

# 4.3.33

EE25BTECH11043 - Nishid Khandagre

**Question:** If the coordinates of the middle point of the portion of a line intercepted between the coordinate axes is  $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ , then the equation of the line will be?

**Solution:** The equation of line is

$$\mathbf{n}^\top \mathbf{x} = c \quad (0.1)$$

Where  $\mathbf{n} = \begin{pmatrix} n_1 \\ n_2 \end{pmatrix}$  is the normal vector and  $\mathbf{x} = \begin{pmatrix} x \\ y \end{pmatrix}$  is the position vector.

X-axis intercept

$$y = 0 \quad (0.2)$$

$$x = \frac{c}{n_1} \quad (0.3)$$

Thus, **A** is  $\begin{pmatrix} \frac{c}{n_1} \\ 0 \end{pmatrix}$ .

Y-axis intercept

$$x = 0 \quad (0.4)$$

$$y = \frac{c}{n_2} \quad (0.5)$$

Thus, **B** is  $\begin{pmatrix} 0 \\ \frac{c}{n_2} \end{pmatrix}$ .

Let **M** is the midpoint of **A** and **B**

Given  $\mathbf{M} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ .

$$\mathbf{M} = \frac{\mathbf{A} + \mathbf{B}}{2} \quad (0.6)$$

$$\begin{pmatrix} 3 \\ 2 \end{pmatrix} = \frac{1}{2} \begin{pmatrix} \frac{c}{n_1} \\ 0 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} 0 \\ \frac{c}{n_2} \end{pmatrix} \quad (0.7)$$

$$\begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} \frac{c}{2n_1} \\ \frac{c}{2n_2} \end{pmatrix} \quad (0.8)$$

$$\frac{c}{2n_1} = 3 \quad (0.9)$$

$$\frac{c}{2n_2} = 2 \quad (0.10)$$

$$\frac{n_1}{n_2} = \frac{2}{3} \quad (0.11)$$

Let  $n_1 = 2$  and  $n_2 = 3$ . Then

$$c = 6 \times 2 = 12 \quad (0.12)$$

The final equation of the line is  $\mathbf{n}^T \mathbf{x} = c$

$$\begin{pmatrix} 2 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 12 \quad (0.13)$$

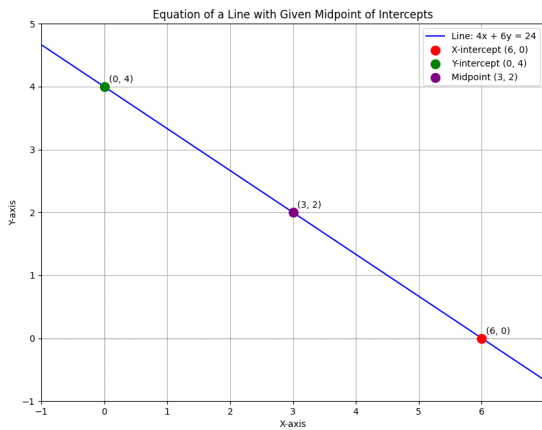


Fig. 0.1