Further Vectors – 2022 GCE AS Pure Further Mathematics A

1. June/2022/Paper_Y531/01/No.1

   (a) Determine whether the point $(19, -12, 17)$ lies on the line $\mathbf{r} = \begin{pmatrix} 4 \\ -2 \\ 7 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ -2 \\ 4 \end{pmatrix}$. [3]

   Vectors $\mathbf{a}$ and $\mathbf{b}$ are given by $\mathbf{a} = \begin{pmatrix} 1 \\ -2 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -3 \\ 6 \\ 2 \end{pmatrix}$.

   (b) (i) Find, in degrees, the angle between $\mathbf{a}$ and $\mathbf{b}$. [3]

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

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The line segment AB is a diameter of a sphere, S. The point C is **any** point on the surface of S.

(a) Explain why $\overrightarrow{AC} \cdot \overrightarrow{BC} = 0$ for **all** possible positions of C. [3]

You are now given that A is the point $(11, 12, -14)$ and B is the point $(9, 13, 6)$.

(b) Given that the coordinates of C have the form $(2p, p, 1)$, where p is a constant, determine the coordinates of the possible positions of C. [6]

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