



QUESTION WORKBOOK

The vector product and the scalar triple product

Further Pure 1 · Year FM

7 questions · 25 marks

PRINT EDITION

SECTION A · Warm-up

A1 State what $|a \times b|$ measures geometrically, and what $a \cdot (b \times c)$ measures. [2]

A2 Find $a \times b$ for $a = (2, -1, 3)$ and $b = (1, 4, -2)$, and verify that it is perpendicular to a . [3]

SECTION B · Standard

B1 Find the area of the triangle with vertices $A(1, 0, 1)$, $B(3, -1, 4)$ and $C(2, 4, -1)$. [4]

- B2** Find the volume of the tetrahedron with edges from the origin along $\mathbf{a} = (1, 1, 1)$, $\mathbf{b} = (2, 3, 1)$ and $\mathbf{c} = (0, 2, 4)$. [4]

- B3** The line l passes through $A(2, -1, 4)$ and is parallel to $\mathbf{b} = \mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$. Write down an equation for l in the form $(\mathbf{r} - \mathbf{a}) \times \mathbf{b} = 0$, and find the direction cosines of l . [3]

- B4** Explain what $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) = 0$ tells you about three non-zero vectors, and how this compares with $\mathbf{a} \times \mathbf{b} = 0$. [3]

SECTION C · Stretch

- c1** The line l_1 has equation $\mathbf{r} = \mathbf{i} + 2\mathbf{k} + \lambda(2\mathbf{i} + \mathbf{j} - \mathbf{k})$ and the line l_2 has equation $\mathbf{r} = 3\mathbf{i} - \mathbf{j} + \mu(\mathbf{i} + 2\mathbf{j} + \mathbf{k})$. Show that l_1 and l_2 are skew, and find the shortest distance between them, giving your answer in exact form. [6]