

# EE3900 : Assignment-4

Nelakuditi Rahul Naga - AI20BTECH11029

Download all python codes from

[https://github.com/Rahul27n/EE3900/blob/main/Assignment\\_4/Assignment\\_4.py](https://github.com/Rahul27n/EE3900/blob/main/Assignment_4/Assignment_4.py)

and latex-tikz codes from

[https://github.com/Rahul27n/EE3900/blob/main/Assignment\\_4/Assignment\\_4.tex](https://github.com/Rahul27n/EE3900/blob/main/Assignment_4/Assignment_4.tex)

## 1 QUESTION: LINEAR FORMS Q2.18

Find the equation of a line that cuts off equal intercepts on the coordinate axes and passes through the point  $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ .

## 2 SOLUTION

The general equation of a line can be written as :

$$\mathbf{n}^T \mathbf{x} = c \quad (2.0.1)$$

where  $\mathbf{n}$  is the normal to the line.

Let the line (2.0.1) cut the x and y co-ordinate axes at **A** and **B** respectively. They can be written as :

$$\mathbf{A} = \begin{pmatrix} k \\ 0 \end{pmatrix} \quad (2.0.2)$$

$$\mathbf{B} = \begin{pmatrix} 0 \\ k \end{pmatrix} \quad (2.0.3)$$

where  $k$  is a constant, as it is given that the line cuts off equal intercepts on the co-ordinate axes. Hence, the direction vector of this line, say  $\mathbf{m}$  is given by:

$$\mathbf{m} = \mathbf{A} - \mathbf{B} \quad (2.0.4)$$

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

$$\mathbf{m} = \begin{pmatrix} k \\ -k \end{pmatrix} \quad (2.0.6)$$

which is equivalent to:

$$\mathbf{m} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (2.0.7)$$

Now the normal vector  $\mathbf{n}$  which is perpendicular to  $\mathbf{m}$  is given by:

$$\mathbf{n} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \mathbf{m} \quad (2.0.8)$$

$$\mathbf{n} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (2.0.9)$$

$$\mathbf{n} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (2.0.10)$$

Hence from (2.0.1) and (2.0.10), the equation of the line is given by:

$$(1 \ 1) \mathbf{x} = c \quad (2.0.11)$$

It is given that  $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$  lies on the line. Hence from (2.0.11) we have:

$$c = (1 \ 1) \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad (2.0.12)$$

$$c = 5 \quad (2.0.13)$$

Therefore the equation of the line is:

$$(1 \ 1) \mathbf{x} = 5 \quad (2.0.14)$$

The illustration of the line is shown below :

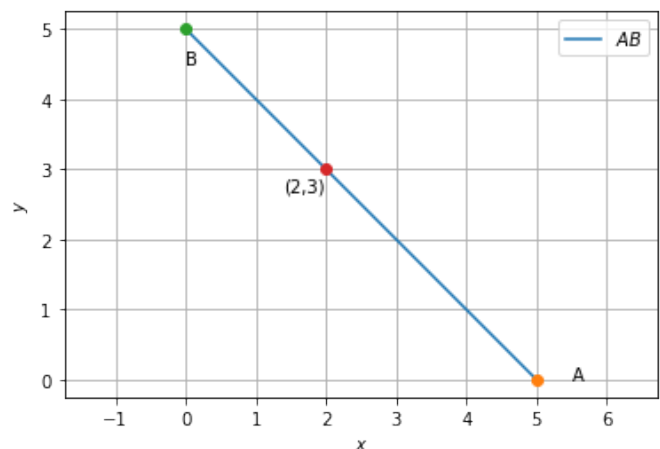


Fig. 0: Line **AB** making equal intercepts on co-ordinate axes