$$L_1 = \begin{pmatrix} -1 \\ 0 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$$

$$L_2 = \begin{pmatrix} -1 \\ 0 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} -1 \\ 2 \\ 0 \end{pmatrix}$$

$$L_3 = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} 0 \\ -3 \\ 1 \end{pmatrix}$$

$$L_8 = \begin{pmatrix} -1 \\ -5 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} -2 \\ 4 \\ 0 \end{pmatrix}$$

Find the area of the hidden rectangle!

Hint: It is in surd form

$$L_4 = \begin{pmatrix} -1 \\ 0 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 0 \\ -1 \end{pmatrix}$$

$$L_7 = \begin{pmatrix} 0 \\ 0 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 0 \\ -1 \end{pmatrix}$$

$$L_6 = \begin{pmatrix} 0 \\ 3 \\ 6 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$$

$$L_5 = \begin{pmatrix} 6 \\ 0 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 0 \\ 6 \end{pmatrix}$$

Skills

- Understand 3D vector notation for equations
- Find the angle between lines
- Find points of intersection
- Find lengths of line segments

Teacher notes

- This isn't a starter activity. It is recommended as an investigation for consolidating or revising the understanding of vectors in C4.
- You may find it useful to recap $\underline{a} \,.\, \underline{b} = \left|\underline{a}\right|\left|\underline{b}\right| \cos\theta$
- Encourage students to identify perpendicular and parallel lines, before looking for points of intersection
- There are several 'red herrings': perpendicular gradients on skew lines, intersecting lines but not enough to make a rectangle, parallel lines …
- Lines 1, 2, 6 & 8 form a rectangle.
- The corners are (-2,2,3), (-1,0,3), (-3,-1,0) & (-4,1,0)
- The sides are √5 and √14, giving an area of √70
- You could use 3D plotting software or graphical calculators or a smartphone app to check the results.