

# ASSIGNMENT-2

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Download all python codes from

<https://github.com/ThurpuNaveena/ASSIGNMENT-2/tree/main/CODES>

and latex-tikz codes from

<https://github.com/ThurpuNaveena/ASSIGNMENT-2/tree/main>

## 1 QUESTION NO-2.14 (LINEAR FORMS)

Find the equation of the line satisfying the following conditions

- 1) Intersecting the x-axis at a distance of 3 units to the left of the origin with slope -2.
- 2) Intersecting the y-axis at a distance of 2 units above the origin and making an angle of  $30^\circ$  with the positive direction of the x-axis.

## 2 SOLUTION

- 1) Given point  $\mathbf{A} = \begin{pmatrix} -3 \\ 0 \end{pmatrix}$  and slope  $m = -2$ .

The direction vector is  $\mathbf{m} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$ . Hence, the normal vector

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

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

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

$$\mathbf{n}^T (\mathbf{x} - \mathbf{A}) = 0 \quad (2.0.3)$$

$$\Rightarrow \begin{pmatrix} 2 & 1 \end{pmatrix} \mathbf{x} = -6 \quad (2.0.4)$$

Plot of the line  $AB$

- 2) Given point  $\mathbf{A} = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$ . From the given information we have,  $\tan 30^\circ = m = \frac{1}{\sqrt{3}}$ .

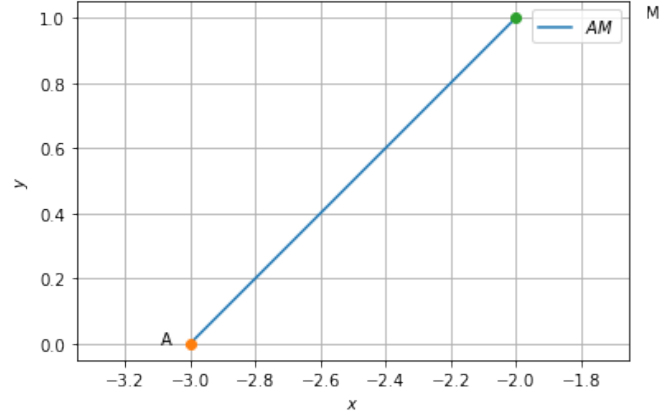


Fig. 2.1: Plot of Line  $AB$  (Part-1)

The direction vector is  $\mathbf{m} = \begin{pmatrix} 1 \\ \tan 30^\circ \end{pmatrix}$ . Hence, the normal vector

$$\mathbf{n} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \mathbf{m} \quad (2.0.5)$$

$$= \begin{pmatrix} -\tan 30^\circ \\ 1 \end{pmatrix} \quad (2.0.6)$$

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

$$\mathbf{n}^T (\mathbf{x} - \mathbf{A}) = 0 \quad (2.0.7)$$

$$\Rightarrow \begin{pmatrix} -1 & \sqrt{3} \end{pmatrix} \mathbf{x} = 2\sqrt{3} \quad (2.0.8)$$

Plot of the line  $AB$

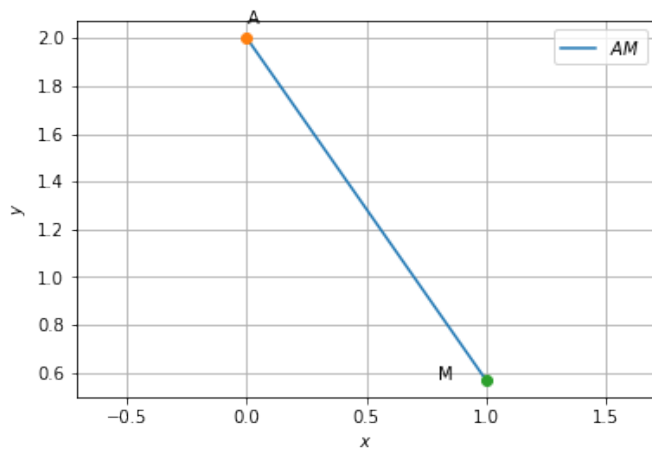


Fig. 2.2: Plot of Line  $AB$  (Part-2)