Marked example 1

Paper 1 style · No calculator

1 6 marks AHL 3.16 ●○○ Routine

Let $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 3 \\ 0 \\ 2 \end{pmatrix}$.

(a) Find $\mathbf{a} \times \mathbf{b}$. [2]

(b) Find a unit vector perpendicular to both $\mathbf{a}$ and $\mathbf{b}$. [2]

(c) Find a vector equation of the line through $(0, 1, 2)$ perpendicular to both $\mathbf{a}$ and $\mathbf{b}$. [2]

MARKSCHEME (a)

$\begin{pmatrix} 2 \times 2 - (-1) \times 0 \\ (-1) \times 3 - 1 \times 2 \\ 1 \times 0 - 2 \times 3 \end{pmatrix}$ M1

$\begin{pmatrix} 4 \\ -5 \\ -6 \end{pmatrix}$ A1

Total 2 marks

Note Correct method for at least two components.

MARKSCHEME (b)

$|\mathbf{a} \times \mathbf{b}| = \sqrt{16 + 25 + 36} = \sqrt{77}$ M1

$\frac{1}{\sqrt{77}} \begin{pmatrix} 4 \\ -5 \\ -6 \end{pmatrix}$ A1

Total 2 marks

Note Or its opposite.

MARKSCHEME (c)

direction $\mathbf{a} \times \mathbf{b}$ M1

$\mathbf{r} = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} + t \begin{pmatrix} 4 \\ -5 \\ -6 \end{pmatrix}$ A1

Total 2 marks

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