



Topic Exam

Vectors

Video Solutions to this exam can be found at:

www.revisionvillage.com/vectors-exam

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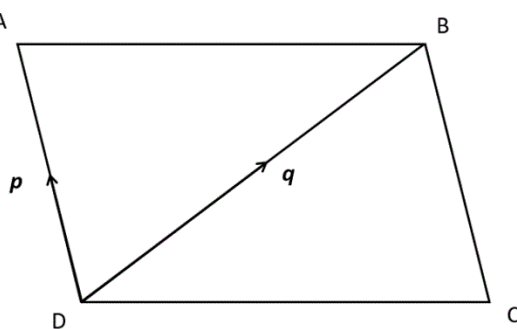
Topic Exam – Vectors

Question 1

[Maximum mark: 7]



The following diagram shows the parallelogram ABCD.

Let $\overrightarrow{DA} = p$ and $\overrightarrow{DB} = q$. Find each of the following vectors in terms of p and q .

(a) \overrightarrow{BA} ; [2]

(b) \overrightarrow{BC} ; [2]

(c) \overrightarrow{CA} . [3]

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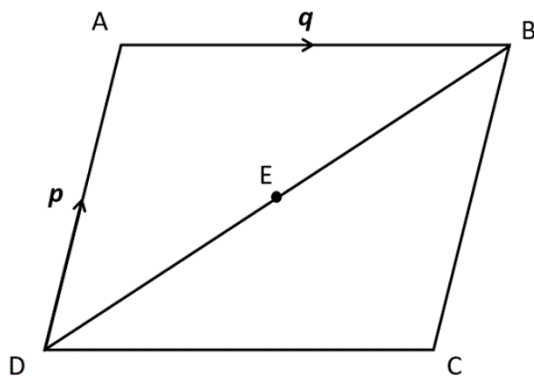
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Question 2

[Maximum mark: 7]



The following diagram shows the parallelogram ABCD.



Let $\overrightarrow{DA} = p$ and $\overrightarrow{AB} = q$. Find each of the following vectors in terms of p and q .

- (a) \overrightarrow{AC} ; [2]
- (b) \overrightarrow{DE} ; [2]
- (c) \overrightarrow{AE} . [3]

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Question 3

[Maximum mark: 8]

Let $\mathbf{u} = 6\mathbf{i} - 2\mathbf{j} - \mathbf{k}$ and $\mathbf{v} = 3\mathbf{i} + 5\mathbf{j} + 3\mathbf{k}$.

(a) Find

(i) $\mathbf{u} + \mathbf{v}$;

(ii) $|\mathbf{u}|$;

(iii) $|\mathbf{v}|$.

[4]

(b) Find $\mathbf{u} \cdot \mathbf{v}$.

[2]

(c) Find the angle between \mathbf{u} and \mathbf{v} .

[2]

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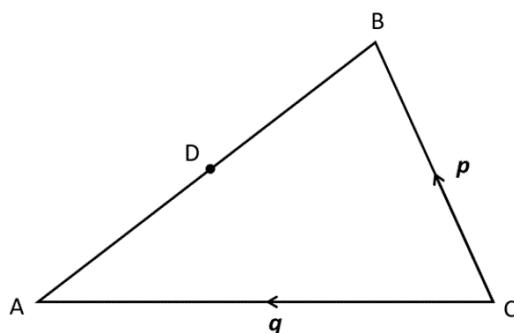
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Question 4

[Maximum mark: 6]



In the following diagram, $\overrightarrow{CB} = p$, $\overrightarrow{CA} = q$ and $\overrightarrow{AD} = \frac{1}{2}\overrightarrow{AB}$



Express each of the following vectors in terms of p and q .

(a) \overrightarrow{AB} ; [2]

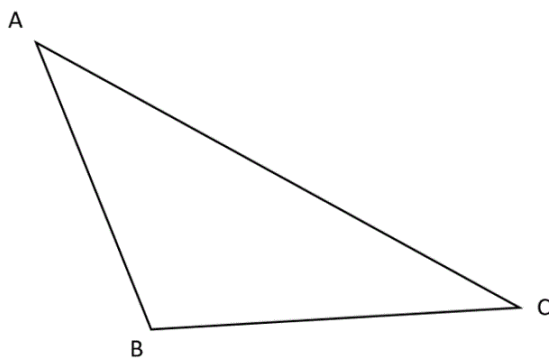
(b) \overrightarrow{CD} ; [4]

Question 5

[Maximum mark: 6]



The following diagram shows triangle ABC.

Let $\overrightarrow{BA} \cdot \overrightarrow{BC} = -6$ and $|\overrightarrow{BA}| |\overrightarrow{BC}| = 12$. Find the area of triangle ABC.

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Question 6

[Maximum mark: 6]



Let $\mathbf{u} = 3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and $\mathbf{v} = 4\mathbf{i} - 5\mathbf{j} + 6\mathbf{k}$. The vector $\mathbf{v} - p\mathbf{u}$ is perpendicular to \mathbf{u} .

Find the value of p .

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Question 7

[Maximum mark: 7]



Let $\mathbf{u} = \begin{bmatrix} 2 \\ -1 \\ 5 \end{bmatrix}$ and $\mathbf{v} = \begin{bmatrix} m \\ n \\ 0 \end{bmatrix}$. Given that \mathbf{v} is a unit vector perpendicular to \mathbf{u} , find the possible values for m and of n .

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Question 8

[Maximum mark: 15]



A line L_1 passes through A (-2, 0, 1) and B (1, 4, 1).

(a) Show that $\overrightarrow{AB} = \begin{bmatrix} 3 \\ 4 \\ 0 \end{bmatrix}$. [2]

(b) Hence, write down

(i) a direction vector for L_1 ;

(ii) a vector equation for L_1 in the form $\mathbf{r} = \mathbf{a} + t\mathbf{b}$. [3]

Another line L_2 has an equation $\mathbf{r} = \begin{bmatrix} 4 \\ 2 \\ -3 \end{bmatrix} + s \begin{bmatrix} k \\ -3 \\ 1 \end{bmatrix}$. L_1 and L_2 are perpendicular.

(c) Find the value of k . [4]

(d) Show that point C (-4, 8, -5) lies on L_2 . [3]

(e) Let D be the point such that ABCD is a parallelogram. Find \overrightarrow{OD} . [3]

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Question 9

[Maximum mark: 15]



The line L_1 has equation $\mathbf{r} = \begin{bmatrix} 4 \\ -1 \\ 0 \end{bmatrix} + t \begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix}$, and point A has coordinates (4, 8, -3).

- (a) Find the coordinates of point B on L_1 , such that \overrightarrow{AB} is perpendicular to L_1 . [8]
- (b) Hence, find the shortest distance from A to L_1 . [3]
- (c) Find the coordinates of the reflection of the point A in L_1 . [4]

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Question 10

[Maximum mark: 15]



Consider the points A (3, 2, -5) and B (-3, 6, -5).

- (a) Find \overrightarrow{AB} . [2]

Let C be a point such that $\overrightarrow{AC} = \begin{bmatrix} 3 \\ 0 \\ 2 \end{bmatrix}$.

- (b) Find the coordinates of C. [2]

The line L passes through B and is parallel to \overrightarrow{AC} .

- (c) Write down a vector equation for L . [2]

- (d) Given that $|\overrightarrow{AB}| = k|\overrightarrow{AC}|$, find k . [3]

- (e) The point D lies on L such that $|\overrightarrow{AB}| = |\overrightarrow{BD}|$. Find the possible coordinates for D. [6]