

## ASSIGNMENT 2

**Question :** Two lines passing through the point(2,3) intersect each other at an angle of  $60^\circ$ . If slope of one line is 2, find equation of the other line.

**Solution :** The equation of one line having slope 2 is

$$(y - 3) = 2(x - 2) \quad (1)$$

$$\text{or, } 2x - y = 1 \quad (2)$$

So, the normal vector is,  $\mathbf{n}_1 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$

Let the slope of another line is  $m$ . So, the equation of the line is

$$(y - 3) = m(x - 2) \quad (3)$$

$$\text{or, } mx - y = 2m - 3 \quad (4)$$

So, the normal vector is,  $\mathbf{n}_2 = \begin{pmatrix} m \\ -1 \end{pmatrix}$

$$\cos 60^\circ = \frac{\mathbf{n}_1 \mathbf{n}_2}{\|\mathbf{n}_1\| \|\mathbf{n}_2\|} \quad (5)$$

$$\frac{1}{2} = \frac{\begin{pmatrix} 2 \\ -1 \end{pmatrix} \begin{pmatrix} m \\ -1 \end{pmatrix}}{\sqrt{5} \sqrt{m^2 + 1}} \quad (6)$$

$$\frac{1}{2} = \frac{2m + 1}{\sqrt{5m^2 + 5}} \quad (7)$$

$$m = \frac{-8 \pm 5\sqrt{3}}{11} \quad (8)$$

So, the equation of the line is

$$(y - 3) = \frac{-8 - 5\sqrt{3}}{11} (x - 2) \quad (9)$$

$$(y - 3) = \frac{-8 + 5\sqrt{3}}{11} (x - 2) \quad (10)$$

$$(11)$$

Figure :

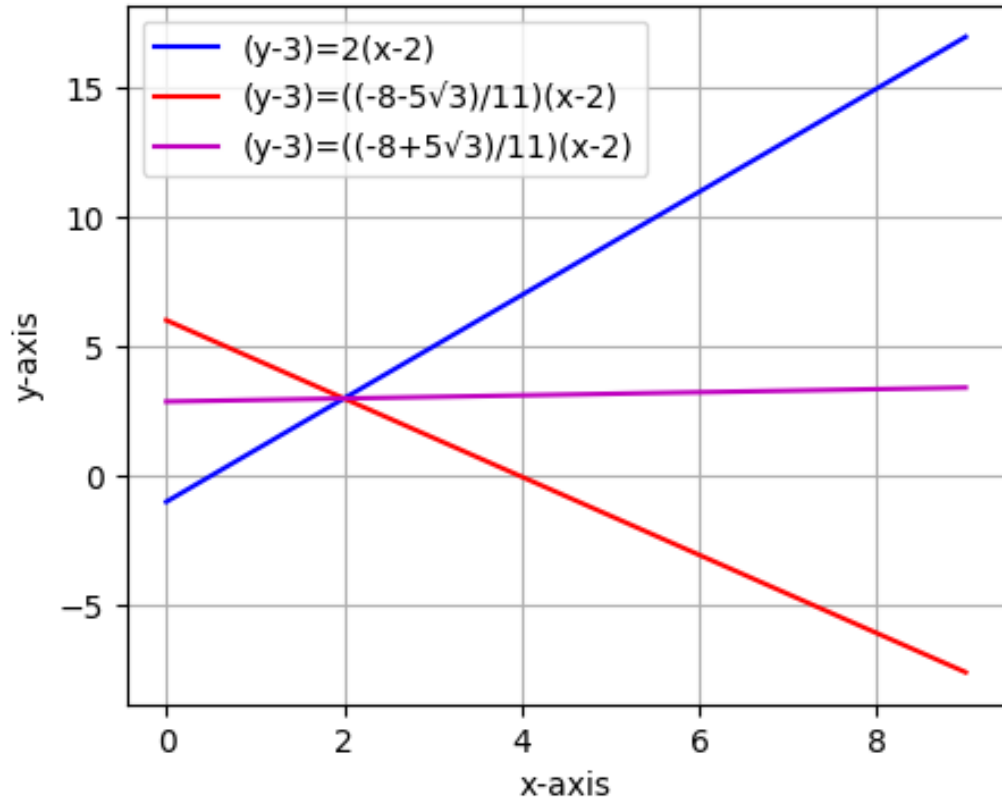


Figure 1: Required Figure