

Vectors

Question Paper 7

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Vectors
Sub Topic	
Booklet	Question Paper 7

Time Allowed: 59 minutes

Score: /49

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 Relative to an origin O , the position vectors of the points A and B are given by

$$\vec{OA} = \begin{pmatrix} 4 \\ 1 \\ -2 \end{pmatrix} \quad \text{and} \quad \vec{OB} = \begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix}.$$

- (i) Given that C is the point such that $\vec{AC} = 2\vec{AB}$, find the unit vector in the direction of \vec{OC} . [4]

The position vector of the point D is given by $\vec{OD} = \begin{pmatrix} 1 \\ 4 \\ k \end{pmatrix}$, where k is a constant, and it is given that $\vec{OD} = m\vec{OA} + n\vec{OB}$, where m and n are constants.

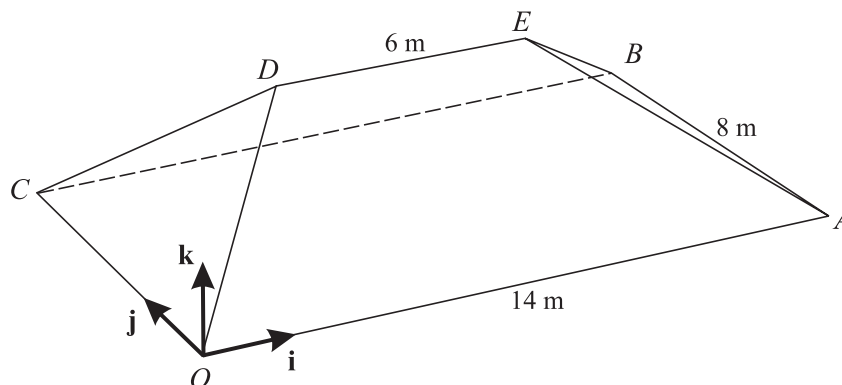
- (ii) Find the values of m , n and k . [4]

- 2 The position vectors of points A and B are $\begin{pmatrix} -3 \\ 6 \\ 3 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$ respectively, relative to an origin O .

- (i) Calculate angle AOB . [3]

- (ii) The point C is such that $\vec{AC} = 3\vec{AB}$. Find the unit vector in the direction of \vec{OC} . [4]

3



The diagram shows the roof of a house. The base of the roof, $OABC$, is rectangular and horizontal with $OA = CB = 14$ m and $OC = AB = 8$ m. The top of the roof DE is 5 m above the base and $DE = 6$ m. The sloping edges OD , CD , AE and BE are all equal in length.

Unit vectors i and j are parallel to OA and OC respectively and the unit vector k is vertically upwards.

- (i) Express the vector \vec{OD} in terms of i , j and k , and find its magnitude. [4]

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

- 4 Relative to an origin O , the position vectors of points P and Q are given by

$$\overrightarrow{OP} = \begin{pmatrix} -2 \\ 3 \\ 1 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OQ} = \begin{pmatrix} 2 \\ 1 \\ q \end{pmatrix},$$

where q is a constant.

- (i) In the case where $q = 3$, use a scalar product to show that $\cos POQ = \frac{1}{7}$. [3]
- (ii) Find the values of q for which the length of \overrightarrow{PQ} is 6 units. [4]

- 5 Relative to an origin O , the position vectors of the points A and B are given by

$$\overrightarrow{OA} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k} \quad \text{and} \quad \overrightarrow{OB} = 4\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}.$$

- (i) Use a scalar product to find angle AOB , correct to the nearest degree. [4]
- (ii) Find the unit vector in the direction of \overrightarrow{AB} . [3]
- (iii) The point C is such that $\overrightarrow{OC} = 6\mathbf{j} + p\mathbf{k}$, where p is a constant. Given that the lengths of \overrightarrow{AB} and \overrightarrow{AC} are equal, find the possible values of p . [4]

- 6 The points A and B have position vectors $\mathbf{i} + 7\mathbf{j} + 2\mathbf{k}$ and $-5\mathbf{i} + 5\mathbf{j} + 6\mathbf{k}$ respectively, relative to an origin O .

- (i) Use a scalar product to calculate angle AOB , giving your answer in radians correct to 3 significant figures. [4]
- (ii) The point C is such that $\overrightarrow{AB} = 2\overrightarrow{BC}$. Find the unit vector in the direction of \overrightarrow{OC} . [4]