ASSIGNMENT 2

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1 QUESTION No 2.15

Find the equation of the line passing through $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$

and perpendicular to the line through the points $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$

and $\begin{pmatrix} -3 \\ 6 \end{pmatrix}$

2 SOLUTION

$$\mathbf{A} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -3 \\ 6 \end{pmatrix} \qquad (2.0.1)$$

$$\mathbf{m_2} = \begin{pmatrix} -3 \\ 6 \end{pmatrix} - \begin{pmatrix} 2 \\ 5 \end{pmatrix} \qquad (2.0.2)$$

$$\mathbf{m_2} = \begin{pmatrix} -5 \\ 1 \end{pmatrix} \qquad (2.0.3)$$

$$\mathbf{m_2} = \frac{-1}{5} \qquad (2.0.4)$$

$$\mathbf{m_1} \times \mathbf{m_2} = -1 \qquad (2.0.5)$$

$$\mathbf{m_1} = 5 \qquad (2.0.6)$$

Given point $\mathbf{P} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$ and slope $\mathbf{m_1} = 5$. The direction vector is $\mathbf{m_1} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$. Hence, the normal vector

$$\mathbf{n} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \mathbf{m_1} \qquad (2.0.7)$$

$$= \begin{pmatrix} -5 \\ 1 \end{pmatrix} \qquad (2.0.8)$$

The equation of the line in terms of the normal vector is then obtained as

$$\mathbf{n}^T (\mathbf{x} - \mathbf{P}) = 0 \qquad (2.0.9)$$

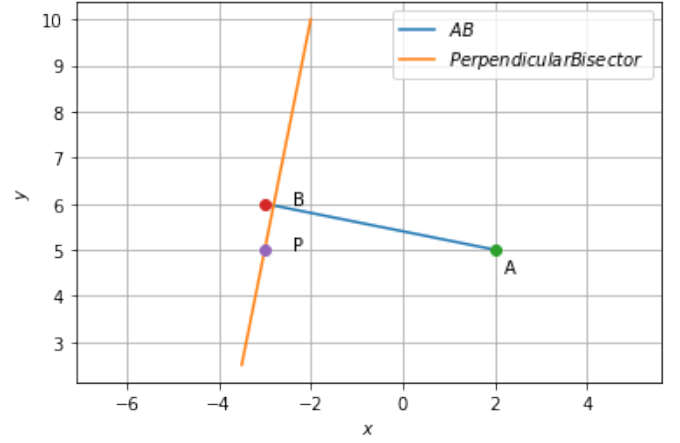$$\implies \begin{pmatrix} 5 & -1 \end{pmatrix} \mathbf{x} = 20 \qquad (2.0.10)$$

Fig. 0: Perpendicular Bisector