

QQQ – Further Pure 1 – Chapter 1 – Vectors (Version 2)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1. Vectors $\mathbf{u}$ and $\mathbf{v}$ are given by

$$\mathbf{u} = 5\mathbf{i} + 4\mathbf{j} - 3\mathbf{k} \quad \text{and} \quad \mathbf{v} = a\mathbf{i} - 6\mathbf{j} + 2\mathbf{k}$$

where a is a constant.

(a) Determine, in terms of a , the vector product $\mathbf{u} \times \mathbf{v}$ (2)

Given that

- $\overrightarrow{AB} = 2\mathbf{u}$
- $\overrightarrow{AC} = \mathbf{v}$
- the area of triangle ABC is 15

(b) determine the possible values of a . (4)

(Total 6 marks)

2.

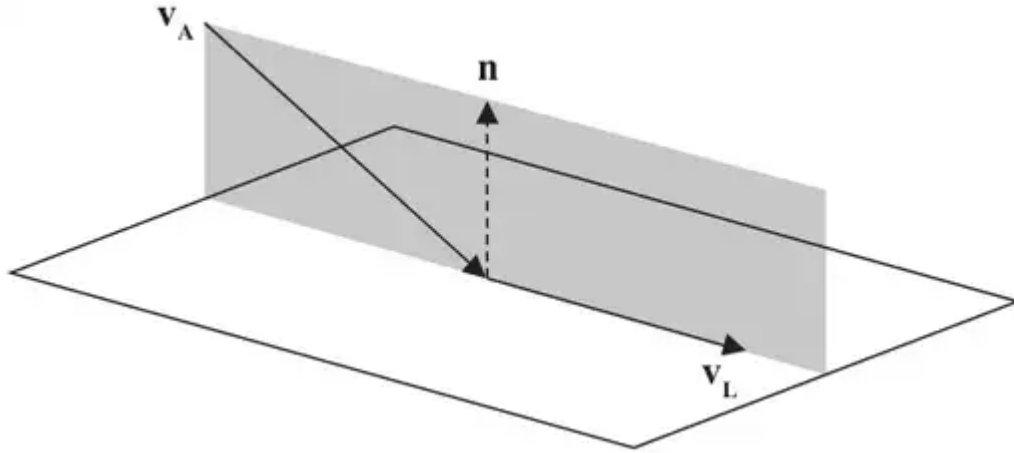


Figure 2

A small aircraft is landing in a field.

In a model for the landing the aircraft travels in different straight lines before and after it lands, as shown in Figure 2.

The vector $\mathbf{v}_A$ is in the direction of travel of the aircraft as it approaches the field.

The vector $\mathbf{v}_L$ is in the direction of travel of the aircraft after it lands.

With respect to a fixed origin, the field is modelled as the plane with equation

$$x - 2y + 25z = 0$$

and

$$\mathbf{v}_A = \begin{pmatrix} 3 \\ -2 \\ -1 \end{pmatrix}$$

(a) Write down a vector $\mathbf{n}$ that is a normal vector to the field. (1)

(b) Show that $\mathbf{n} \times \mathbf{v}_A = \lambda \begin{pmatrix} 13 \\ 19 \\ 1 \end{pmatrix}$, where λ is a constant to be determined. (2)

When the aircraft lands it remains in contact with the field and travels in the direction $\mathbf{v}_L$

The vector $\mathbf{v}_L$ is in the same plane as both $\mathbf{v}_A$ and $\mathbf{n}$ as shown in Figure 2.

(c) Determine a vector which has the same direction as $\mathbf{v}_L$ (3)

(d) State a limitation of the model. (1)

(Total 7 marks)

Edexcel A2 October 2021 Q4

3. The parallelogram P has vertices E, F, G and H , with coordinates

$$E(10, -1, -6) \quad F(7, -2, 7) \quad G(10, 2, 9) \quad H(13, 3, -4)$$

(a) Determine the exact area of P , giving your answer as a simplified surd. **(3)**

The line l passes through E and is perpendicular to the plane containing P

(b) Determine an equation for l giving your answer in the form $(\mathbf{r} - \mathbf{a}) \times \mathbf{b} = \mathbf{0}$ where $\mathbf{a}$ and $\mathbf{b}$ are constant vectors. **(2)**

Given that

- P is one face of a parallelepiped
 - the opposite face of the parallelepiped lies in the plane Π
 - the point $(25, -4, 13)$ lies in Π
- (c)** determine the volume of the parallelepiped. **(5)**

(Total 10 marks)

Edexcel A2 June 2025 Q9