



Basic Mathematics_22103_ UO-3.3

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Unit 3: Coordinate Geometry

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Topic : Straight Line

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Learning Objective/ Key learning

- Identify perpendicular distance from the given point to the line.



Contents

- ▶ Perpendicular Distance between Point and Line:
- ▶ Examples based on distance between point and line

Straight Line

Perpendicular Distance between Point and Line:

If $P(x_1, y_1)$ is any point and $Ax + By + C = 0$ is a line, the perpendicular distance of a point P from the line is given by $\left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right|$.

Solved Examples

1) Find the length of the perpendicular on the line $3x + 4y - 5 = 0$ from the point (3, 4)

Solution: Given line is $3x + 4y - 5 = 0$

Here $A = 3$, $B = 4$, $C = -5$

Also, $P(x_1, y_1) = (3, 4)$

Length of perpendicular from $P(x_1, y_1)$ to the line $Ax + By + C = 0$ is given by

$$\begin{aligned} P &= \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right| \\ &= \left| \frac{3(3) + 4(4) - 5}{\sqrt{(3)^2 + (4)^2}} \right| \\ &= \left| \frac{9 + 16 - 5}{\sqrt{9 + 16}} \right| = \left| \frac{20}{\sqrt{25}} \right| = \left| \frac{20}{5} \right| \end{aligned}$$

$$P = 4 \text{ Units}$$

2) Find the length of perpendicular from the point $(-3, -4)$ on the line $4(x + 2) = 3(y - 4)$.

Solution : Given line is

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

$$4x + 8 = 3y - 12$$

$$4x - 3y + 8 + 12 = 0$$

$$4x - 3y + 20 = 0$$

Here $A = 4$, $B = -3$, $C = 20$

Also, $P(x_1, y_1) = (-3, -4)$

Now length of perpendicular from $P(x_1, y_1)$ to the line $Ax + By + C = 0$ is given by

$$\begin{aligned} P &= \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right| \\ &= \left| \frac{4(-3) + (-3)(-4) + 20}{\sqrt{(4)^2 + (-3)^2}} \right| \\ &= \left| \frac{-12 + 12 + 20}{\sqrt{16 + 9}} \right| = \left| \frac{20}{\sqrt{25}} \right| = \left| \frac{20}{5} \right| \end{aligned}$$

$P = 4$ Units

3) If length of perpendicular from (5, 4) on the straight line $2x + y + K = 0$ is $4\sqrt{5}$ units. Find the value of K.

Solution : Given line is

$$2x + y + K = 0$$

Here $A = 2$, $B = 1$, $C = K$

Also, $P(x_1, y_1) = (5, 4)$ and Given $P = 4\sqrt{5}$

Now length of perpendicular from $P(x_1, y_1)$ to the line $Ax + By + C = 0$ is given by

$$P = \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right|$$

$$4\sqrt{5} = \left| \frac{2(5) + 1(4) + k}{\sqrt{(2)^2 + (1)^2}} \right|$$

$$4\sqrt{5} = \left| \frac{10 + 4 + k}{\sqrt{5}} \right|$$

$$4\sqrt{5} = \left| \frac{14 + k}{\sqrt{5}} \right|$$

$$4\sqrt{5} \cdot \sqrt{5} = |14 + k|$$

$$20 = |14 + k|$$

$$\therefore 20 = 14 + K \quad \text{OR} \quad -20 = 14 + K$$

$$\therefore 20 - 14 = K \quad \text{OR} \quad -20 - 14 = K$$

$$\therefore K = 6 \quad \text{OR} \quad K = -34$$

So today we learn-

- Perpendicular Distance between Point and Line:
- Examples based on distance between point and line

.Quiz

1) State the formula to find distance of point (x_1, y_1) from line $Ax + By + C = 0$

$$\text{a) } P = \left| \frac{Ax_1 - By_1 - C}{\sqrt{A^2 + B^2}} \right| \quad \text{b) } P = \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right| \quad \text{c) } P = \left| \frac{Ax_1 + By_1 + C}{\sqrt{B^2 + C^2}} \right| \quad \text{d) } P = \left| \frac{Ax_1 - By_1 - C}{\sqrt{B^2 + C^2}} \right|$$

2) Find the length of the perpendicular from the Origin to the straight line $4x + 3y - 2 = 0$.

$$\text{a) } \frac{2}{5} \quad \text{b) } \frac{3}{7} \quad \text{c) } \frac{7}{3} \quad \text{d) } \frac{3}{5}$$

Ans: 1. b) 2.a)



Thank You