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 let 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° with the positive direction of the x-axis.

2 SOLUTION

1) Let line AB intersect the x-axis at a distance 3 units to the let of origin. At x-axis, y is always 0. slope $m = -2$. The direction vector is $\mathbf{m} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$. Hence, the normal vector

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

$$= \begin{pmatrix} 2 \\ 1 \end{pmatrix} \tag{2.0.2}$$

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

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

$$\implies \begin{pmatrix} 2 & 1 \end{pmatrix} \mathbf{x} = -6 \tag{2.0.4}$$

$$\mathbf{A} = \begin{pmatrix} -3 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ -6 \end{pmatrix} \tag{2.0.5}$$

Plot of the line AB

2) Line AB intersects the y-axis 2 units above origin. As we know that at y-axis,x-coordinate will be 0 always. From the given information we have, $\tan 30° = m = \frac{1}{\sqrt{3}}$.

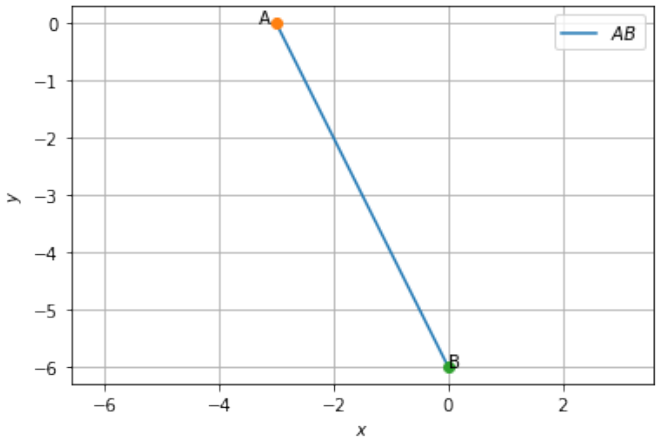

Fig. 2.1: Plot of Line AB (Part-1)

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

$$\mathbf{n} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \mathbf{m} \tag{2.0.6}$$

$$= \begin{pmatrix} -\tan 30° \\ 1 \end{pmatrix} \tag{2.0.7}$$

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

$$\mathbf{n}^T (\mathbf{x} - \mathbf{A}) = 0 \tag{2.0.8}$$

$$\implies \begin{pmatrix} -1 & \sqrt{3} \end{pmatrix} \mathbf{x} = 2\sqrt{3} \tag{2.0.9}$$

$$\mathbf{A} = \begin{pmatrix} -2\sqrt{3} \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 2 \end{pmatrix} \tag{2.0.10}$$

Plot of the line AB

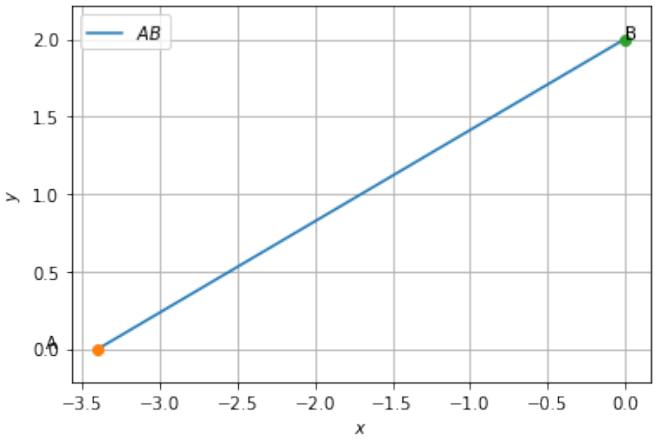

Fig. 2.2: Plot of Line AB (Part-2)