

Assignment 1

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- 1) Point $\mathbf{R}(h, k)$ divides a line segment between the axes in the ratio 1: 2. Find equation of the line.

Solution: Let the line segment between the axes be AB , with point \mathbf{A} on X-axis, \mathbf{B} on Y-axis. Let the points \mathbf{A} , \mathbf{B} be

$$\mathbf{A} = \begin{pmatrix} \alpha \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ \beta \end{pmatrix} \quad (0.0.1)$$

Given that $\frac{AR}{RB} = \frac{1}{2}$. By using section formula, we get

$$\mathbf{R} = \frac{2\mathbf{A} + \mathbf{B}}{3} \quad (0.0.2)$$

$$\begin{pmatrix} h \\ k \end{pmatrix} = \frac{1}{3} \begin{pmatrix} 2\alpha \\ \beta \end{pmatrix} \quad (0.0.3)$$

$$h = \frac{2\alpha}{3} \quad (0.0.4)$$

$$k = \frac{\beta}{3} \quad (0.0.5)$$

$$\mathbf{A} = \begin{pmatrix} \frac{3h}{2} \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 3k \end{pmatrix} \quad (0.0.6)$$

The direction vector of the line is given by,

$$\mathbf{m} = \mathbf{R} - \mathbf{B} \quad (0.0.7)$$

$$\mathbf{m} = \begin{pmatrix} h \\ -2k \end{pmatrix} \quad (0.0.8)$$

The normal vector to the line is given by,

$$\mathbf{n} = \begin{pmatrix} 2k \\ h \end{pmatrix} \quad (0.0.9)$$

The equation of line is given by,

$$\mathbf{n}^\top \mathbf{x} = \mathbf{n}^\top \mathbf{B} \quad (0.0.10)$$

$$\begin{pmatrix} 2k & h \end{pmatrix} \mathbf{x} = \begin{pmatrix} 2k & h \end{pmatrix} \begin{pmatrix} 0 \\ 3k \end{pmatrix} \quad (0.0.11)$$

$$\begin{pmatrix} 2k & h \end{pmatrix} \mathbf{x} = 3hk \quad (0.0.12)$$

The equation of the line is given by,
 $\begin{pmatrix} 2k & h \end{pmatrix} \mathbf{x} = 3hk$