

A line  $L_1$  passes through  $(2,0,-3)$  and  $(4,3,2)$ .

a) Find the equation of the line  $L_1$

A second line  $L_2$  has equation  $\mathbf{r} = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ -4 \\ k \end{pmatrix}$

b) Given that  $L_1$  and  $L_2$  are perpendicular, find  $k$ .

$$\text{a) } L_1 \text{ is parallel to } \begin{pmatrix} 4 \\ 3 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ 0 \\ -3 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}$$

$$L_1 \text{ passes through } \begin{pmatrix} 2 \\ 0 \\ -3 \end{pmatrix}$$

$$L_1: \underline{r} = \begin{pmatrix} 2 \\ 0 \\ -3 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}$$

$$\text{b) Direction of } L_1 = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix} \quad \text{Direction of } L_2 = \begin{pmatrix} 1 \\ -4 \\ k \end{pmatrix}$$

If lines are perpendicular scalar product = 0

$$\begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ -4 \\ k \end{pmatrix} = 2 \cdot 1 + 3 \cdot (-4) + 5 \cdot k = 0$$

$$2 - 12 + 5k = 0$$

$$-10 + 5k = 0$$

$$5k = 10$$

$$k = 2$$