

Self-assessment: 14 Lines and planes in space

1. Line l_1 passes through points with coordinates $(4, 0, 3)$ and $(5, -1, 1)$. Line l_2 has equation

$$\mathbf{r} = \begin{pmatrix} -4 \\ 5 \\ -5 \end{pmatrix} + t \begin{pmatrix} 2 \\ -1 \\ 2 \end{pmatrix}$$

- (a) Find the equation of l_1 .
(b) Determine whether l_1 and l_2 intersect, and if so, at what point.

(accessible to students on the path to grade 3 or 4) [8 marks]

2. (a) Find the angle between the planes with Cartesian equations $4x + y - 2z = 6$ and $x - y = 2$.
(b) Find the vector equation of the line of intersection of the two planes.

(accessible to students on the path to grade 5 or 6) [8 marks]

3. The line l has equation $\mathbf{r} = \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix} + t \begin{pmatrix} -1 \\ 1 \\ 2 \end{pmatrix}$. Point D has coordinates $(5, 3, 4)$.

- (a) Show that the point $A(5, -1, -3)$ lies on line l .

(accessible to students on the path to grade 3 or 4)

- (b) Evaluate $\overrightarrow{AD} \times \begin{pmatrix} -1 \\ 1 \\ 2 \end{pmatrix}$.

- (c) Hence, or otherwise, find the Cartesian equation of the plane containing the line l and point D.

- (d) Find the coordinates of point P on l such that DP is perpendicular to l .

(accessible to students on the path to grade 5 or 6)

[14 marks]