

Matrices in Geometry - 4.7.27

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Sep, 2025

Problem Statement

The equation of the straight line passing through the point $(3,2)$ and perpendicular to the line $y = x$ is ?

Solution

Given,

The point $\mathbf{P} \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and the line $(1 \quad -1) \begin{pmatrix} x \\ y \end{pmatrix} = 0$

The general equation of a line is written as $\mathbf{n}^\top \mathbf{P} = c$ where \mathbf{n} is the vector normal to the line.

So, $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ is the direction vector for required line.

Hence, the normal to the required line will be

$$\mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (1)$$

Solution

As it is passing through the given point, the required equation is

$$\mathbf{n}^T \left(\mathbf{x} - \begin{pmatrix} 3 \\ 2 \end{pmatrix} \right) = 0 \quad (2)$$

$$\implies \mathbf{n}^T \mathbf{x} = 5 \quad (3)$$

Conclusion

∴ The equation of the required straight line is $\begin{pmatrix} 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 5$

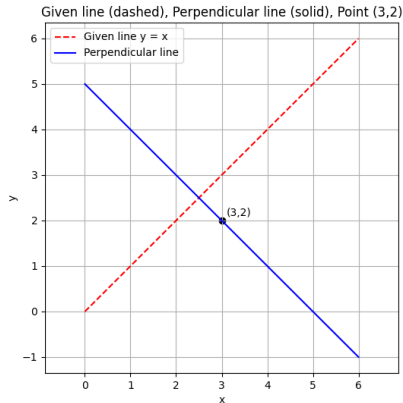


Figure: