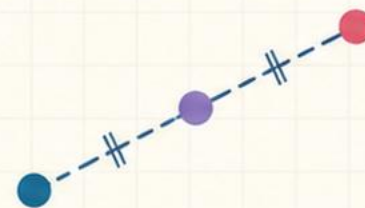
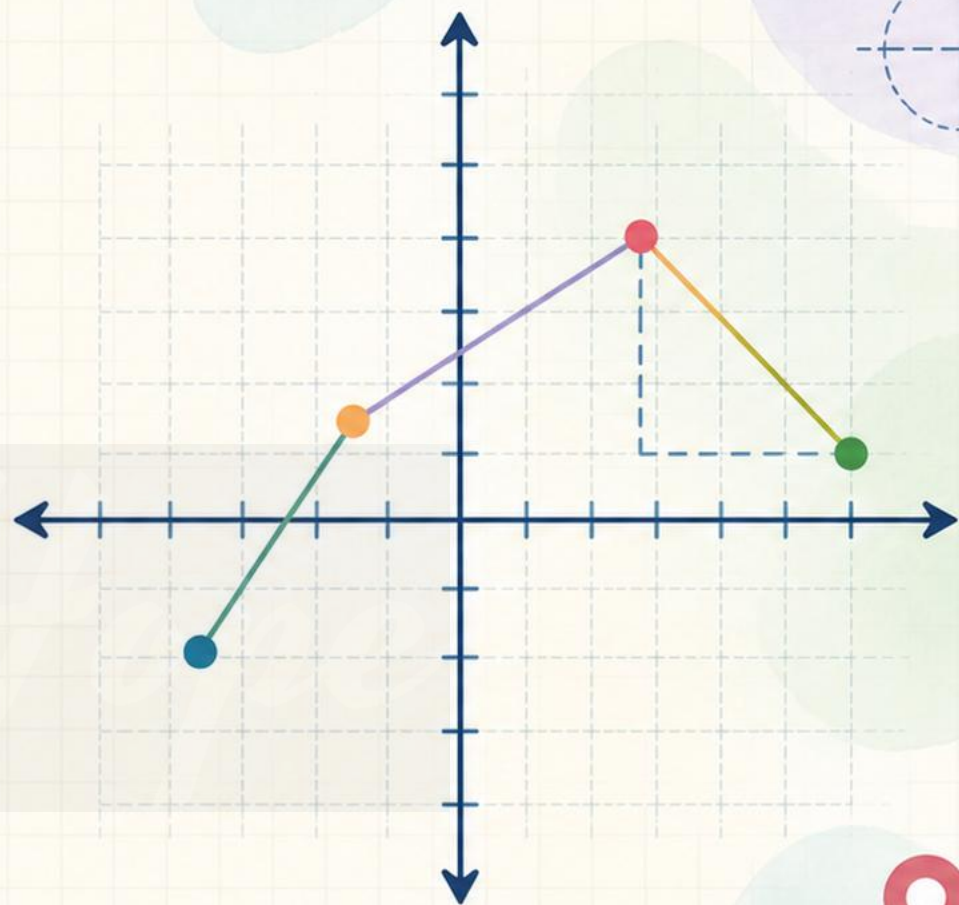


MATHEMATICS • CLASS 10

CHAPTER 7

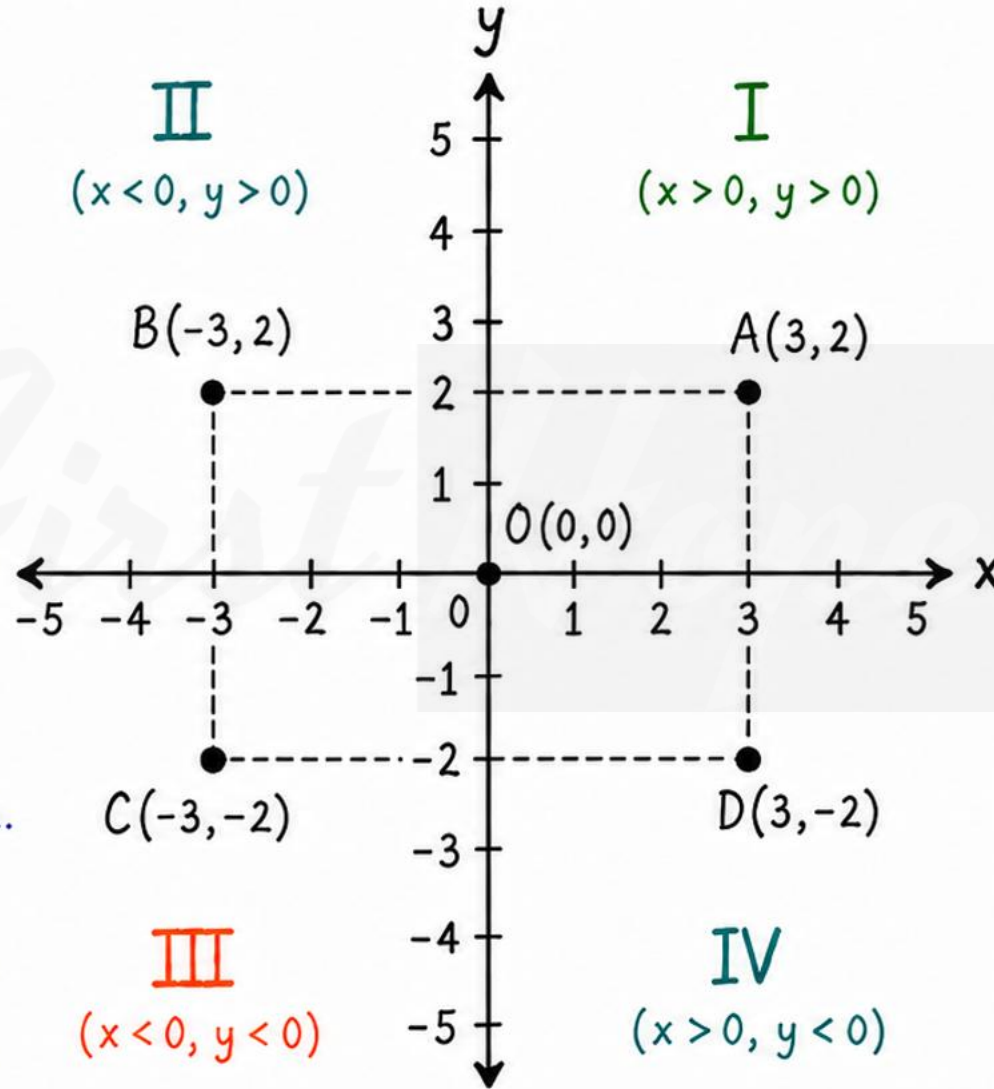
Coordinate Geometry

CHAPTER NOTES



CARTESIAN PLANE & COORDINATES

- The Cartesian plane is formed by two perpendicular number lines called the x-axis (horizontal) and the y-axis (vertical).
- The two axes intersect at a point O , called the origin, whose coordinates are $O(0,0)$.
- Any point P on the plane is represented by an ordered pair of real numbers $P(x,y)$.
- The x-coordinate (abscissa) tells the horizontal signed position from the origin.
- The y-coordinate (ordinate) tells the vertical signed position from the origin.
- Every point on the x-axis has $y = 0$.
- Every point on the y-axis has $x = 0$.



SIGNS OF COORDINATES

Quadrant	x	y
I	+	+
II	-	+
III	-	-
IV	+	-

ORDER MATTERS:

In an ordered pair (x, y) , the first number is the x-coordinate and the second number is the y-coordinate. (x, y) is generally not (y, x) .

DISTANCE BETWEEN TWO POINTS

Let $P(x_1, y_1)$ and $Q(x_2, y_2)$ be any two points in the Cartesian plane. We find the distance PQ .

Construction: Through Q , draw a perpendicular to the horizontal through P . Let it meet that line at R .

Then PR is horizontal and RQ is vertical. $\triangle PRQ$ is a right-angled triangle, right-angled at R .

Lengths of the legs:

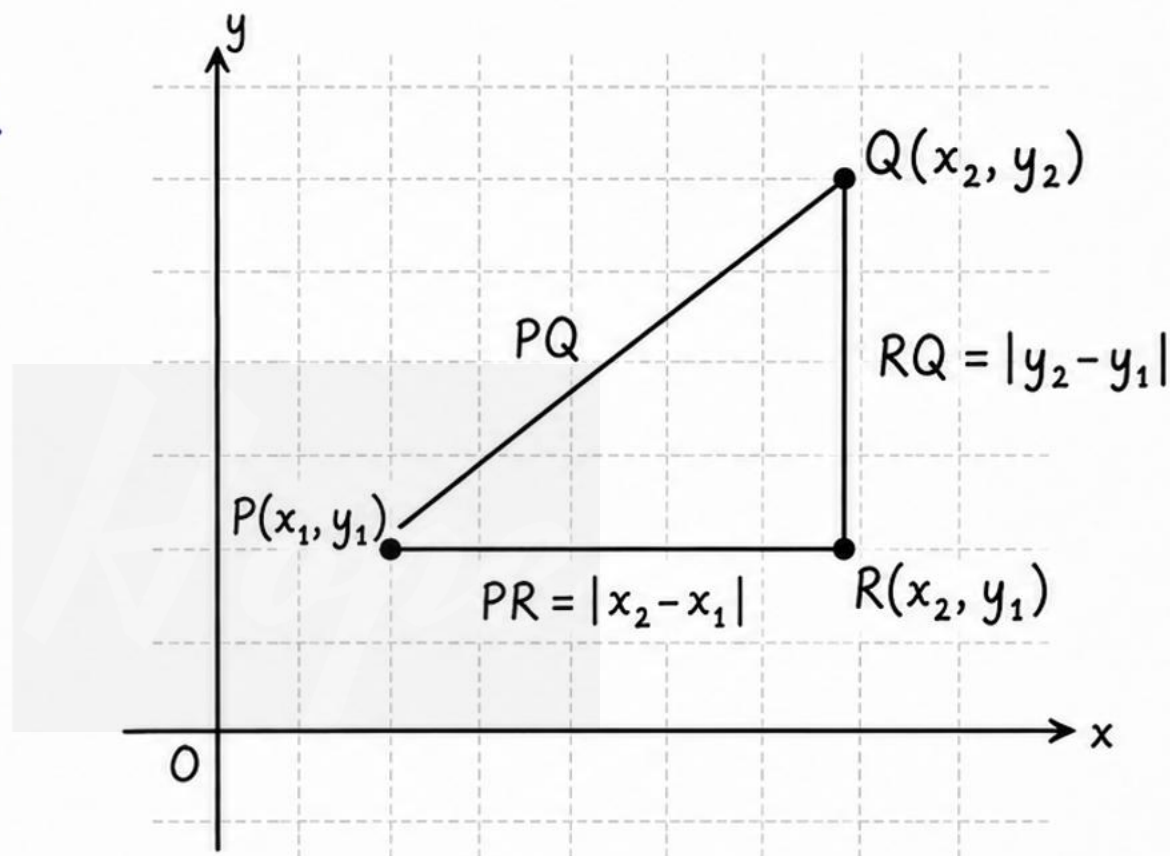
$$PR = |x_2 - x_1| \quad \text{and} \quad RQ = |y_2 - y_1|$$

By Pythagoras Theorem in right-angled $\triangle PRQ$,

$$\begin{aligned} PQ^2 &= PR^2 + RQ^2 \\ &= (x_2 - x_1)^2 + (y_2 - y_1)^2 \end{aligned}$$

Therefore, the distance between P and Q is

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



Special case: Distance from the origin

Let $P(x, y)$ be any point. Then

$$OP = \sqrt{x^2 + y^2}$$

Checks and Important Points

- Distance is always non-negative.
 $PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \geq 0$
- Symmetry: Swapping P and Q does not change the distance.
 $PQ = QP = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

- Use consistent coordinate order. For $P(x_1, y_1)$ and $Q(x_2, y_2)$, always substitute as $(x_2 - x_1)$ and $(y_2 - y_1)$ in the formula.

DISTANCE FORMULA IN A TRIANGLE

EXAMPLE - Identify a Triangle

The vertices of a triangle are $A(-2, -3)$, $B(2, 1)$ and $C(2, -3)$.
Find the lengths of the sides and identify the triangle.

1. Length of AB: $AB^2 = (2 + 2)^2 + (1 + 3)^2$
 $= 16 + 16$
 $= 32$

$$\therefore AB = 4\sqrt{2}$$

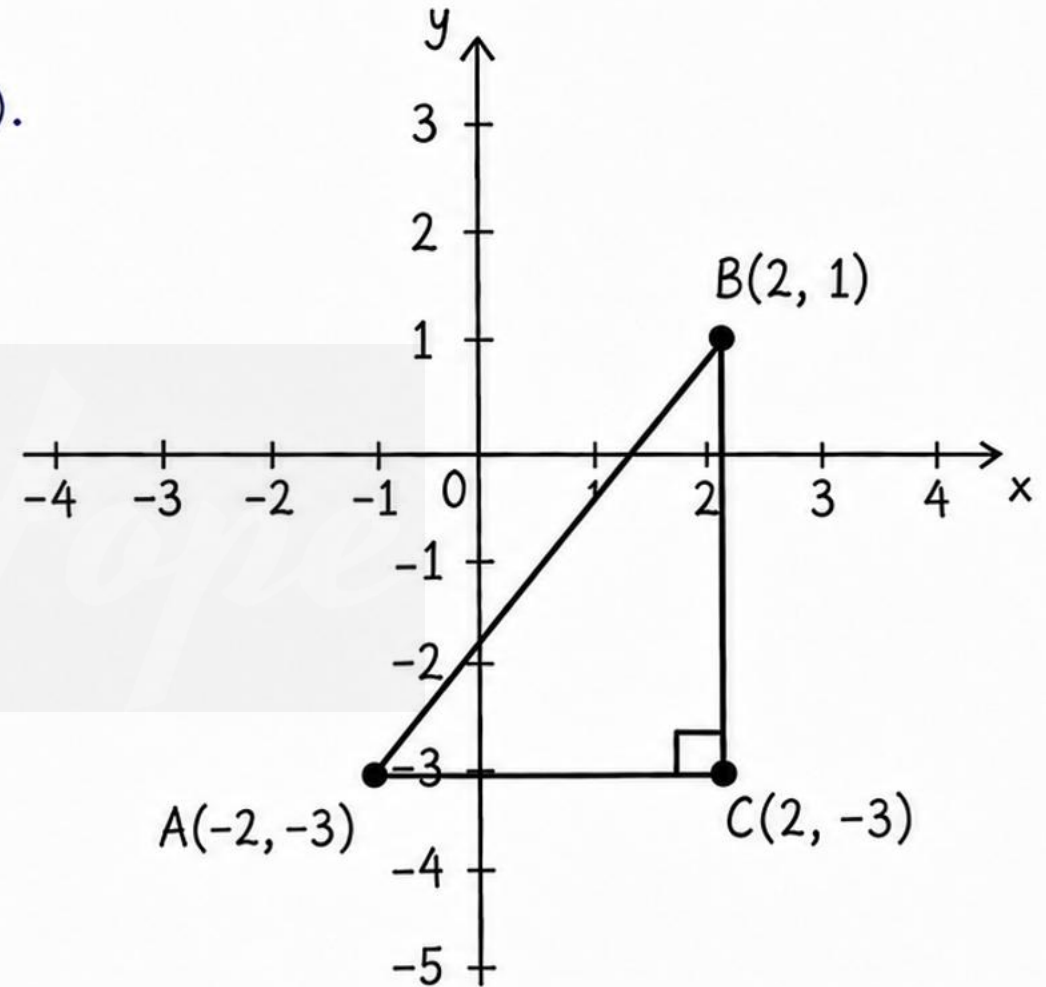
2. Length of BC: $BC^2 = (2 - 2)^2 + (-3 - 1)^2$
 $= 0^2 + (-4)^2$
 $= 16$

$$\therefore BC = 4$$

3. Length of CA: $CA^2 = (-2 - 2)^2 + (-3 + 3)^2$
 $= (-4)^2 + 0^2$
 $= 16$

$$\therefore CA = 4$$

Since $BC = CA$ (both are 4) and
 $BC^2 + CA^2 = 16 + 16 = 32 = AB^2$,
the triangle ABC is right-angled isosceles, right angle at C.



Therefore, $\triangle ABC$ is a right-angled isosceles triangle with right angle at C.



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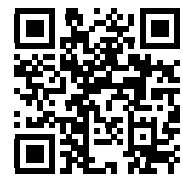


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