

Scalar Product

Difficulty: Easy

Question Paper 1

Level	A Level
Subject	Maths Pure 3
Exam Board	CIE
Topic	Vectors
Sub-Topic	Scalar Product
Difficulty	Easy
Booklet	Question Paper 1

Time allowed: 29 minutes

Score: /21

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>90%	81%	70%	58%	46%	34%

Question 1

The lines l and m have vector equations

$$\mathbf{r} = \mathbf{i} + \mathbf{j} + \mathbf{k} + s(\mathbf{i} - \mathbf{j} + 2\mathbf{k}) \quad \text{and} \quad \mathbf{r} = 4\mathbf{i} + 6\mathbf{j} + \mathbf{k} + t(2\mathbf{i} + 2\mathbf{j} + \mathbf{k})$$

respectively.

(i) Show that l and m intersect.

[4]

(ii) Calculate the acute angle between the lines.

[3]

Question 2

The point P has coordinates $(-1, 4, 11)$ and the line l has equation $\mathbf{r} = \begin{pmatrix} 1 \\ 3 \\ -4 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$.

- (i) Find the perpendicular distance from P to l . [4]

Question 3

The line l has equation $\mathbf{r} = 4\mathbf{i} - 9\mathbf{j} + 9\mathbf{k} + \lambda(-2\mathbf{i} + \mathbf{j} - 2\mathbf{k})$. The point A has position vector $3\mathbf{i} + 8\mathbf{j} + 5\mathbf{k}$.

- (i) Show that the length of the perpendicular from A to l is 15. [5]

Question 4

Relative to the origin O , the point A has position vector given by $\vec{OA} = \mathbf{i} + 2\mathbf{j} + 4\mathbf{k}$. The line l has equation $\mathbf{r} = 9\mathbf{i} - \mathbf{j} + 8\mathbf{k} + \mu(3\mathbf{i} - \mathbf{j} + 2\mathbf{k})$.

- (i) Find the position vector of the foot of the perpendicular from A to l . Hence find the position vector of the reflection of A in l . [5]