

Vectors

Question Paper 5

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|-------------------|-----------------------|
| Level | International A Level |
| Subject | Maths |
| Exam Board | CIE |
| Topic | Vectors |
| Sub Topic | |
| Booklet | Question Paper 5 |

Time Allowed: 58 minutes

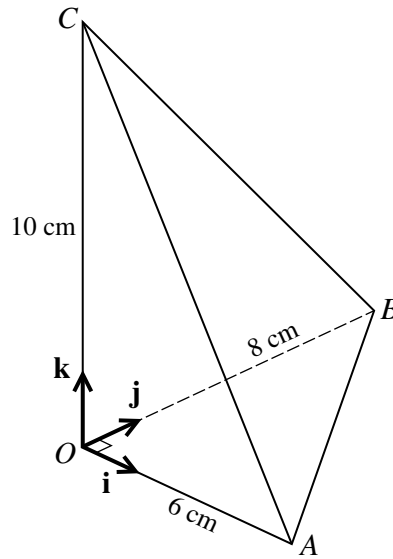
Score: /48

Percentage: /100

Grade Boundaries:

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

1

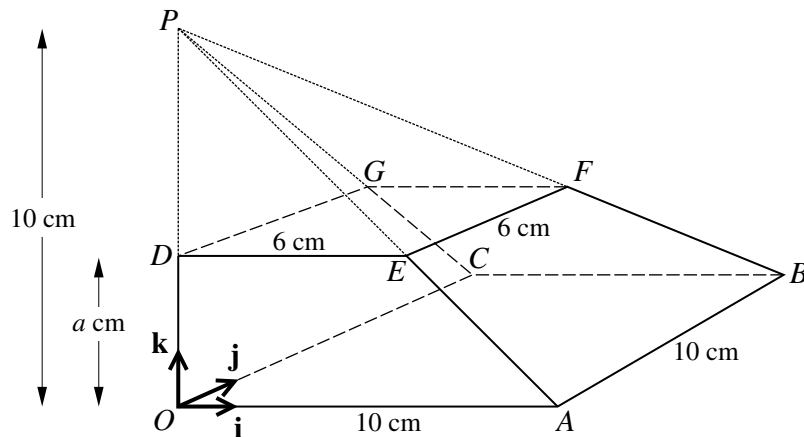


The diagram shows a pyramid $OABC$ with a horizontal base OAB where $OA = 6$ cm, $OB = 8$ cm and angle $AOB = 90^\circ$. The point C is vertically above O and $OC = 10$ cm. Unit vectors \mathbf{i} , \mathbf{j} and \mathbf{k} are parallel to OA , OB and OC as shown.

Use a scalar product to find angle ACB .

[6]

2



The diagram shows a pyramid $OABCP$ in which the horizontal base $OABC$ is a square of side 10 cm and the vertex P is 10 cm vertically above O . The points D , E , F , G lie on OP , AP , BP , CP respectively and $DEFG$ is a horizontal square of side 6 cm. The height of $DEFG$ above the base is a cm. Unit vectors \mathbf{i} , \mathbf{j} and \mathbf{k} are parallel to OA , OC and OD respectively.

(i) Show that $a = 4$.

[2]

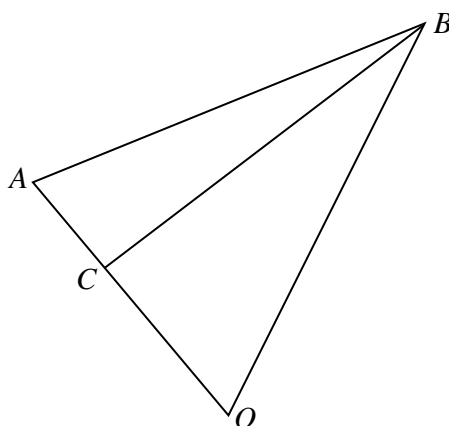
(ii) Express the vector \overrightarrow{BG} in terms of \mathbf{i} , \mathbf{j} and \mathbf{k} .

[2]

(iii) Use a scalar product to find angle GBA .

[4]

3



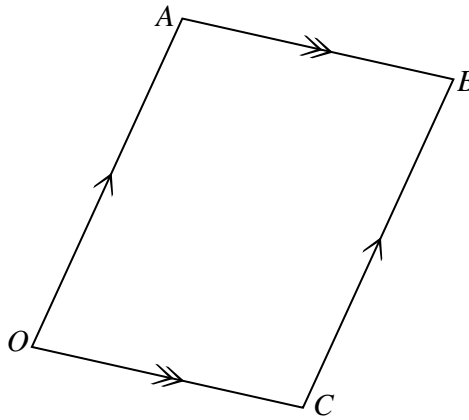
The diagram shows triangle OAB , in which the position vectors of A and B with respect to O are given by

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

C is a point on OA such that $\vec{OC} = p\vec{OA}$, where p is a constant.

- (i) Find angle AOB . [4]
- (ii) Find \vec{BC} in terms of p and vectors \mathbf{i} , \mathbf{j} and \mathbf{k} . [1]
- (iii) Find the value of p given that BC is perpendicular to OA . [4]

4



The diagram shows the parallelogram $OABC$. Given that $\vec{OA} = \mathbf{i} + 3\mathbf{j} + 3\mathbf{k}$ and $\vec{OC} = 3\mathbf{i} - \mathbf{j} + \mathbf{k}$, find

- (i) the unit vector in the direction of \vec{OB} , [3]
- (ii) the acute angle between the diagonals of the parallelogram, [5]
- (iii) the perimeter of the parallelogram, correct to 1 decimal place. [3]

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

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

- (i) Find the value of p for which \vec{OA} is perpendicular to \vec{OB} . [2]
- (ii) Find the values of p for which the magnitude of \vec{AB} is 7. [4]

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

$$\vec{OA} = \mathbf{i} - 2\mathbf{j} + 4\mathbf{k}, \quad \vec{OB} = 3\mathbf{i} + 2\mathbf{j} + 8\mathbf{k}, \quad \vec{OC} = -\mathbf{i} - 2\mathbf{j} + 10\mathbf{k}.$$

- (i) Use a scalar product to find angle ABC . [6]
- (ii) Find the perimeter of triangle ABC , giving your answer correct to 2 decimal places. [2]