

CLASS 9 · HOTS · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 1: HOTS: Orienting Yourself, the Coordinate Plane (Class 9)

Topic-wise short notes with solved examples

Higher order thinking questions on the coordinate plane and the distance formula for Class 9: equidistant points, classifying triangles and quadrilaterals from their vertices, and unknown coordinates, each with a full solution.

1 Solved HOTS questions

- The distance between (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. A point on the x-axis has $y = 0$ and a point on the y-axis has $x = 0$. To classify a shape, find all the side lengths (and the diagonals).

Example 1.1 Find the distance between $(2, 3)$ and $(-4, -5)$.

SOLUTION

$$\sqrt{(-4 - 2)^2 + (-5 - 3)^2} = \sqrt{36 + 64} = \sqrt{100}.$$

10 units

Example 1.2 Find the point on the y-axis which is equidistant from $(3, 2)$ and $(-3, 4)$.

SOLUTION

Let the point be $(0, y)$. $9 + (y - 2)^2 = 9 + (y - 4)^2$.

$(y - 2)^2 = (y - 4)^2$ gives $-4y + 4 = -8y + 16$, so $4y = 12$ and $y = 3$.

Check: both distances are $\sqrt{9 + 1}$.

$(0, 3)$

Example 1.3 Show that the triangle with vertices $A(0, 3)$, $B(4, 0)$ and $C(-4, 0)$ is isosceles, and find its perimeter.

SOLUTION

$$AB = \sqrt{16 + 9} = 5, AC = \sqrt{16 + 9} = 5 \text{ and } BC = 8.$$

Two sides are equal, so the triangle is isosceles.

Isosceles with perimeter $5 + 5 + 8 = 18$ units

Example 1.4 The point $(a, a + 1)$ is 5 units from the origin. Find a and the points.

SOLUTION

$$a^2 + (a + 1)^2 = 25, \text{ so } 2a^2 + 2a - 24 = 0 \text{ and } a^2 + a - 12 = 0.$$

$$(a + 4)(a - 3) = 0, \text{ so } a = 3 \text{ or } a = -4.$$

$a = 3$ gives $(3, 4)$ and $a = -4$ gives $(-4, -3)$

Example 1.5 Show that $(0, 0)$, $(3, 4)$, $(8, 4)$ and $(5, 0)$ are the vertices of a rhombus.

SOLUTION

$$(0, 0) \text{ to } (3, 4): \sqrt{9 + 16} = 5. (3, 4) \text{ to } (8, 4): 5. (8, 4) \text{ to } (5, 0): \sqrt{9 + 16} = 5. (5, 0) \text{ to } (0, 0): 5.$$

All four sides are equal, so it is a rhombus. The diagonals are $\sqrt{64 + 16}$ and $\sqrt{4 + 16}$, which are not equal, so it is not a square.

A rhombus (not a square)