

# ASSIGNMENT 4

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January 17, 2021

## Question 1:

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

## Solution:

Let  $AB$  be the line passing through  $(-3, 5)$   
perpendicular to the line  $CD$  through  $(2, 5)$  and  $(-3, 6)$

Let slope of  $AB = m_1$  slope of  $CD = m_2$

Now

Line  $AB$  is perpendicular to line  $CD$

If two lines are perpendicular then product of their slopes are equal to -1

$$\text{Slope of } AB * \text{Slope of } CD = -1$$

$$\text{so, } m_1 * m_2 = -1 \quad (1)$$

$$\text{slope of line passing through } (x_1, y_1) \text{ and } (x_2, y_2) = \frac{y_2 - y_1}{x_2 - x_1}$$

So, Slope of line  $CD$  passing through  $(2, 5)$  and  $(-3, 6)$

$$m_2 = \frac{6-5}{-3-2} = \frac{1}{-5} = -\frac{1}{5}$$

from (1)

$$m_1 * m_2 = -1 \quad (2)$$

$$m_1 * \frac{-1}{5} = -1 \quad (3)$$

$$m_1 = -1 * \frac{5}{-1} \quad (4)$$

$$m_1 = 5 \quad (5)$$

$$(6)$$

therefore, Slope of line  $AB = m_1 = 5$

Equation of line passing through point  $(x_o, y_o)$  having slope  $m$ ;

$$(y - y_o) = m_1(x - x_o)$$

Equation of line AB passing through  $(-3, 5)$  having slope 5

$$(y - 5) = m_1(x - (-3))$$

$$(y - 5) = 5(x + 3)$$

$$y - 5 = 5x + 15$$

$$0 = 5x - y + 20$$

$$5x - y + 20 = 0$$

Hence, the required equation is  $5x - y + 20 = 0$

## Question 2:

Find the direction vectors and y-intercepts of the following lines

a)  $(1 \quad 7)x = 0$

b)  $(6 \quad 3)x = 5$

c)  $(0 \quad 1)x = 0$

## Solution:

a) given  $(1 \quad 7)x = 0$   
direction vector is

$$\begin{pmatrix} 1 \\ m \end{pmatrix}$$
$$m = \frac{-1}{7}$$

thus direction vector is,

$$\begin{pmatrix} 1 \\ \frac{-1}{7} \end{pmatrix}$$

now let, the Y intercept intersects the Y axis at  $\begin{pmatrix} 0 \\ y \end{pmatrix}$  now,

$$(1 \quad 7) \begin{pmatrix} 0 \\ y \end{pmatrix} = 0$$
$$0 + 7y = 0$$
$$y = 0$$

therefore the y intercept is 0

b)given  $(6 \quad 3)x = 5$   
direction vector is

$$\begin{pmatrix} 1 \\ m \end{pmatrix}$$
$$m = \frac{-6}{3}$$
$$m = -2$$

thus direction vector is,

$$\begin{pmatrix} 1 \\ -2 \end{pmatrix}$$

now let, the Y intercept intersects the Y axis at  $\begin{pmatrix} 0 \\ y \end{pmatrix}$  now,

$$\begin{aligned}(6 \quad 3) \begin{pmatrix} 0 \\ y \end{pmatrix} &= 5 \\ 3y &= 5 \\ y &= \frac{5}{3}\end{aligned}$$

therefore the intercept is  $\frac{5}{3}$

c) given  $(0 \quad 1)x = 0$   
direction vector is

$$\begin{aligned}\begin{pmatrix} 1 \\ m \end{pmatrix} \\ m = 0\end{aligned}$$

thus direction vector is,

$$\begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

now let, the Y intercept intersects the Y axis at  $\begin{pmatrix} 0 \\ y \end{pmatrix}$  now,

$$\begin{aligned}(0 \quad 1) \begin{pmatrix} 0 \\ y \end{pmatrix} &= 0 \\ y &= 0\end{aligned}$$

therefore the y intercept is 0