

Vector Geometry

Question Paper

Level	Pre U
Subject	Maths
Exam Board	Cambridge International Examinations
Topic	Vector Geometry
Booklet	Question Paper

Time Allowed: 52 minutes

Score: /43

Percentage: /100

Grade Boundaries:

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- 1 The points A and B have position vectors \mathbf{a} and \mathbf{b} relative to an origin O , where $\mathbf{a} = 5\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$ and $\mathbf{b} = -7\mathbf{i} + 3\mathbf{j} + \mathbf{k}$.

(i) Find the length of AB . [3]

(ii) Use a scalar product to find angle OAB . [4]

- 2 Two intersecting straight lines have equations

$$\frac{x-5}{4} = \frac{y-11}{3} = \frac{z-7}{-5} \quad \text{and} \quad \frac{x-9}{-2} = \frac{y-4}{1} = \frac{z+4}{4}.$$

Find the coordinates of their point of intersection. [6]

- 3 Vectors \mathbf{u} and \mathbf{v} are given by $\mathbf{u} = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$.

(i) Find $\mathbf{u} + \mathbf{v}$ and $\mathbf{u} - \mathbf{v}$. [2]

(ii) Show that $|\mathbf{u} + \mathbf{v}| = |\mathbf{u} - \mathbf{v}|$. [2]

- 4 Three points A , B and C have coordinates $(1, 0, 7)$, $(13, 9, 1)$ and $(2, -1, -7)$ respectively.

(i) Use a scalar product to find angle ACB . [5]

(ii) Hence find the area of triangle ACB . [2]

(iii) Show that a vector equation of the line AB is given by $\mathbf{r} = \mathbf{i} + 7\mathbf{k} + \lambda(4\mathbf{i} + 3\mathbf{j} - 2\mathbf{k})$, where λ is a scalar parameter. [3]

- 5 (i) Given that the point $(-1, -2, 4)$ lies on both the lines

$$\mathbf{r} = \begin{pmatrix} 2 \\ -3 \\ a \end{pmatrix} + \lambda \begin{pmatrix} -3 \\ 1 \\ 1 \end{pmatrix} \quad \text{and} \quad \mathbf{r} = \begin{pmatrix} 2 \\ 4 \\ b \end{pmatrix} + \mu \begin{pmatrix} -1 \\ -2 \\ 1 \end{pmatrix},$$

find a and b . [3]

(ii) Find the acute angle between the lines. [4]

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- 6 The points A and B have position vectors $\mathbf{i} - \mathbf{j} + \mathbf{k}$ and $2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$ respectively, relative to the origin O . The point C is on the line OA extended so that $\overrightarrow{AC} = 2\overrightarrow{OA}$ and the point D is on the line OB extended so that $\overrightarrow{BD} = 3\overrightarrow{OB}$. The point X is such that $OCXD$ is a parallelogram.
- (i) Show that a vector equation of the line AX is $\mathbf{r} = \mathbf{i} - \mathbf{j} + \mathbf{k} + \lambda(5\mathbf{i} + \mathbf{j} + 7\mathbf{k})$ and find an equation of the line CD in a similar form. [5]
- (ii) Prove that the lines AX and CD intersect and find the position vector of their point of intersection. [4]