

Question	Scheme	Marks	AOs
2(a)	$\begin{pmatrix} 3 \\ -4 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} 6 \\ 2 \\ 12 \end{pmatrix} = 18 - 8 + 24$	M1	3.1a
	$d = \frac{18 - 8 + 24 - 5}{\sqrt{3^2 + 4^2 + 2^2}}$	M1	1.1b
	$= \sqrt{29}$	A1	1.1b
		(3)	
(b)	$\begin{pmatrix} -1 \\ -3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 1 \\ 5 \end{pmatrix} = \dots$ and $\begin{pmatrix} -1 \\ -3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ -1 \\ -2 \end{pmatrix} = \dots$	M1	2.1
	$\begin{pmatrix} -1 \\ -3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 1 \\ 5 \end{pmatrix} = 0$ and $\begin{pmatrix} -1 \\ -3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ -1 \\ -2 \end{pmatrix} = 0$ $\therefore -\mathbf{i} - 3\mathbf{j} + \mathbf{k}$ is perpendicular to Π_2	A1	2.2a
		(2)	
(c)	$\begin{pmatrix} -1 \\ -3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ -4 \\ 2 \end{pmatrix} = -3 + 12 + 2$	M1	1.1b
	$\sqrt{(-1)^2 + (-3)^2 + 1^2} \sqrt{(3)^2 + (-4)^2 + 2^2} \cos \theta = 11$ $\Rightarrow \cos \theta = \frac{11}{\sqrt{(-1)^2 + (-3)^2 + 1^2} \sqrt{(3)^2 + (-4)^2 + 2^2}}$	M1	2.1
	So angle between planes $\theta = 52^\circ$ *	A1*	2.4
		(3)	

(8 marks)**Notes:****(a)****M1:** Realises the need to and so attempts the scalar product between the normal and the position vector**M1:** Correct method for the perpendicular distance**A1:** Correct distance**(b)****M1:** Recognises the need to calculate the scalar product between the given vector and both direction vectors**A1:** Obtains zero both times and makes a conclusion**(c)****M1:** Calculates the scalar product between the two normal vectors**M1:** Applies the scalar product formula with their 11 to find a value for $\cos \theta$ **A1*:** Identifies the correct angle by linking the angle between the normal and the angle between the planes