Further Vectors – 2022 GCE AS Additional Pure Further Mathematics A

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The points A, B and C have position vectors $\mathbf{a} = \begin{pmatrix} 1 \\ 1 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 1 \\ 2 \end{pmatrix}$ respectively, relative to the origin O.

(a) Calculate, in its simplest exact form, the area of triangle OAB. [3]

(b) Show that $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) + \mathbf{b} \times (\mathbf{c} \times \mathbf{a}) + \mathbf{c} \times (\mathbf{a} \times \mathbf{b}) = \mathbf{0}$. [3]