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Class	9th	Chapter	07
Subject	Mathematics	Board	Punjab

Chapter 7: Coordinate Geometry

Exercise 7.1

Q1. Find the distance between the following pairs of points:

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

- **(i)** $A(2,3), B(6,6)$
  - *Step 1:* Identify coordinates: $x_1 = 2, y_1 = 3, x_2 = 6, y_2 = 6$.
  - *Step 2:* Apply formula:

$$d = \sqrt{(6-2)^2 + (6-3)^2} = \sqrt{(4)^2 + (3)^2} = \sqrt{16+9} = \sqrt{25} = \mathbf{5} \text{ units}$$

- **(ii)** $P(-1,3), Q(3,-1)$
  - *Step 1:* Identify coordinates: $x_1 = -1, y_1 = 3, x_2 = 3, y_2 = -1$.
  - *Step 2:* Apply formula:

$$d = \sqrt{\big(3-(-1)\big)^2 + (-1-3)^2} = \sqrt{(4)^2 + (-4)^2} = \sqrt{16+16} = \sqrt{32} = \mathbf{4\sqrt{2}} \text{ units}$$

- **(iii)** $R(-3,-2), S(-7,-5)$
  - *Step 1:* Identify coordinates: $x_1 = -3, y_1 = -2, x_2 = -7, y_2 = -5$.
  - *Step 2:* Apply formula:

$$d = \sqrt{\big(-7-(-3)\big)^2 + \big(-5-(-2)\big)^2} = \sqrt{(-4)^2 + (-3)^2} = \sqrt{16+9} = \sqrt{25} = \mathbf{5} \text{ units}$$

Q2. Find the midpoint of the line segment joining the points:

Midpoint Formula: $M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

- **(i)** $A(1,2), B(5,8)$
  - *Step 1:* $x_1 = 1, y_1 = 2, x_2 = 5, y_2 = 8$.
  - *Step 2:* Apply formula:

$$M = \left(\frac{1+5}{2}, \frac{2+8}{2}\right) = \left(\frac{6}{2}, \frac{10}{2}\right) = (\mathbf{3}, \mathbf{5})$$

- **(ii)** $P(-4,6), Q(2,-2)$
  - *Step 1:* $x_1 = -4, y_1 = 6, x_2 = 2, y_2 = -2$.

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- *Step 2:* Apply formula:

$$M = \left(\frac{-4+2}{2}, \frac{6+(-2)}{2}\right) = \left(\frac{-2}{2}, \frac{4}{2}\right) = (\mathbf{-1, 2})$$

- **(iii)** $R(-3,-5), S(-1,-1)$
  - *Step 1:* $x_1 = -3, y_1 = -5, x_2 = -1, y_2 = -1.$
  - *Step 2:* Apply formula:

$$M = \left(\frac{-3+(-1)}{2}, \frac{-5+(-1)}{2}\right) = \left(\frac{-4}{2}, \frac{-6}{2}\right) = (\mathbf{-2, -3})$$

Q3. Show that the points $A(1,1)$, $B(4,5)$, and $C(7,9)$ are collinear.

- **Step 1:** Calculate distance AB:

$$AB = \sqrt{(4-1)^2 + (5-1)^2} = \sqrt{3^2 + 4^2} = \sqrt{9+16} = 5$$

- **Step 2:** Calculate distance BC:

$$BC = \sqrt{(7-4)^2 + (9-5)^2} = \sqrt{3^2 + 4^2} = \sqrt{9+16} = 5$$

- **Step 3:** Calculate distance AC:

$$AC = \sqrt{(7-1)^2 + (9-1)^2} = \sqrt{6^2 + 8^2} = \sqrt{36+64} = \sqrt{100} = 10$$

- **Step 4:** Verify collinearity:

$$AB + BC = 5 + 5 = 10 = AC$$

Since $AB + BC = AC$, the points A, B, and C lie on the same straight line (**Collinear**).

Q4. Show that the points $A(0,0)$, $B(3,0)$, and $C(0,4)$ form a right-angled triangle.

- **Step 1:** Find lengths of all three sides:
  - $AB = \sqrt{(3-0)^2 + (0-0)^2} = \sqrt{9} = 3$
  - $AC = \sqrt{(0-0)^2 + (4-0)^2} = \sqrt{16} = 4$
  - $BC = \sqrt{(0-3)^2 + (4-0)^2} = \sqrt{(-3)^2 + 4^2} = \sqrt{9+16} = \sqrt{25} = 5$
- **Step 2:** Verify Pythagoras Theorem ($AB^2 + AC^2 = BC^2$):

$$3^2 + 4^2 = 9 + 16 = 25 = 5^2$$

Since the side lengths satisfy Pythagoras Theorem, $\triangle ABC$ is a **right-angled triangle**.

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Exercise 7.2

Q1. Find the slope (gradient) of the line passing through the points:

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

- **(i)** $A(2,3), B(5,9)$
  - *Step:* $m = \frac{9-3}{5-2} = \frac{6}{3} = \mathbf{2}$
- **(ii)** $P(-2,4), Q(3,-1)$
  - *Step:* $m = \frac{-1-4}{3-(-2)} = \frac{-5}{5} = \mathbf{-1}$
- **(iii)** $R(4,-2), S(4,6)$
  - *Step:* $m = \frac{6-(-2)}{4-4} = \frac{8}{0} \Longrightarrow$ Undefined (Vertical Line)

Q2. Find the equation of the line passing through the point $(2, 5)$ with slope $m = 3$.

Point-Slope Form: $y - y_1 = m(x - x_1)$

- *Step 1:* Substitute $(x_1, y_1) = (2,5)$ and $m = 3$:

$$y - 5 = 3(x - 2)$$

- *Step 2:* Simplify:

$$y - 5 = 3x - 6 \Longrightarrow 3x - y - 1 = 0 \quad \text{or} \quad \mathbf{y = 3x - 1}$$

Q3. Find the equation of the line passing through the points $A(1, 3)$ and $B(4, 9)$.

- *Step 1:* Find the slope m:

$$m = \frac{9 - 3}{4 - 1} = \frac{6}{3} = 2$$

- *Step 2:* Use Point-Slope Form with point $A(1,3)$:

$$y - 3 = 2(x - 1)$$

- *Step 3:* Simplify:

$$y - 3 = 2x - 2 \Longrightarrow \mathbf{2x - y + 1 = 0} \quad \text{or} \quad \mathbf{y = 2x + 1}$$

Q4. Convert the linear equation $3x + 2y - 6 = 0$ into slope-intercept form ($y = mx + c$) and state its slope and y-intercept.

- *Step 1:* Isolate y:

$$2y = -3x + 6$$

$$y = -\frac{3}{2}x + \frac{6}{2} \Longrightarrow \mathbf{y = -\frac{3}{2}x + 3}$$

- *Step 2:* Compare with $y = mx + c$:
  - **Slope (m): $-\frac{3}{2}$**
  - **y-intercept (c): 3** (or point $(0,3)$)

Review Exercise 7

Q1. Multiple Choice Questions:

- **(i)** Distance between points $(0,0)$ and $(3,4)$ is: **(a) 5**
- **(ii)** Midpoint of $(2,4)$ and $(6,8)$ is: **(b)** $(4,6)$

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- **(iii)** Slope of a horizontal line is: **(c) 0**
- **(iv)** Slope of a vertical line is: **(b) undefined**
- **(v)** If two lines are parallel, their slopes are: **(a) equal**
- **(vi)** y-intercept of $y = 2x + 5$ is: **(c) 5**
- **(vii)** Distance formula between (x_1, y_1) and (x_2, y_2) is: **(a)** $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Q2. Find the distance and midpoint between $A(-3, 5)$ and $B(3, -3)$.

- **Distance (d):**

$$d = \sqrt{\big(3 - (-3)\big)^2 + (-3 - 5)^2} = \sqrt{(6)^2 + (-8)^2} = \sqrt{36 + 64} = \sqrt{100} = \mathbf{10} \text{ units}$$

- **Midpoint (M):**

$$M = \left(\frac{-3 + 3}{2}, \frac{5 + (-3)}{2}\right) = \left(\frac{0}{2}, \frac{2}{2}\right) = (\mathbf{0}, \mathbf{1})$$

Q3. Find the equation of the line passing through $(3, -2)$ with slope $m = -4$.

- *Step:* Use $y - y_1 = m(x - x_1)$:

$$y - (-2) = -4(x - 3)$$

$$y + 2 = -4x + 12 \Rightarrow \mathbf{4x + y - 10 = 0} \quad \text{or} \quad \mathbf{y = -4x + 10}$$

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