

Assignment 1

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Download all python codes from

<https://github.com/KUSUMAPRIYAPULAVARTY/assignment1/tree/master/codes>

and latex-tikz codes from

<https://github.com/KUSUMAPRIYAPULAVARTY/assignment1>

Solving, m_2 yields values $\frac{-8+5\sqrt{3}}{11}$ and $\frac{-8-5\sqrt{3}}{11}$
Equation of line with normal vectorn and passing through point A is given by

$$\mathbf{n}^T(\mathbf{X} - \mathbf{A}) = 0 \quad (2.0.8)$$

Hence, equation of line with slope $\frac{-8+5\sqrt{3}}{11}$ passing through $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ is

$$\left(\frac{8-5\sqrt{3}}{11} \quad 1\right)\left(\mathbf{X} - \begin{pmatrix} 2 \\ 3 \end{pmatrix}\right) = 0 \quad (2.0.9)$$

$$\Rightarrow \left(\frac{8-5\sqrt{3}}{11} \quad 1\right)\mathbf{X} = \frac{49 - 10\sqrt{3}}{11} \quad (2.0.10)$$

Similarly, equation of line with slope $\frac{-8-5\sqrt{3}}{11}$ passing through $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ is

$$\left(\frac{8+5\sqrt{3}}{11} \quad 1\right)\left(\mathbf{X} - \begin{pmatrix} 2 \\ 3 \end{pmatrix}\right) = 0 \quad (2.0.11)$$

$$\Rightarrow \left(\frac{8+5\sqrt{3}}{11} \quad 1\right)\mathbf{X} = \frac{49 + 10\sqrt{3}}{11} \quad (2.0.12)$$

Thus, the required line equations are

$$\left(\frac{8-5\sqrt{3}}{11} \quad 1\right)\mathbf{X} = \frac{49 - 10\sqrt{3}}{11} \quad (2.0.13)$$

$$\text{and} \quad (2.0.14)$$

$$\left(\frac{8+5\sqrt{3}}{11} \quad 1\right)\mathbf{X} = \frac{49 + 10\sqrt{3}}{11} \quad (2.0.15)$$

1 QUESTION No. 40

Two lines passing through the point $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ intersect each other at an angle of 60° . If one line has slope 2, find equation of the other line.

2 EXPLANATION

Directional vector of a line having slope 2 is $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$
Hence normal vector \mathbf{n}_1 is given as

$$\mathbf{n}_1 = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad (2.0.1)$$

$$= \begin{pmatrix} -2 \\ 1 \end{pmatrix} \quad (2.0.2)$$

Similarly normal vector for line 2

$$\mathbf{n}_2 = \begin{pmatrix} -m_2 \\ 1 \end{pmatrix} \quad (2.0.3)$$

Angle between two lines θ can be given by

$$\cos \theta = \frac{\mathbf{n}_1^T \mathbf{n}_2}{\|\mathbf{n}_1\| \|\mathbf{n}_2\|} \quad (2.0.4)$$

$$\Rightarrow \cos 60^\circ = \frac{1}{2} \quad (2.0.5)$$

$$= \frac{2m_2 + 1}{\sqrt{5} \times \sqrt{1 + m_2}} \quad (2.0.6)$$

$$\Rightarrow 11m_2^2 + 16m_2 - 1 = 0 \quad (2.0.7)$$

