Marked example 3

Paper 2 style · Graphic display calculator

3 6 marks AHL 3.18 · 1.16 ●●○ Typical

The planes Π_1 and Π_2 have equations $x - 2y + z = 3$ and $2x + y - z = 1$.

(a) Find the acute angle between Π_1 and Π_2, in degrees. **[2]**

(b) Find a vector in the direction of the line of intersection of Π_1 and Π_2. **[2]**

(c) Find a vector equation of this line. **[2]**

MARKSCHEME (a)

$\cos\theta = \dfrac{|2 - 2 - 1|}{\sqrt{6} \times \sqrt{6}} = \dfrac{1}{6}$ **M1**

$80.4°$ $(80.4059\ldots)$ **A1**

Total 2 marks

MARKSCHEME (b)

$\mathbf{n}_1 \times \mathbf{n}_2 = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} \times \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$ **M1**

$\begin{pmatrix} 1 \\ 3 \\ 5 \end{pmatrix}$ **A1**

Total 2 marks

MARKSCHEME (c)

$z = 0$: $x - 2y = 3, 2x + y = 1$, so $(1, -1, 0)$ **M1**

$\mathbf{r} = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix} + t \begin{pmatrix} 1 \\ 3 \\ 5 \end{pmatrix}$ **A1**

Total 2 marks

Note Any point of both planes.

Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software.
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