

Vectors in 3D

Difficulty: Medium

Question Paper 1

Level	A Level only
Subject	Maths - Pure
Exam Board	Edexcel
Topic	Vectors
Sub-Topic	Vectors in 3D
Difficulty	Medium
Booklet	Question Paper 1

Time allowed: 36 minutes

Score: /30

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>76%	61%	52%	42%	33%	23%	<23%

Question 1

Relative to a fixed origin O ,

the point A has position vector $(2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k})$,

the point B has position vector $(4\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$,

and the point C has position vector $(a\mathbf{i} + 5\mathbf{j} - 2\mathbf{k})$, where a is a constant and $a < 0$

D is the point such that $\overrightarrow{AB} = \overrightarrow{BD}$.

(a) Find the position vector of D .

(2)

Given $|\overrightarrow{AC}| = 4$

(b) find the value of a .

(3)

(Total 5 marks)

Question 2

Given that $(b - a)\mathbf{i} - 2abc\mathbf{j} + 2\mathbf{k} = 10\mathbf{i} - 96\mathbf{j} + (7a + 5b)\mathbf{k}$, find the values of a , b and c .

(6 marks)

(Total 6 marks)

Question 3

A triangle has vertices $A(-2, 0, -4)$, $B(-2, 4, -6)$ and $C(3, 4, 4)$.

By considering the side lengths of the triangle, show that the triangle is a right-angled triangle.

(6 marks)

(Total 6 marks)

Question 4

The point A has position vector $\mathbf{a} = 2\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and the point B has position vector $\mathbf{b} = \mathbf{i} + \mathbf{j} - 4\mathbf{k}$, relative to an origin O .

(a) Find the position vector of the point C , with position vector \mathbf{c} , given by

$$\mathbf{c} = \mathbf{a} + \mathbf{b}. \quad (1)$$

(b) Show that $OACB$ is a rectangle, and find its exact area. (6)

The diagonals of the rectangle, AB and OC , meet at the point D .

(c) Write down the position vector of the point D . (1)

(Total 8 marks)

Question 5

Relative to a fixed origin O ,

the point A has position vector $\mathbf{i} + 7\mathbf{j} - 2\mathbf{k}$,
the point B has position vector $4\mathbf{i} + 3\mathbf{j} + 3\mathbf{k}$,
and the point C has position vector $2\mathbf{i} + 10\mathbf{j} + 9\mathbf{k}$.

Given that $ABCD$ is a parallelogram,

(a) find the position vector of point D .

(2)

The vector \vec{AX} has the same direction as \vec{AB} .

Given that $|\vec{AX}| = 10\sqrt{2}$,

(b) find the position vector of X .

(3)

(Total 5 marks)