

QQQ – Pure Year 1 – Chapter 11 – Vectors (Version 2)

Total Marks: 25

(25 = Platinum, 23 = Gold, 20 = Silver, 17 = Bronze)

1. [In this question the unit vectors $\mathbf{i}$ and $\mathbf{j}$ are due east and due north respectively.]

A stone slides horizontally across ice.

Initially the stone is at the point $A(-24\mathbf{i} - 10\mathbf{j})$ m relative to a fixed point O .

After 4 seconds the stone is at the point $B(12\mathbf{i} + 5\mathbf{j})$ m relative to the fixed point O .

The motion of the stone is modelled as that of a particle moving in a straight line at constant speed.

Using the model,

(a) prove that the stone passes through O , (2)

(b) calculate the speed of the stone. (3)

(Total 5 marks)

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2. The triangle PQR is such that $\overrightarrow{PQ} = 3\mathbf{i} + 5\mathbf{j}$ and $\overrightarrow{PR} = 13\mathbf{i} - 15\mathbf{j}$

(a) Find $\overrightarrow{QR}$ (2)

(b) Hence find $|\overrightarrow{QR}|$ giving your answer as a simplified surd. (2)

The point S lies on the line segment QR so that $QS : SR = 3 : 2$

(c) Find $\overrightarrow{PS}$ (2)

(Total 6 marks)

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3.

(a) Simplify $2 \begin{pmatrix} 6 \\ -3 \end{pmatrix} - 3 \begin{pmatrix} -1 \\ 2 \end{pmatrix}$. [2]

(b) The vector $\mathbf{a}$ is defined by $\mathbf{a} = r \begin{pmatrix} 6 \\ -3 \end{pmatrix} + s \begin{pmatrix} -1 \\ 2 \end{pmatrix}$, where r and s are constants.

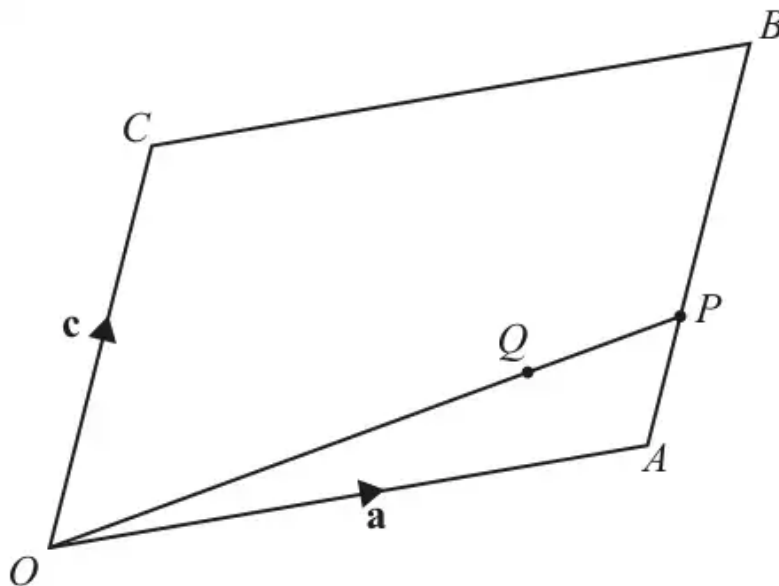
Determine two pairs of values of r and s such that $\mathbf{a}$ is parallel to the y -axis and $|\mathbf{a}| = 3$.

[5]

(Total 7 marks)

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4. In this question you must show detailed reasoning.



The diagram shows a parallelogram $OABC$. The position vectors of A and C are $\mathbf{a}$ and $\mathbf{c}$ respectively.

- The point P lies on AB such that $AP = \frac{1}{3}AB$.
- The point Q lies on OP such that $OQ = \frac{3}{4}OP$.

(a) Show that $\overrightarrow{OQ} = \frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{c}$. [4]

(b) Hence show that Q lies on AC . [3]

(Total 7 marks)

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