

# Line Assignment

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September 2022

**Problem Statement** - Find equation of the line through the point (0,2) making an angle

$$2\pi/3 \quad (1)$$

with the positive X-axis. Also find the equation of the line parallel to it and crossing the Y-axis at a distance of 2 units below the origin

**Solution**

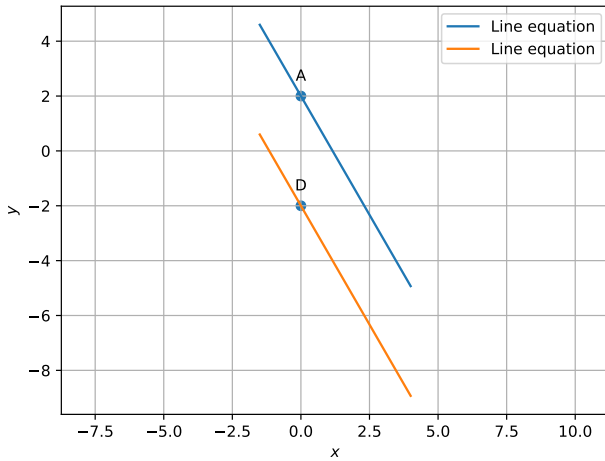


Figure 1:

## 1 construction

Point	Value
A	$\begin{pmatrix} 0 \\ 2 \end{pmatrix}$
$\theta$	$2\pi/3$
D	$\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

## Assumptions

To find the line equation through the point (0,2)

The Directional vector is:

$$\mathbf{m} = \begin{pmatrix} 1 \\ -\sqrt{3} \end{pmatrix} \quad (2)$$

we know that the Normal vector is:

$$\mathbf{n} = \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix} \quad (3)$$

$$\mathbf{m} = \begin{pmatrix} 1 \\ -\sqrt{3} \end{pmatrix} \mathbf{n} = \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix} \quad (4)$$

$$\mathbf{n}^T = (\sqrt{3} \ 1) \quad (5)$$

Where line equation is given by:

$$\mathbf{n}^T(\mathbf{x} - \mathbf{p}) = 0 \quad (6)$$

By substituting the values in the above equation:

$$(\sqrt{3} \ 1) \left( \begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 0 \\ 2 \end{pmatrix} \right) = 0 \quad (7)$$

$$(\sqrt{3} \ 1)(\mathbf{x}) = 2 \quad (8)$$

Also find the equation of the line parallel to it and crossing the Y-axis at a distance of 2 units below the origin:

$$(\sqrt{3} \ 1) \left( \begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 0 \\ -2 \end{pmatrix} \right) = 0 \quad (9)$$

$$(\sqrt{3} \ 1)(\mathbf{x}) = -2 \quad (10)$$