= \sqrt{3^2 + (-1)^2} \\&= \sqrt{9 + 1}\end{aligned}$$

$$\therefore d(Q, R) = \sqrt{10} \quad \dots(ii)$$

$$\begin{aligned}d(P, R) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{[4 - (-2)]^2 + (1 - 3)^2} \\&= \sqrt{(4 + 2)^2 + (1 - 3)^2} \\&= \sqrt{6^2 + (-2)^2} \\&= \sqrt{36 + 4} \\&= \sqrt{40}\end{aligned}$$

$$\therefore d(P, R) = 2\sqrt{10} \quad \dots(iii)$$

On adding (i) and (ii),

$$d(P, Q) + d(Q, R) = \sqrt{10} + \sqrt{10} = 2\sqrt{10}$$

$$\therefore d(P, Q) + d(Q, R) = d(P, R) \dots [\text{From (iii)}]$$

$\therefore$ Points P, Q and R are collinear.

Coordinate Geometry Class 10 Practice Set 5.1 Question 3. Find the point on the X-axis which is equidistant from A (-3,4) and B (1, -4).

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Solution:

Let point C be on the X-axis which is equidistant from points A and B.

Point C lies on X-axis.

∴ its y co-ordinate is 0.

Let C = (x, 0)

C is equidistant from points A and B.

∴ AC = BC

$$\begin{aligned}\sqrt{[x - (-3)]^2 + (0 - 4)^2} &= \sqrt{(x - 1)^2 + [0 - (-4)]^2} \\ &\dots[\text{By distance formula}] \\ [x - (-3)]^2 + (0 - 4)^2 &= (x - 1)^2 + [0 - (-4)]^2 \\ &\dots[\text{Squaring both sides}]\end{aligned}$$

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

$$\therefore x^2 + 6x + 9 + 16 = x^2 - 2x + 1 + 16$$

$$\therefore 8x = -8$$

$$\therefore x = -88 = -1$$

∴ The point on X-axis which is equidistant from points A and B is (-1,0).

Question 4. Verify that points P (-2, 2), Q (2, 2) and R (2, 7) are vertices of a right angled triangle.

Solution:

Distance between two points

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

By distance formula,

$$\begin{aligned} PQ &= \sqrt{[2 - (-2)]^2 + (2 - 2)^2} \\ &= \sqrt{(2 + 2)^2 + (0)^2} = \sqrt{(4)^2} = 4 \quad \dots(i) \end{aligned}$$

$$\begin{aligned} QR &= \sqrt{(2 - 2)^2 + (7 - 2)^2} \\ &= \sqrt{(0)^2 + (5)^2} = \sqrt{(5)^2} = 5 \quad \dots(ii) \end{aligned}$$

$$\begin{aligned} PR &= \sqrt{[2 - (-2)]^2 + (7 - 2)^2} \\ &= \sqrt{(2 + 2)^2 + (5)^2} = \sqrt{(4)^2 + (5)^2} \\ &= \sqrt{16 + 25} = \sqrt{41} \end{aligned}$$

$$\text{Now, } PR^2 = (\sqrt{41})^2 = 41 \quad \dots(iii)$$

Consider, $PQ^2 + QR^2 = 42 + 52 = 16 + 25 = 41 \dots$ [From (i) and (ii)]

$\therefore PR^2 = PQ^2 + QR^2 \dots$ [From (iii)]

$\therefore \triangle PQR$ is a right angled triangle. $\dots$ [Converse of Pythagoras theorem]

$\therefore$ Points P, Q and R are the vertices of a right angled triangle.

Question 5.

Show that points P (2, -2), Q (7, 3), R (11, -1) and S (6, -6) are vertices of a parallelogram.

Proof:

Distance between two points

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

By distance formula,

$$\begin{aligned} PQ &= \sqrt{(7-2)^2 + [3-(-2)]^2} \\ &= \sqrt{(7-2)^2 + (3+2)^2} \\ &= \sqrt{5^2 + 5^2} = \sqrt{25+25} = \sqrt{50} \quad \dots(i) \end{aligned}$$

$$\begin{aligned} QR &= \sqrt{(11-7)^2 + (-1-3)^2} \\ &= \sqrt{4^2 + (-4)^2} = \sqrt{16+16} = \sqrt{32} \quad \dots(ii) \end{aligned}$$

$$\begin{aligned} RS &= \sqrt{(6-11)^2 + [-6-(-1)]^2} \\ &= \sqrt{(6-11)^2 + (-6+1)^2} \\ &= \sqrt{(-5)^2 + (-5)^2} = \sqrt{25+25} = \sqrt{50} \quad \dots(iii) \end{aligned}$$

$$\begin{aligned} PS &= \sqrt{(6-2)^2 + [-6-(-2)]^2} \\ &= \sqrt{(6-2)^2 + (-6+2)^2} \\ &= \sqrt{4^2 + (-4)^2} = \sqrt{16+16} = \sqrt{32} \quad \dots(iv) \end{aligned}$$

$PQ = RS \dots$ [From (i) and (iii)]

$QR = PS \dots$ [From (ii) and (iv)]

A quadrilateral is a parallelogram, if both the pairs of its opposite sides are congruent.

$\therefore \square PQRS$ is a parallelogram.

$\therefore$ Points P, Q, R and S are the vertices of a parallelogram.

Question 6.

Show that points A (-4, -7), B (-1, 2), C (8, 5) and D (5, -4) are vertices of rhombus ABCD.

Proof:

Distance between two points

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

By distance formula,

$$\begin{aligned} AB &= \sqrt{[-1 - (-4)]^2 + [2 - (-7)]^2} \\ &= \sqrt{(-1 + 4)^2 + (2 + 7)^2} \\ &= \sqrt{3^2 + 9^2} = \sqrt{9 + 81} = \sqrt{90} \quad \dots(i) \end{aligned}$$

$$\begin{aligned} BC &= \sqrt{[8 - (-1)]^2 + (5 - 2)^2} \\ &= \sqrt{(8 + 1)^2 + (5 - 2)^2} \\ &= \sqrt{9^2 + 3^2} = \sqrt{81 + 9} = \sqrt{90} \quad \dots(ii) \end{aligned}$$

$$\begin{aligned} CD &= \sqrt{(5 - 8)^2 + (-4 - 5)^2} \\ &= \sqrt{(-3)^2 + (-9)^2} = \sqrt{9 + 81} = \sqrt{90} \quad \dots(iii) \end{aligned}$$

$$\begin{aligned} AD &= \sqrt{[5 - (-4)]^2 + [-4 - (-7)]^2} \\ &= \sqrt{(5 + 4)^2 + (-4 + 7)^2} \\ &= \sqrt{9^2 + 3^2} = \sqrt{81 + 9} = \sqrt{90} \quad \dots(iv) \end{aligned}$$

$\therefore AB = BC = CD = AD$...[From (i), (ii), (iii) and (iv)]

In a quadrilateral, if all the sides are equal, then it is a rhombus.

$\therefore \square ABCD$ is a rhombus.

$\therefore$ Points A, B, C and D are the vertices of rhombus ABCD.

Question 7. Find x if distance between points L (x, 7) and M (1,15) is 10.

Solution:

$$X_1 = x, y_1 = 7, x_2 = 1, y_2 = 15$$

By distance formula,

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$$\begin{aligned}d(L, M) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ \therefore d(L, M) &= \sqrt{(1-x)^2 + (15-7)^2} \\ \therefore 10 &= \sqrt{(1-x)^2 + 8^2} \\ \therefore 100 &= (1-x)^2 + 64 \quad \dots [\text{Squaring both sides}] \\ \therefore (1-x)^2 &= 100 - 64 \\ \therefore (1-x)^2 &= 36 \\ \therefore 1-x &= \pm\sqrt{36} \\ &\dots [\text{Taking square root of both sides}]\end{aligned}$$

$$\therefore 1-x = \pm 6$$

$$\therefore 1-x = 6 \text{ or } 1-x = -6$$

$$\therefore x = -5 \text{ or } x = 7$$

$\therefore$ The value of x is -5 or 7 .

Question 8. Show that the points A (1, 2), B (1, 6), C ($1 + 2\sqrt{3}$, 4) are vertices of an equilateral triangle.

Proof:

Distance between two points

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

By distance formula,

$$\begin{aligned} AB &= \sqrt{(1-1)^2 + (6-2)^2} = \sqrt{0^2 + 4^2} \\ &= \sqrt{4^2} = 4 \quad \dots(i) \end{aligned}$$

$$\begin{aligned} BC &= \sqrt{(1+2\sqrt{3}-1)^2 + (4-6)^2} \\ &= \sqrt{(2\sqrt{3})^2 + (-2)^2} \\ &= \sqrt{12+4} = \sqrt{16} = 4 \quad \dots(ii) \end{aligned}$$

$$\begin{aligned} AC &= \sqrt{(1+2\sqrt{3}-1)^2 + (4-2)^2} \\ &= \sqrt{(2\sqrt{3})^2 + 2^2} \\ &= \sqrt{12+4} = \sqrt{16} = 4 \quad \dots(iii) \end{aligned}$$

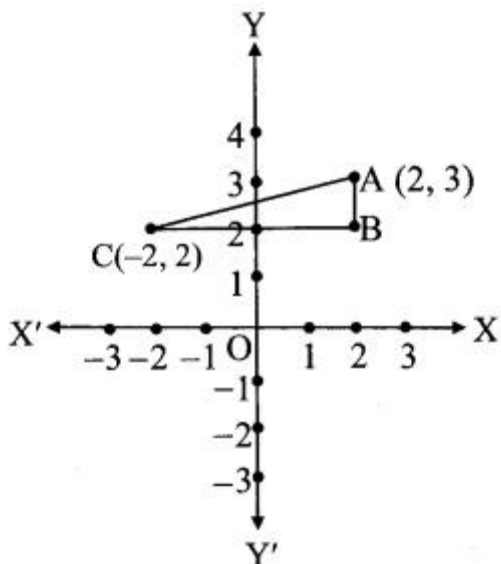
$\therefore AB = BC = AC \dots$ [From (i), (ii) and (iii)]

$\therefore \triangle ABC$ is an equilateral triangle.

$\therefore$ Points A, B and C are the vertices of an equilateral triangle.

Question 1.

In the figure, seg AB || Y-axis and seg CB || X-axis. Co-ordinates of points A and C are given. To find AC, fill in the boxes given below. (Textbook pa. no. 102)



Solution:

In $\triangle ABC$, $\angle B = 90^\circ$

$\therefore (AB)^2 + (BC)^2 = (AC)^2 \dots (i) \dots$ [Pythagoras theorem]

seg CB $\parallel$ X-axis

$\therefore$ y co-ordinate of B = 2

seg BA $\parallel$ Y-axis

$\therefore$ x co-ordinate of B = 2

$\therefore$ co-ordinate of B is $(2, 2) = (x_1, y_1)$

co-ordinate of A is $(2, 3) = (x_2, y_2)$

Since, AB $\parallel$ to Y-axis,

$$d(A, B) = y_2 - y_1$$

$$d(A, B) = 3 - 2 = 1$$

co-ordinate of C is $(-2, 2) = (x_1, y_1)$

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co-ordinate of B is $(2, 2) = (x_2, y_2)$

Since, BC || to X-axis,

$$d(B, C) = x_2 - x_1$$

$$d(B, C) = 2 - -2 = 4$$

$$\therefore AC^2 = 12 + 42 \dots [\text{From (i)}]$$

$$= 1 + 16 = 17$$

$$\therefore AC = 17--\sqrt{\text{units}} \dots [\text{Taking square root of both sides}]$$

Practice Set 5.2

Question 1.

Find the co-ordinates of point P if P divides the line segment joining the points A $(-1, 7)$ and B $(4, -3)$ in the ratio 2:3.

Solution:

Let the co-ordinates of point P be (x, y) and A (x_1, y_1) B (x_2, y_2) be the given points.

Here, $x_1 = -1, y_1 = 7, x_2 = 4, y_2 = -3, m = 2, n = 3$

$\therefore$ By section formula,

$$\begin{aligned} x &= \frac{mx_2 + nx_1}{m+n} = \frac{2(4) + 3(-1)}{2+3} \\ &= \frac{8-3}{5} = \frac{5}{5} = 1 \end{aligned}$$

$$\begin{aligned} y &= \frac{my_2 + ny_1}{m+n} = \frac{2(-3) + 3(7)}{2+3} \\ &= \frac{-6+21}{5} = \frac{15}{5} = 3 \end{aligned}$$

The co-ordinates of point P are $(1, 3)$.

$\therefore$ The co-ordinates of point P are $(1, 3)$.

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Question 2.

In each of the following examples find the co-ordinates of point A which divides segment PQ in the ratio a : b.

i. P (-3, 7), Q (1, -4), a : b = 2 : 1

ii. P (-2, -5), Q (4, 3), a : b = 3 : 4

iii. P (2, 6), Q (-4, 1), a : b = 1 : 2

Solution:

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

i. Let P (x_1 , y_1), Q (x_2 , y_2) be the given points.

Here, $x_1 = -3$, $y_1 = 7$, $x_2 = 1$, $y_2 = -4$, $a = 2$, $b = 1$

∴ By section formula,

$$\begin{aligned}x &= \frac{ax_2 + bx_1}{a + b} = \frac{2(1) + 1(-3)}{2 + 1} \\&= \frac{2 - 3}{3} = \frac{-1}{3} \\y &= \frac{ay_2 + by_1}{a + b} = \frac{2(-4) + 1(7)}{2 + 1} \\&= \frac{-8 + 7}{3} = \frac{-1}{3}\end{aligned}$$

∴ The co-ordinates of point A are (-13, -13).

ii. Let P (x_1 , y_1), Q (x_2 , y_2) be the given points.

Here, $x_1 = -2$, $y_1 = -5$, $x_2 = 4$, $y_2 = 3$, $a = 3$, $b = 4$

By section formula,

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$$x = \frac{ax_2 + bx_1}{a + b} = \frac{3(4) + 4(-2)}{3 + 4}$$
$$= \frac{12 - 8}{7} = \frac{4}{7}$$

$$y = \frac{ay_2 + by_1}{a + b} = \frac{3(3) + 4(-5)}{3 + 4}$$
$$= \frac{9 - 20}{7}$$
$$= \frac{-11}{7}$$

∴ The co-ordinates of point A are $(\frac{4}{7}, -\frac{11}{7})$

iii. Let P (x_1, y_1) , Q (x_2, y_2) be the given points.

Here, $x_1 = 2, y_1 = 6, x_2 = -4, y_2 = 1, a = 1, b = 2$

∴ By section formula,

$$x = \frac{ax_2 + bx_1}{a + b} = \frac{1(-4) + 2(2)}{1 + 2}$$
$$= \frac{-4 + 4}{3}$$
$$= 0$$

$$y = \frac{ay_2 + by_1}{a + b} = \frac{1(1) + 2(6)}{1 + 2}$$
$$= \frac{1 + 12}{3}$$
$$= \frac{13}{3}$$

∴ The co-ordinates of point A are $(0, \frac{13}{3})$

Question 3.

Find the ratio in which point T $(-1, 6)$ divides the line segment joining the points P $(-3, 10)$ and Q $(6, -8)$.

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Solution:

Let P (x_1, y_1), Q (x_2, y_2) and T (x, y) be the given points.

Here, $x_1 = -3, y_1 = 10, x_2 = 6, y_2 = -8, x = -1, y = 6$

∴ By section formula,

$$\begin{aligned}x &= \frac{mx_2 + nx_1}{m+n} \\ \therefore -1 &= \frac{m(6) + n(-3)}{m+n} \\ \therefore -m - n &= 6m - 3n \\ \therefore -n + 3n &= 6m + m \\ \therefore 2n &= 7m \\ \therefore \frac{m}{n} &= \frac{2}{7} \\ \therefore m : n &= 2 : 7\end{aligned}$$

∴ Point T divides seg PQ in the ratio 2 : 7.

Question 4.

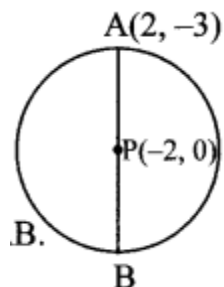
Point P is the centre of the circle and AB is a diameter. Find the co-ordinates of point B if co-ordinates of point A and P are (2, -3) and (-2,0) respectively.

Solution:

Let A (x_1, y_1), B (x_2, y_2) and P (x, y) be the given points.

Here, $x_1 = 2, y_1 = -3,$

$x = -2, y = 0$



Point P is the midpoint of seg AB.

∴ By midpoint formula,

$$x = \frac{x_1 + x_2}{2}$$

$$\therefore -2 = \frac{2 + x_2}{2}$$

$$\therefore -4 = 2 + x_2$$

$$\therefore x_2 = -4 - 2 = -6$$

$$y = \frac{y_1 + y_2}{2}$$

$$\therefore 0 = \frac{-3 + y_2}{2}$$

$$\therefore -3 + y_2 = 0$$

$$\therefore y_2 = 3$$

∴ The co-ordinates of point B are (-6,3).

Question 5.

Find the ratio in which point P (k, 7) divides the segment joining A (8, 9) and B (1,2). Also find k.

Solution:

Let A (x_1 , y_1), B (x_2 , y_2) and P (x , y) be the given points.

Here, $x_1 = 8$, $y_1 = 9$, $x_2 = 1$, $y_2 = 2$, $x = k$, $y = 7$

∴ By section formula,

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$$\begin{aligned}y &= \frac{my_2 + ny_1}{m+n} \\ \therefore 7 &= \frac{2m+9n}{m+n} \\ \therefore 7m+7n &= 2m+9n \\ \therefore 5m &= 2n \\ \therefore \frac{m}{n} &= \frac{2}{5} \\ \therefore m:n &= 2:5 \\ x &= \frac{mx_2 + nx_1}{m+n} \\ \therefore k &= \frac{2(1)+5(8)}{2+5} \\ &= \frac{2+40}{7} \\ &= \frac{42}{7} \\ &= 6\end{aligned}$$

$\therefore$ Point P divides seg AB in the ratio 2 : 5, and the value of k is 6.

Question 6.

Find the co-ordinates of midpoint of the segment joining the points (22, 20) and (0,16).

Solution:

Let A (x_1 , y_1) = A (22, 20),

B (x_2 , y_2) = B (0, 16)

Let the co-ordinates of the midpoint be P (x , y).

$\therefore$ By midpoint formula,

$$x = \frac{x_1 + x_2}{2} = \frac{22 + 0}{2} = 11$$

$$y = \frac{y_1 + y_2}{2} = \frac{20 + 16}{2} = \frac{36}{2} = 18$$

The co-ordinates of the midpoint of the segment joining (22, 20) and (0, 16) are (11, 18).

Question 7.

Find the centroids of the triangles whose vertices are given below.

i. (-7, 6), (2, -2), (8, 5)

ii. (3, -5), (4, 3), (11, -4)

iii. (4, 7), (8, 4), (7, 11)

Solution:

i. Let A (x_1 , y_1) = A (-7, 6),

B (x_2 , y_2) = B (2, -2),

C (x_3 , y_3) = C (8, 5)

∴ By centroid formula,

$$x = \frac{x_1 + x_2 + x_3}{3}$$
$$= \frac{-7 + 2 + 8}{3} = \frac{3}{3} = 1$$

$$y = \frac{y_1 + y_2 + y_3}{3}$$
$$= \frac{6 - 2 + 5}{3} = \frac{9}{3} = 3$$

∴ The co-ordinates of the centroid are (1, 3).

ii. Let A (x_1 , y_1) = A (3, -5),

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$$B(x_2, y_2) = B(4, 3),$$

$$C(x_3, y_3) = C(11, -4)$$

∴ By centroid formula,

$$\begin{aligned}x &= \frac{x_1 + x_2 + x_3}{3} \\&= \frac{3 + 4 + 11}{3} = \frac{18}{3} = 6\end{aligned}$$

$$\begin{aligned}y &= \frac{y_1 + y_2 + y_3}{3} \\&= \frac{-5 + 3 - 4}{3} = \frac{-6}{3} = -2\end{aligned}$$

∴ The co-ordinates of the centroid are (6, -2).

iii. Let $A(x_1, y_1) = A(4, 7),$

$$B(x_2, y_2) = B(8, 4),$$

$$C(x_3, y_3) = C(7, 11)$$

∴ By centroid formula,

$$\begin{aligned}x &= \frac{x_1 + x_2 + x_3}{3} \\&= \frac{4 + 8 + 7}{3} = \frac{19}{3}\end{aligned}$$

$$\begin{aligned}y &= \frac{y_1 + y_2 + y_3}{3} \\&= \frac{7 + 4 + 11}{3} = \frac{22}{3}\end{aligned}$$

∴ The co-ordinates of the centroid are (19/3, 22/3)

Question 8.

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In $\triangle ABC$, G (-4, -7) is the centroid. If A (-14, -19) and B (3, 5), then find the co-ordinates of C.

Solution:

$$G(x, y) = G(-4, -7),$$

$$A(x_1, y_1) = A(-14, -19),$$

$$B(x_2, y_2) = B(3, 5)$$

Let the co-ordinates of point C be (x_3, y_3) .

G is the centroid.

By centroid formula,

$$x = \frac{x_1 + x_2 + x_3}{3}$$

$$\therefore -4 = \frac{-14 + 3 + x_3}{3}$$

$$\therefore -12 = -11 + x_3$$

$$\therefore x_3 = -12 + 11$$

$$\therefore x_3 = -1$$

$$y = \frac{y_1 + y_2 + y_3}{3}$$

$$\therefore -7 = \frac{-19 + 5 + y_3}{3}$$

$$\therefore -21 = -14 + y_3$$

$$\therefore y_3 = -21 + 14$$

$$\therefore y_3 = -7$$

$\therefore$ The co-ordinates of point C are $(-1, -7)$.

Question 9.

A (h, -6), B (2, 3) and C (-6, k) are the co-ordinates of vertices of a triangle whose centroid is G (1,5). Find h and k.

Solution:

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$$A(x_1, y_1) = A(h, -6),$$

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

$$C(x_3, y_3) = C(-6, k)$$

$$\therefore \text{centroid } G(x, y) = G(1, 5)$$

G is the centroid.

By centroid formula,

$$x = \frac{x_1 + x_2 + x_3}{3}$$

$$\therefore 1 = \frac{h + 2 + (-6)}{3}$$

$$\therefore 3 = h + 2 - 6$$

$$\therefore 3 = h - 4$$

$$\therefore h = 3 + 4$$

$$\therefore h = 7$$

$$y = \frac{y_1 + y_2 + y_3}{3}$$

$$\therefore 5 = \frac{-6 + 3 + k}{3}$$

$$\therefore 15 = -3 + k$$

$$\therefore k = 15 + 3$$

$$\therefore k = 18$$

$$\therefore h = 7 \text{ and } k = 18$$

Question 10.

Find the co-ordinates of the points of trisection of the line segment AB with A (2,7) and B (-4, -8).

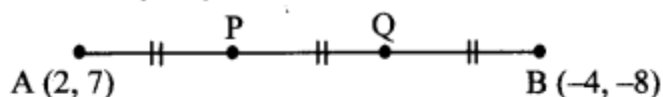
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Solution:

A (2, 7), B (-4, -8)

Suppose the points P and Q trisect seg AB.

$\therefore AP = PQ = QB$



Let $AP = PQ = QB = x$

$$\frac{AP}{PB} = \frac{AP}{PQ + QB} \quad \dots [P - Q - B]$$

$$\therefore \frac{AP}{PB} = \frac{x}{x + x} = \frac{x}{2x} = \frac{1}{2}$$

$\therefore$ Point P divides seg AB in the ratio 1:2.

$\therefore$ By section formula,

$$\begin{aligned} x \text{ co-ordinate of P} &= \frac{mx_2 + nx_1}{m + n} \\ &= \frac{1(-4) + 2(2)}{1 + 2} \\ &= \frac{-4 + 4}{3} = 0 \end{aligned}$$

$$\begin{aligned} y \text{ co-ordinate of P} &= \frac{my_2 + ny_1}{m + n} \\ &= \frac{1(-8) + 2(7)}{1 + 2} \\ &= \frac{-8 + 14}{3} = \frac{6}{3} = 2 \end{aligned}$$

Co-ordinates of P are (0, 2).

Point Q is the midpoint of PB.

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By midpoint formula,

$$\begin{aligned}x \text{ co-ordinate of } Q &= \frac{x_1 + x_2}{2} \\&= \frac{0 + (-4)}{2} = \frac{-4}{2} = -2\end{aligned}$$

$$\begin{aligned}y \text{ co-ordinate of } Q &= \frac{y_1 + y_2}{2} \\&= \frac{2 + (-8)}{2} \\&= \frac{2 - 8}{2} = \frac{-6}{2} = -3\end{aligned}$$

Co-ordinates of Q are (-2, -3).

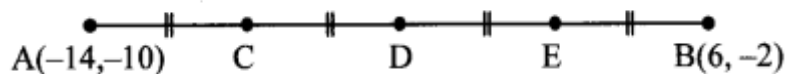
∴ The co-ordinates of the points of trisection seg AB are (0, 2) and (-2, -3).

Question 11.

If A (-14, -10), B (6, -2) are given, find the co-ordinates of the points which divide segment AB into four equal parts.

Solution:

Let the points C, D and E divide seg AB in four equal parts.



Point D is the midpoint of seg AB.

∴ By midpoint formula,

$$\begin{aligned}x \text{ co-ordinate of D} &= \frac{x_1 + x_2}{2} \\&= \frac{-14 + 6}{2} \\&= \frac{-8}{2} = -4\end{aligned}$$

$$\begin{aligned}y \text{ co-ordinate of D} &= \frac{y_1 + y_2}{2} \\&= \frac{-10 - 2}{2} \\&= \frac{-12}{2} = -6\end{aligned}$$

∴ Co-ordinates of D are (-4, -6).

Point C is the midpoint of seg AD.

∴ By midpoint formula,

$$\begin{aligned}x \text{ co-ordinate of C} &= \frac{x_1 + x_2}{2} \\&= \frac{-14 - 4}{2} \\&= \frac{-18}{2} = -9\end{aligned}$$

$$\begin{aligned}y \text{ co-ordinate of C} &= \frac{y_1 + y_2}{2} \\&= \frac{-10 - 6}{2} \\&= \frac{-16}{2} = -8\end{aligned}$$

∴ Co-ordinates of C are (-9, -8).

Point E is the midpoint of seg DB.

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∴ By midpoint formula,

$$\begin{aligned} \text{x co-ordinate of E} &= \frac{x_1 + x_2}{2} \\ &= \frac{-4 + 6}{2} \\ &= \frac{2}{2} = 1 \end{aligned}$$

$$\begin{aligned} \text{y co-ordinate of E} &= \frac{y_1 + y_2}{2} \\ &= \frac{-6 - 2}{2} \\ &= \frac{-8}{2} = -4 \end{aligned}$$

∴ Co-ordinates of E are (1, -4).

∴ The co-ordinates of the points dividing seg AB in four equal parts are C(-9, -8), D(-4, -6) and E(1, -4).

Question 12.

If A (20, 10), B (0, 20) are given, find the co-ordinates of the points which divide segment AB into five congruent parts.

Solution:

Suppose the points C, D, E and F divide seg AB in five congruent parts.

∴ AC = CD = DE = EF = FB

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$$\frac{AC}{CB} = \frac{AC}{CD + DE + EF + FB} \quad \dots \begin{bmatrix} C - D - E \\ D - E - F \\ E - F - B \end{bmatrix}$$

$$\therefore \frac{AC}{CB} = \frac{x}{x + x + x + x} = \frac{x}{4x} = \frac{1}{4}$$

$\therefore$ Point C divides seg AB in the ratio 1 : 4.
By section formula,

$$\begin{aligned} x \text{ co-ordinate of C} &= \frac{mx_2 + nx_1}{m + n} \\ &= \frac{1(0) + 4(20)}{1 + 4} \\ &= \frac{80}{5} = 16 \end{aligned}$$

$$\begin{aligned} y \text{ co-ordinate of C} &= \frac{my_2 + ny_1}{m + n} \\ &= \frac{1(20) + 4(10)}{1 + 4} \\ &= \frac{60}{5} = 12 \end{aligned}$$

$\therefore$ co-ordinates of C are (16, 12).

E is the midpoint of seg CB.

By midpoint formula,

$$\begin{aligned}x \text{ co-ordinate of E} &= \frac{x_1 + x_2}{2} \\&= \frac{16 + 0}{2} = \frac{16}{2} = 8\end{aligned}$$

$$\begin{aligned}y \text{ co-ordinate of E} &= \frac{y_1 + y_2}{2} \\&= \frac{12 + 20}{2} = \frac{32}{2} = 16\end{aligned}$$

∴ co-ordinates of E are (8, 16).

D is the midpoint of seg CE.

$$\begin{aligned}x \text{ co-ordinate of D} &= \frac{x_1 + x_2}{2} \\&= \frac{16 + 8}{2} = \frac{24}{2} = 12\end{aligned}$$

$$\begin{aligned}y \text{ co-ordinate of D} &= \frac{y_1 + y_2}{2} \\&= \frac{12 + 16}{2} = \frac{28}{2} = 14\end{aligned}$$

∴ co-ordinates of D are (12, 14).

F is the midpoint of seg EB.

$$\begin{aligned}x \text{ co-ordinate of F} &= \frac{x_1 + x_2}{2} \\&= \frac{8 + 0}{2} = 4\end{aligned}$$

$$\begin{aligned}y \text{ co-ordinate of F} &= \frac{y_1 + y_2}{2} \\&= \frac{16 + 20}{2} = \frac{36}{2} = 18\end{aligned}$$

∴ co-ordinates of F are (4, 18).

∴ The co-ordinates of the points dividing seg AB in five congruent parts are C (16, 12), D (12, 14), E (8, 16) and F (4, 18).

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Question 1.

A (15, 5), B (9, 20) and A-P-B. Find the ratio in which point P (11, 15) divides segment AB. Find the ratio using x and y co-ordinates. Write the conclusion. (Textbook pg. no. 113)

Solution:

Suppose point P (11,15) divides segment AB in the ratio m : n.

By section formula,

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

$$\therefore 11 = \frac{9m + 15n}{m+n}$$

$$\therefore 11m + 11n = 9m + 15n$$

$$\therefore 2m = 4n$$

$$\therefore \frac{m}{n} = \frac{4}{2} = \frac{2}{1} = 2 : 1$$

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

$$\therefore 15 = \frac{20m + 5n}{m+n}$$

$$\therefore 15m + 15n = 20m + 5n$$

$$\therefore 5m = 10n$$

$$\therefore \frac{m}{n} = \frac{10}{5} = \frac{2}{1} = 2 : 1$$

$\therefore$ Point P divides seg AB in the ratio 2 : 1.

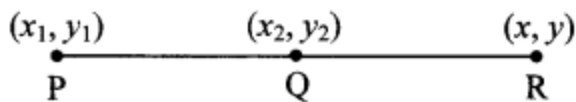
The ratio obtained by using x and y co-ordinates is the same.

Question 2.

External division: (Textbook pg. no. 115)

Suppose point R divides seg PQ externally in the ratio 3:1.

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$$\therefore \frac{PR}{QR} = \frac{3}{1}$$

Let the common multiple be k.

Let $PR = 3k$ and $QR = k$

Now, $PR = PQ + QR \dots [P - Q - R]$

$$\therefore 3k = PQ + k$$

$$\therefore PQQR = 2kk = 21$$

$\therefore$ Point Q divides seg PR in the ratio 2 : 1 internally.

Thus, we can find the co-ordinates of point R, when co-ordinates of points P and Q are given.

Practice Set 5.3

Question 1. Angles made by the line with the positive direction of X-axis are given. Find the slope of these lines.

i. 45°

ii. 60°

iii. 90°

Solution:

i. Angle made with the positive direction of

X-axis $(\theta) = 45^\circ$

Slope of the line $(m) = \tan \theta$

$$\therefore m = \tan 45^\circ = 1$$

$\therefore$ The slope of the line is 1.

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ii. Angle made with the positive direction of X-axis (θ) = 60°

Slope of the line (m) = $\tan \theta$

$$\therefore m = \tan 60^\circ = 3-\sqrt{3}$$

$\therefore$ The slope of the line is $3-\sqrt{3}$.

iii. Angle made with the positive direction of

X-axis (θ) = 90°

Slope of the line (m) = $\tan \theta$

$$\therefore m = \tan 90^\circ$$

But, the value of $\tan 90^\circ$ is not defined.

$\therefore$ The slope of the line cannot be determined.

Question 2. Find the slopes of the lines passing through the given points.

i. A (2, 3), B (4, 7)

ii. P(-3, 1), Q (5, -2)

iii. C (5, -2), D (7, 3)

iv. L (-2, -3), M (-6, -8)

v. E (-4, -2), F (6, 3)

vi. T (0, -3), s (0,4)

Solution:

i. A (x_1, y_1) = A (2, 3) and B (x_2, y_2) = B (4, 7)

Here, $x_1 = 2$, $x_2 = 4$, $y_1 = 3$, $y_2 = 7$

$$\begin{aligned}\text{Slope of line AB} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{7-3}{4-2} = \frac{4}{2} = 2\end{aligned}$$

∴ The slope of line AB is 2.

ii. P (x_1, y_1) = P (-3, 1) and Q (x_2, y_2) = Q (5, -2)

Here, $x_1 = -3, x_2 = 5, y_1 = 1, y_2 = -2$

$$\begin{aligned}\text{Slope of line PQ} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-2-1}{5-(-3)} = \frac{-3}{5+3} = \frac{-3}{8}\end{aligned}$$

∴ The slope of line PQ is $-\frac{3}{8}$

iii. C (x_1, y_1) = C (5, -2) and D (x_2, y_2) = D (7, 3)

Here, $x_1 = 5, x_2 = 7, y_1 = -2, y_2 = 3$

$$\begin{aligned}\text{Slope of line CD} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3-(-2)}{7-5} = \frac{3+2}{2} = \frac{5}{2}\end{aligned}$$

∴ The slope of line CD is $\frac{5}{2}$

iv. L (x_1, y_1) = L (-2, -3) and M (x_2, y_2) = M (-6, -8)

Here, $x_1 = -2, x_2 = -6, y_1 = -3, y_2 = -8$

$$\begin{aligned}\text{Slope of line LM} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-8 - (-3)}{-6 - (-2)} = \frac{-8 + 3}{-6 + 2} \\ &= \frac{-5}{-4} = \frac{5}{4}\end{aligned}$$

∴ The slope of line LM is 5/4

v. E (x₁, y₁) = E (-4, -2) and F (x₂, y₂) = F (6, 3)

Here, x₁ = -4, x₂ = 6, y₁ = -2, y₂ = 3

$$\begin{aligned}\text{Slope of line EF} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3 - (-2)}{6 - (-4)} = \frac{3 + 2}{6 + 4} \\ &= \frac{5}{10} = \frac{1}{2}\end{aligned}$$

∴ The slope of line EF is 1/2.

vi. T (x₁, y₁) = T (0, -3) and S (x₂, y₂) = S (0, 4)

Here, x₁ = 0, x₂ = 0, y₁ = -3, y₂ = 4

$$\begin{aligned}\text{Slope of line TS} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{4 - (-3)}{0 - 0} = \frac{4 + 3}{0} = \frac{7}{0} \\ &= \text{Not defined}\end{aligned}$$

∴ The slope of line TS cannot be determined.

Question 3. Determine whether the following points are collinear.

i. A (-1, -1), B (0, 1), C (1, 3)

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ii. D (-2, -3), E (1, 0), F (2, 1)

iii. L (2, 5), M (3, 3), N (5, 1)

iv. P (2, -5), Q (1, -3), R (-2, 3)

v. R (1, -4), S (-2, 2), T (-3, 4)

vi. A(-4, 4), K[-2, 5], N (4, -2)

Solution:

$$\text{i. Slope of line AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-1)}{0 - (-1)} = \frac{1+1}{0+1} = 2$$

$$\text{Slope of line BC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-1}{1-0} = 2$$

∴ slope of line AB = slope of line BC

∴ line AB || line BC

Also, point B is common to both the lines.

∴ Both lines are the same.

∴ Points A, B and C are collinear.

$$\begin{aligned} \text{ii. Slope of line DE} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - (-3)}{1 - (-2)} \\ &= \frac{0+3}{1+2} = \frac{3}{3} = 1 \end{aligned}$$

$$\text{Slope of line EF} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-0}{2-1} = 1$$

∴ slope of line DE = slope of line EF

∴ line DE || line EF

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Also, point E is common to both the lines.

∴ Both lines are the same.

∴ Points D, E and F are collinear.

iii. Slope of line LM = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 5}{3 - 2} = -2$

Slope of line MN = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 3}{5 - 3} = -\frac{2}{2} = -1$

∴ slope of line LM ≠ slope of line MN

∴ Points L, M and N are not collinear.

iv. Slope of line PQ = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - (-5)}{1 - 2}$
 $= \frac{-3 + 5}{-1} = -2$

Slope of line QR = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-3)}{-2 - 1}$
 $= \frac{3 + 3}{-3} = \frac{6}{-3} = -2$

∴ slope of line PQ = slope of line QR

∴ line PQ || line QR

Also, point Q is common to both the lines.

∴ Both lines are the same.

∴ Points P, Q and R are collinear.

$$\begin{aligned}\text{v. Slope of line RS} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-4)}{-2 - 1} \\ &= \frac{2 + 4}{-3} = \frac{6}{-3} = -2\end{aligned}$$

$$\begin{aligned}\text{Slope of line ST} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 2}{-3 - (-2)} \\ &= \frac{2}{-3 + 2} = -2\end{aligned}$$

∴ slope of line RS = slope of line ST

∴ line RS || line ST

Also, point S is common to both the lines.

∴ Both lines are the same.

∴ Points R, S and T are collinear.

$$\begin{aligned}\text{vi. Slope of line AK} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{\frac{5}{2} - 4}{-2 - (-4)} = \frac{\frac{5-8}{2}}{-2+4} = \frac{5-8}{2(2)} \\ &= \frac{-3}{4}\end{aligned}$$

$$\begin{aligned}\text{Slope of line KN} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-2 - \frac{5}{2}}{4 - (-2)} = \frac{\frac{-4-5}{2}}{4+2} \\ &= \frac{-4-5}{2(6)} = \frac{-9}{12} = \frac{-3}{4}\end{aligned}$$

∴ slope of line AK = slope of line KN

∴ line AK || line KN

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Also, point K is common to both the lines.

∴ Both lines are the same.

∴ Points A, K and N are collinear.

Practice Set 5.3 Geometry 9th Standard Question 4. If A (1, -1), B (0,4), C (-5,3) are vertices of a triangle, then find the slope of each side.

Solution:

We know that, slope of line = $\frac{y_2 - y_1}{x_2 - x_1}$

$$\text{Slope of side AB} = \frac{4 - (-1)}{0 - 1} = \frac{4 + 1}{-1} = -5$$

$$\text{Slope of side BC} = \frac{3 - 4}{-5 - 0} = \frac{-1}{-5} = \frac{1}{5}$$

$$\begin{aligned}\text{Slope of side AC} &= \frac{3 - (-1)}{-5 - 1} \\ &= \frac{3 + 1}{-6} = \frac{-4}{6} = \frac{-2}{3}\end{aligned}$$

∴ The slopes of the sides AB, BC and AC are -5, 15 and -23 respectively.

Question 5. Show that A (-4, -7), B (-1, 2), C (8, 5) and D (5, -4) are the vertices of a parallelogram.

Proof:

We know that, slope of line = $\frac{y_2 - y_1}{x_2 - x_1}$

$$\begin{aligned}\text{Slope of side AB} &= \frac{2 - (-7)}{-1 - (-4)} \\ &= \frac{2+7}{-1+4} = \frac{9}{3} = 3 \quad \dots(i)\end{aligned}$$

$$\begin{aligned}\text{Slope of side BC} &= \frac{5-2}{8-(-1)} = \frac{3}{8+1} \\ &= \frac{3}{9} = \frac{1}{3} \quad \dots(ii)\end{aligned}$$

$$\text{Slope of side CD} = \frac{-4-5}{5-8} = \frac{-9}{-3} = 3 \quad \dots(iii)$$

$$\begin{aligned}\text{Slope of side AD} &= \frac{-4-(-7)}{5-(-4)} \\ &= \frac{-4+7}{5+4} = \frac{3}{9} = \frac{1}{3} \quad \dots(iv)\end{aligned}$$

$\therefore$ Slope of side AB = Slope of side CD ... [From (i) and (iii)]

$\therefore$ side AB $\parallel$ side CD

Slope of side BC = Slope of side AD ... [From (ii) and (iv)]

$\therefore$ side BC $\parallel$ side AD

Both the pairs of opposite sides of ABCD are parallel.

ABCD is a parallelogram.

Points A(-4, -7), B(-1, 2), C(8, 5) and D(5, -4) are the vertices of a parallelogram.

Question 6.

Find k, if R (1, -1), S (-2, k) and slope of line RS is -2.

Solution:

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$$R(x_1, y_1) = R(1, -1), S(x_2, y_2) = S(-2, k)$$

$$\text{Here, } x_1 = 1, x_2 = -2, y_1 = -1, y_2 = k$$

$$\text{Slope of line RS} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{k - (-1)}{-2 - 1} = \frac{k + 1}{-3}$$

But, slope of line RS is -2. ... [Given]

$$\therefore -2 = \frac{k + 1}{-3}$$

$$\therefore k + 1 = 6$$

$$\therefore k = 6 - 1$$

$$\therefore k = 5$$

Question 7. Find k, if B (k, -5), C (1, 2) and slope of the line is 7.

Solution:

$$B(x_1, y_1) = B(k, -5), C(x_2, y_2) = C(1, 2)$$

$$\text{Here, } x_1 = k, x_2 = 1, y_1 = -5, y_2 = 2$$

$$\begin{aligned} \text{Slope of line BC} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-5)}{1 - k} \\ &= \frac{2 + 5}{1 - k} = \frac{7}{1 - k} \end{aligned}$$

But, slope of line BC is 7. ...[Given]

$$\therefore 7 = \frac{7}{1 - k}$$

$$\therefore 7(1 - k) = 7$$

$$\therefore 1 - k = 1$$

$$\therefore 1 - k = 1$$

$$\therefore k = 0$$

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Question 8.

Find k, if PQ || RS and P (2, 4), Q (3, 6), R (3,1), S (5, k).

Solution:

$$\text{Slope of line PQ} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 4}{3 - 2} = 2$$

$$\text{Slope of line RS} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{k - 1}{5 - 3} = \frac{k - 1}{2}$$

But, line PQ || line RS ... [Given]

∴ Slope of line PQ = Slope of line RS

$$\therefore 2 = k - 1$$

$$\therefore 4 = k - 1$$

$$\therefore k = 4 + 1$$

$$\therefore k = 5$$



Maharashtra Board Solutions

Class 10 Maths (Part 2)

- Chapter 1- Similarity
- Chapter 2- Pythagoras Theorem
- Chapter 3- Circle
- Chapter 4- Geometric Constructions
- Chapter 5- Co-ordinate Geometry
- Chapter 6- Trigonometry
- Chapter 7- Mensuration

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The Maharashtra State Board of Secondary and Higher Secondary Education or MSBSHSE (Marathi: महाराष्ट्र राज्य माध्यमिक आणि उच्च माध्यमिक शिक्षण मंडळ), is an **autonomous and statutory body established in 1965**. The board was amended in the year 1977 under the provisions of the Maharashtra Act No. 41 of 1965.

The Maharashtra State Board of Secondary & Higher Secondary Education (MSBSHSE), Pune is an independent body of the Maharashtra Government. There are more than 1.4 million students that appear in the examination every year. The Maha State Board conducts the board examination twice a year. This board conducts the examination for SSC and HSC.

The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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