CLASS 10 SSC MATHS PART 2

Part 2 Chapter 5 – Coordinate Geometry_complete textbook solutions

📌 Key Formulas & Core Concepts

1. Distance Formula: any two points $A(x_1, y_1)$ and $B(x_2, y_2)$:

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

Distance from Origin: The distance of a point $P(x, y)$ from the origin $O(0,0)$ is:

$$d(O, P) = \sqrt{x^2 + y^2}$$

2. **Section Formula**

Used to find the coordinates of a point $P(x, y)$ that divides the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio $m: n$:

$$x = \frac{mx_2 + nx_1}{m + n}, \quad y = \frac{my_2 + ny_1}{m + n}$$

3. Midpoint Formula

If point $M(x, y)$ is the midpoint of the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ (i.e., ratio is $1: 1$):

$$x = \frac{x_1 + x_2}{2}, \quad y = \frac{y_1 + y_2}{2}$$

4. Centroid Formula

If $G(x, y)$ is the centroid of a triangle with vertices $A(x_1, y_1)$, $B(x_2, y_2)$, and $C(x_3, y_3)$:

$$x = \frac{x_1 + x_2 + x_3}{3}, \quad y = \frac{y_1 + y_2 + y_3}{3}$$

5. Slope of a Line (m)

- **From Inclination (θ):** If a line makes an angle θ with the positive direction of the X-axis:

$$m = \tan\theta$$

  - If $\theta = 0° \Longrightarrow m = 0$ (Parallel to X-axis)
  - If $\theta = 90° \Longrightarrow m$ is not defined (Parallel to Y-axis)

- **From Two Points:** Slope of a line passing through $A(x_1, y_1)$ and $B(x_2, y_2)$:

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad (x_1 \neq x_2)$$

Practice Set 5.1 (Page 107)

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

(1) $\boldsymbol{A(2,3), B(4,1)}$

Solution:

Let $\boldsymbol{A(x_1,y_1)}$ and $\boldsymbol{B(x_2,y_2)}$ be the given points.

By distance formula:

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

Here, $\boldsymbol{x_1 = 2, y_1 = 3, x_2 = 4, y_2 = 1}$

$$\boldsymbol{d(A,B) = \sqrt{(4-2)^2+(1-3)^2}}$$

$$\boldsymbol{d(A,B) = \sqrt{2^2+(-2)^2}}$$

$$\boldsymbol{d(A,B) = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}}$$

Answer: The distance between $\boldsymbol{A}$ and $\boldsymbol{B}$ is $\boldsymbol{2\sqrt{2}}$ units.

(2) $\boldsymbol{P(-5,7), Q(-1,3)}$

Solution:

Let $\boldsymbol{P(x_1,y_1)}$ and $\boldsymbol{Q(x_2,y_2)}$ be the given points.

By distance formula:

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

Here, $\boldsymbol{x_1 = -5, y_1 = 7, x_2 = -1, y_2 = 3}$

$$\boldsymbol{d(P,Q) = \sqrt{[-1-(-5)]^2+(3-7)^2}}$$

$$\boldsymbol{d(P,Q) = \sqrt{4^2+(-4)^2}}$$

$$\boldsymbol{d(P,Q) = \sqrt{16+16} = \sqrt{32} = 4\sqrt{2}}$$

Answer: The distance between $\boldsymbol{P}$ and $\boldsymbol{Q}$ is $\boldsymbol{4\sqrt{2}}$ units.

(3) $\boldsymbol{R(0,-3), S\left(0,\frac{5}{2}\right)}$

Solution:

Let $\boldsymbol{R(x_1,y_1)}$ and $\boldsymbol{S(x_2,y_2)}$ be the given points.

By distance formula:

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

Here, $x_1 = 0$, $y_1 = -3$, $x_2 = 0$, $y_2 = \frac{5}{2}$

$$d(R,S) = \sqrt{(0-0)^2 + \left[\frac{5}{2} - (-3)\right]^2}$$

$$d(R,S) = \sqrt{0 + \left(\frac{11}{2}\right)^2}$$

$$d(R,S) = \sqrt{\frac{121}{4}} = \frac{11}{2}$$

Answer: The distance between R and S is $\frac{11}{2}$ units.

2. Determine whether the points are collinear.

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

Solution:

If the sum of any two distances out of $d(A,B)$, $d(B,C)$, and $d(A,C)$ is equal to the third, then the points A, B, and C are collinear.

Coordinates: $A(1,-3)$, $B(2,-5)$, $C(-4,7)$

By distance formula:

$$d(A,B) = \sqrt{(2-1)^2 + [-5-(-3)]^2} = \sqrt{1^2 + (-2)^2} = \sqrt{1+4} = \sqrt{5} \quad \text{--- (i)}$$

$$d(B,C) = \sqrt{(-4-2)^2 + [7-(-5)]^2} = \sqrt{(-6)^2 + 12^2} = \sqrt{36+144} = \sqrt{180} = 6\sqrt{5} \quad \text{--- (ii)}$$

$$d(A,C) = \sqrt{(-4-1)^2 + [7-(-3)]^2} = \sqrt{(-5)^2 + 10^2} = \sqrt{25+100} = \sqrt{125} = 5\sqrt{5} \quad \text{--- (iii)}$$

From (i), (ii), and (iii):

$$\sqrt{5} + 5\sqrt{5} = 6\sqrt{5}$$

$$d(A,B) + d(A,C) = d(B,C)$$

Answer: Points A, B, and C are collinear.

(2) $\boldsymbol{L(-2,3), M(1,-3), N(5,4)}$

Solution:

Coordinates: $\boldsymbol{L(-2,3)}$, $\boldsymbol{M(1,-3)}$, $\boldsymbol{N(5,4)}$

By distance formula:

$$\boldsymbol{d(L,M) = \sqrt{[1-(-2)]^2 + (-3-3)^2} = \sqrt{3^2 + (-6)^2} = \sqrt{9+36} = \sqrt{45} = 3\sqrt{5}} \quad \text{--- (i)}$$

$$\boldsymbol{d(M,N) = \sqrt{(5-1)^2 + [4-(-3)]^2} = \sqrt{4^2 + 7^2} = \sqrt{16+49} = \sqrt{65}} \quad \text{--- (ii)}$$

$$\boldsymbol{d(L,N) = \sqrt{[5-(-2)]^2 + (4-3)^2} = \sqrt{7^2 + 1^2} = \sqrt{49+1} = \sqrt{50} = 5\sqrt{2}} \quad \text{--- (iii)}$$

Adding (i) and (iii):

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

$$\boldsymbol{d(L,M) + d(L,N) \neq d(M,N)}$$

Answer: Points $\boldsymbol{L}$, $\boldsymbol{M}$, and $\boldsymbol{N}$ are not collinear.

3. Find the point on the X-axis which is equidistant from $\boldsymbol{A(-3,4)}$ and $\boldsymbol{B(1,-4)}$.

Solution:

Let $\boldsymbol{C}$ be the point on the X-axis equidistant from $\boldsymbol{A(-3,4)}$ and $\boldsymbol{B(1,-4)}$.

Since $\boldsymbol{C}$ lies on the X-axis, its Y-coordinate is $\boldsymbol{0}$. Let $\boldsymbol{C = (x,0)}$.

Since $\boldsymbol{C}$ is equidistant from $\boldsymbol{A}$ and $\boldsymbol{B}$, $\boldsymbol{AC = BC}$.

By distance formula:

$$\boldsymbol{d(A,C) = \sqrt{[x-(-3)]^2 + (0-4)^2} = \sqrt{(x+3)^2 + 16}} \quad \text{--- (i)}$$

$$\boldsymbol{d(B,C) = \sqrt{(x-1)^2 + [0-(-4)]^2} = \sqrt{(x-1)^2 + 16}} \quad \text{--- (ii)}$$

Equating (i) and (ii):

$$\boldsymbol{\sqrt{(x+3)^2 + 16} = \sqrt{(x-1)^2 + 16}}$$

Squaring both sides:

$$\boldsymbol{(x+3)^2 + 16 = (x-1)^2 + 16}$$

$$\boldsymbol{x^2 + 6x + 9 + 16 = x^2 - 2x + 1 + 16}$$

$$\boldsymbol{x^2 + 6x + 25 = x^2 - 2x + 17}$$

$$\boldsymbol{6x + 2x = 17 - 25}$$

$$\boldsymbol{8x = -8}$$

$$\boldsymbol{x = -1}$$

Answer: The point on the X-axis equidistant from $\boldsymbol{A}$ and $\boldsymbol{B}$ is $\boldsymbol{C(-1,0)}$.

4. Verify that points $\boldsymbol{P(-2,2)}$, $\boldsymbol{Q(2,2)}$, and $\boldsymbol{R(2,7)}$ are vertices of a right-angled triangle.

Solution:

Given $\boldsymbol{P(-2,2)}$, $\boldsymbol{Q(2,2)}$, and $\boldsymbol{R(2,7)}$.

By distance formula:

$$\boldsymbol{PQ = \sqrt{[2-(-2)]^2 + (2-2)^2} = \sqrt{4^2 + 0^2} = \sqrt{16} = 4} \quad \text{--- (i)}$$

$$\boldsymbol{QR = \sqrt{(2-2)^2 + (7-2)^2} = \sqrt{0^2 + 5^2} = \sqrt{25} = 5} \quad \text{--- (ii)}$$

$$\boldsymbol{PR = \sqrt{[2-(-2)]^2 + (7-2)^2} = \sqrt{4^2 + 5^2} = \sqrt{16+25} = \sqrt{41}} \quad \text{--- (iii)}$$

Checking Pythagoras' theorem:

$$\boldsymbol{PQ^2 + QR^2 = 4^2 + 5^2 = 16 + 25 = 41}$$

$$\boldsymbol{PR^2 = \left(\sqrt{41}\right)^2 = 41}$$

Since $\boldsymbol{PQ^2 + QR^2 = PR^2}$, $\triangle \boldsymbol{PQR}$ is a right-angled triangle.

Answer: Points $\boldsymbol{P}$, $\boldsymbol{Q}$, and $\boldsymbol{R}$ are vertices of a right-angled triangle.

Practice Set 5.2 (Page 115)

1. Find the coordinates 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 $P(x,y)$ be the required point.

$A(x_1,y_1) = (-1,7), B(x_2,y_2) = (4,-3), m = 2, n = 3.$

By Section formula:

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

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

Answer: The coordinates of point P are $(1,3)$.

2. In each of the following examples, find the coordinates of point A which divides segment PQ in the ratio $a:b$.

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

Solution:

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

By Section formula:

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

$$y = \frac{2(-4) + 1(7)}{2+1} = \frac{-8+7}{3} = -\frac{1}{3}$$

Answer: Coordinates of A are $\left(-\frac{1}{3}, -\frac{1}{3}\right)$.

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

Solution:

$x_1 = -2, y_1 = -5, x_2 = 4, y_2 = 3, m = 3, n = 4$

By Section formula:

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

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

Answer: Coordinates of A are $\left(\frac{4}{7}, -\frac{11}{7}\right)$.

(3) $P(2,6), Q(-4,1), a:b = 1:2$

Solution:

$x_1 = 2, y_1 = 6, x_2 = -4, y_2 = 1, m = 1, n = 2$

By Section formula:

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

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

Answer: Coordinates of A are $\left(0, \frac{13}{3}\right)$.

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

Solution:

Let point $T(-1,6)$ divide segment PQ in ratio $m:n$.

$P(-3,10)$, $Q(6,-8)$, $x=-1, y=6$.

By Section formula:

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

$$-1=\frac{m(6)+n(-3)}{m+n}$$

$$-1(m+n)=6m-3n$$

$$-m-n=6m-3n$$

$$3n-n=6m+m$$

$$2n=7m \Longrightarrow \frac{m}{n}=\frac{2}{7}$$

Answer: Point T divides PQ in the ratio $2:7$.

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

Solution:

$P(-2,0)$ is the midpoint of diameter AB with $A(2,-3)$ and $B(x_2,y_2)$.

By Midpoint formula:

$$x=\frac{x_1+x_2}{2} \Longrightarrow -2=\frac{2+x_2}{2} \Longrightarrow -4=2+x_2 \Longrightarrow x_2=-6$$

$$y=\frac{y_1+y_2}{2} \Longrightarrow 0=\frac{-3+y_2}{2} \Longrightarrow 0=-3+y_2 \Longrightarrow y_2=3$$

Answer: Coordinates of point B are $(-6,3)$.

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 ratio be $m:n$. $A(8,9)$, $B(1,2)$, $P(k,7)$.

By Section formula for y:

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

$$7 = \frac{m(2) + n(9)}{m + n}$$

$$7m + 7n = 2m + 9n$$

$$5m = 2n \Longrightarrow \frac{m}{n} = \frac{2}{5}$$

Ratio is $2:5$. Now by Section formula for x:

$$k = \frac{2(1) + 5(8)}{2 + 5} = \frac{2 + 40}{7} = \frac{42}{7} = 6$$

Answer: Ratio is $2:5$ and $k = 6$.

6. Find the coordinates of the midpoint of the segment joining $(22, 20)$ and $(0, 16)$.

Solution:

By Midpoint formula:

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

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

Answer: Midpoint coordinates are $(11,18)$.

Practice Set 5.3 (Page 121)

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

(1) 45°

$$\text{Slope } m = \tan 45^\circ = 1$$

(2) 60°

$$\text{Slope } m = \tan 60^\circ = \sqrt{3}$$

(3) 90°

$$\text{Slope } m = \tan 90^\circ = \text{Not defined}$$

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

(1) $A(2, 3), B(4, 7)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-3}{4-2} = \frac{4}{2} = 2$$

(2) $\boldsymbol{P(-3, 1), Q(5, -2)}$

$$m = \frac{-2-1}{5-(-3)} = \frac{-3}{8} = -\frac{3}{8}$$

(3) $\boldsymbol{C(5, -2), D(7, 3)}$

$$m = \frac{3-(-2)}{7-5} = \frac{5}{2}$$

(4) $\boldsymbol{L(-2, -3), M(-6, -8)}$

$$m = \frac{-8-(-3)}{-6-(-2)} = \frac{-5}{-4} = \frac{5}{4}$$

(5) $\boldsymbol{E(-4, -2), F(6, 3)}$

$$m = \frac{3-(-2)}{6-(-4)} = \frac{5}{10} = \frac{1}{2}$$

(6) $\boldsymbol{T(0, -3), S(0, 4)}$

$$m = \frac{4-(-3)}{0-0} = \frac{7}{0} = \text{Not defined}$$

3. Determine whether the following points are collinear.

(1) $\boldsymbol{A(-1, -1), B(0, 1), C(1, 3)}$

$$\text{Slope of } AB = \frac{1-(-1)}{0-(-1)} = 2$$

$$\text{Slope of } BC = \frac{3-1}{1-0} = 2$$

Since Slope of $AB =$ Slope of BC and point B is common, **points** A, B, C **are collinear**.

(2) $\boldsymbol{D(-2, -3), E(1, 0), F(2, 1)}$

$$\text{Slope of } DE = \frac{0-(-3)}{1-(-2)} = \frac{3}{3} = 1$$

$$\text{Slope of } EF = \frac{1-0}{2-1} = 1$$

Since Slope of $DE =$ Slope of EF and point E is common, **points** D, E, F **are collinear**.

(3) $\boldsymbol{L(2, 5), M(3, 3), N(5, 1)}$

$$\text{Slope of } LM = \frac{3-5}{3-2} = -2$$

$$\text{Slope of } MN = \frac{1-3}{5-3} = \frac{-2}{2} = -1$$

Since Slope of $LM \neq$ Slope of MN, **points L, M, N are not collinear**.

4. If $A(1,-1), B(0,4), C(-5,3)$ are vertices of a triangle, then find the slope of each side.

Solution:

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

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

$$\text{Slope of } AC = \frac{3-(-1)}{-5-1} = \frac{4}{-6} = -\frac{2}{3}$$

Answer: Slopes of sides AB, BC, and AC are $-5, \frac{1}{5}$**, and** $-\frac{2}{3}$ respectively.

Problem Set 5 (Page 122)

1. Fill in the blanks using correct alternatives.

1. **Seg AB is parallel to Y-axis and coordinates of point A are $(1,3)$ then coordinates of point B can be:**

Answer: (D) $(1,-3)$ *(Since x-coordinate remains same for lines parallel to Y-axis)*

2. **Out of the following, point .... lies to the right of the origin on X-axis:**

Answer: (D) $(2,0)$

3. **Distance of point $(-3,4)$ from the origin is:**

Answer: (C) 5 *($\sqrt{(-3)^2+4^2} = \sqrt{25} = 5$)*

4. **A line makes an angle of $30°$ with positive direction of X-axis. So the slope of the line is:**

Answer: (C) $\frac{1}{\sqrt{3}}$ *($\tan 30° = \frac{1}{\sqrt{3}}$)*

2. Determine whether the given points are collinear.

(1) $A(0,2), B(1,-0.5), C(2,-3)$

$$\text{Slope of } AB = \frac{-0.5-2}{1-0} = -2.5$$

$$\text{Slope of } BC = \frac{-3-(-0.5)}{2-1} = -2.5$$

Answer: Points A, B, C are **collinear**.

(2) $\boldsymbol{P(1,2), Q\left(2,\frac{8}{5}\right), R\left(3,\frac{6}{5}\right)}$

$$\text{Slope of } PQ = \frac{\frac{8}{5}-2}{2-1} = \frac{-\frac{2}{5}}{1} = -\frac{2}{5}$$

$$\text{Slope of } QR = \frac{\frac{6}{5}-\frac{8}{5}}{3-2} = -\frac{2}{5}$$

Answer: Points P, Q, R are **collinear**.

(3) $\boldsymbol{L(1,2), M(5,3), N(8,6)}$

$$\text{Slope of } LM = \frac{3-2}{5-1} = \frac{1}{4}$$

$$\text{Slope of } MN = \frac{6-3}{8-5} = \frac{3}{3} = 1$$

Answer: Points L, M, N are **not collinear**.

3. Find the coordinates of the midpoint of the line segment joining $\boldsymbol{P(0,6)}$ and $\boldsymbol{Q(12,20)}$.

Solution:

$$x = \frac{0+12}{2} = 6, \quad y = \frac{6+20}{2} = 13$$

Answer: Midpoint coordinates are $(6,13)$.

4. Find the ratio in which the line segment joining $\boldsymbol{A(3,8)}$ and $\boldsymbol{B(-9,3)}$ is divided by the Y-axis.

Solution:

Let point on Y-axis be $P(0,y)$ dividing AB in ratio $m:n$.

By Section formula for x:

$$0 = \frac{m(-9)+n(3)}{m+n} \Longrightarrow -9m+3n = 0 \Longrightarrow 9m = 3n \Longrightarrow \frac{m}{n} = \frac{1}{3}$$

Answer: Required ratio is $1:3$.

5. Find the point on X-axis which is equidistant from $\boldsymbol{P(2,-5)}$ and $\boldsymbol{Q(-2,9)}$.

Solution:

Let point be $M(x,0)$. Given $PM = QM \Longrightarrow PM^2 = QM^2$.

$$(x-2)^2+(0+5)^2=(x+2)^2+(0-9)^2$$

$$x^2-4x+4+25=x^2+4x+4+81$$

$$-4x+29=4x+85$$

$$-8x=56 \Longrightarrow x=-7$$

Answer: Point on X-axis is $(-7,0)$.

6. Find the distances between the following points.

(i) $\boldsymbol{A(a,0), B(0,a)}$

$$d(A,B)=\sqrt{(0-a)^2+(a-0)^2}=\sqrt{a^2+a^2}=\sqrt{2a^2}=a\sqrt{2}\text{ units}$$

(ii) $\boldsymbol{P(-6,-3), Q(-1,9)}$

$$d(P,Q)=\sqrt{[-1-(-6)]^2+[9-(-3)]^2}=\sqrt{5^2+12^2}=\sqrt{25+144}=\sqrt{169}=13\text{ units}$$

(iii) $\boldsymbol{R(-3a,a), S(a,-2a)}$

$$d(R,S)=\sqrt{[a-(-3a)]^2+(-2a-a)^2}=\sqrt{(4a)^2+(-3a)^2}=\sqrt{16a^2+9a^2}=\sqrt{25a^2}=5a\text{ units}$$

7. Find the coordinates of the circumcentre of a triangle whose vertices are $\boldsymbol{A(-3,1), B(0,-2)}$, and $\boldsymbol{C(1,3)}$.

Solution:

Let circumcentre be $O(h,k)$. Then $OA^2=OB^2=OC^2$.

From $OA^2=OB^2$:

$$(h+3)^2+(k-1)^2=h^2+(k+2)^2$$

$$h^2+6h+9+k^2-2k+1=h^2+k^2+4k+4$$

$$6h-6k=-6 \Longrightarrow h-k=-1 \quad \text{--- (1)}$$

From $OB^2=OC^2$:

$$h^2+(k+2)^2=(h-1)^2+(k-3)^2$$

$$h^2+k^2+4k+4=h^2-2h+1+k^2-6k+9$$

$$2h+10k=6 \Longrightarrow h+5k=3 \quad \text{--- (2)}$$

Subtracting (1) from (2):

$$6k=4 \Longrightarrow k=\frac{2}{3}$$

Substituting $k = \frac{2}{3}$ in (1):

$$h - \frac{2}{3} = -1 \Longrightarrow h = -\frac{1}{3}$$

Answer: Coordinates of circumcentre are $\left(-\frac{1}{3}, \frac{2}{3}\right)$.

8. In the following examples, can the segment joining the given points form a triangle? If yes, state its type.

(1) $\boldsymbol{L(6,4), M(-5,-3), N(-6,8)}$

$$LM = \sqrt{(-11)^2 + (-7)^2} = \sqrt{170}$$

$$MN = \sqrt{(-1)^2 + 11^2} = \sqrt{122}$$

$$LN = \sqrt{(-12)^2 + 4^2} = \sqrt{160}$$

Sum of any two sides is greater than the third side, and $LM \neq MN \neq LN$.

Answer: Forms a Scalene Triangle.

(2) $\boldsymbol{P(-2,-6), Q(-4,-2), R(-5,0)}$

$$PQ = \sqrt{(-2)^2 + 4^2} = \sqrt{20} = 2\sqrt{5}$$

$$QR = \sqrt{(-1)^2 + 2^2} = \sqrt{5}$$

$$PR = \sqrt{(-3)^2 + 6^2} = \sqrt{45} = 3\sqrt{5}$$

$PQ + QR = 2\sqrt{5} + \sqrt{5} = 3\sqrt{5} = PR$.

Answer: Points are collinear, **No triangle can be formed**.

9. Find $\boldsymbol{k}$ if the line passing through points $\boldsymbol{P(-12,-3)}$ and $\boldsymbol{Q(4,k)}$ has slope $\boldsymbol{\frac{1}{2}}$.

Solution:

$$\text{Slope } m = \frac{k - (-3)}{4 - (-12)} = \frac{k+3}{16}$$

$$\frac{1}{2} = \frac{k+3}{16} \Longrightarrow 2(k+3) = 16 \Longrightarrow k + 3 = 8 \Longrightarrow k = 5$$

Answer: $k = \mathbf{5}$.

10. Show that line joining $\boldsymbol{A(4,8)}$ and $\boldsymbol{B(5,5)}$ is parallel to line joining $\boldsymbol{C(2,4)}$ and $\boldsymbol{D(1,7)}$.

Proof:

$$\text{Slope of } AB = \frac{5-8}{5-4} = -3$$

$$\text{Slope of } CD = \frac{7-4}{1-2} = -3$$

Since Slope of AB = Slope of CD, **line** AB **is parallel to line** CD. *(Hence Proved)*

11. Show that points $P(1,-2), Q(5,2), R(3,-1), S(-1,-5)$ are vertices of a parallelogram.

Proof:

By distance formula:

$$PQ = \sqrt{(5-1)^2 + [2-(-2)]^2} = \sqrt{16+16} = \sqrt{32}$$

$$QR = \sqrt{(3-5)^2 + (-1-2)^2} = \sqrt{4+9} = \sqrt{13}$$

$$RS = \sqrt{(-1-3)^2 + [-5-(-1)]^2} = \sqrt{16+16} = \sqrt{32}$$

$$PS = \sqrt{(-1-1)^2 + [-5-(-2)]^2} = \sqrt{4+9} = \sqrt{13}$$