

Vector

(Past Year Topical Questions 2012-2017)

Oct/Nov 2012 (12)

1.

It is given that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 21 \\ 2 \end{pmatrix}$.

(i) Find $|\mathbf{a} + \mathbf{b} + \mathbf{c}|$.

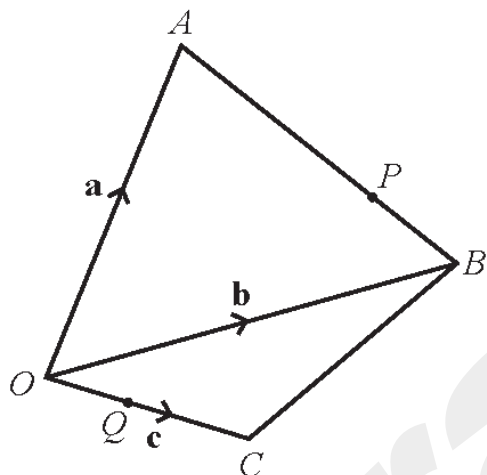
[2]

(ii) Find λ and μ such that $\lambda \mathbf{a} + \mu \mathbf{b} = \mathbf{c}$.

[3]

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9.



The figure shows points A , B and C with position vectors \mathbf{a} , \mathbf{b} and \mathbf{c} respectively, relative to an origin O . The point P lies on AB such that $AP:AB = 3:4$. The point Q lies on OC such that $OQ:QC = 2:3$.

(i) Express \overrightarrow{AP} in terms of \mathbf{a} and \mathbf{b} and hence show that $\overrightarrow{OP} = \frac{1}{4}(\mathbf{a} + 3\mathbf{b})$. [3]

(ii) Find \overrightarrow{PQ} in terms of \mathbf{a} , \mathbf{b} and \mathbf{c} . [3]

(iii) Given that $5\vec{PQ} = 6\vec{BC}$, find \mathbf{c} in terms of \mathbf{a} and \mathbf{b} . [2]

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2.

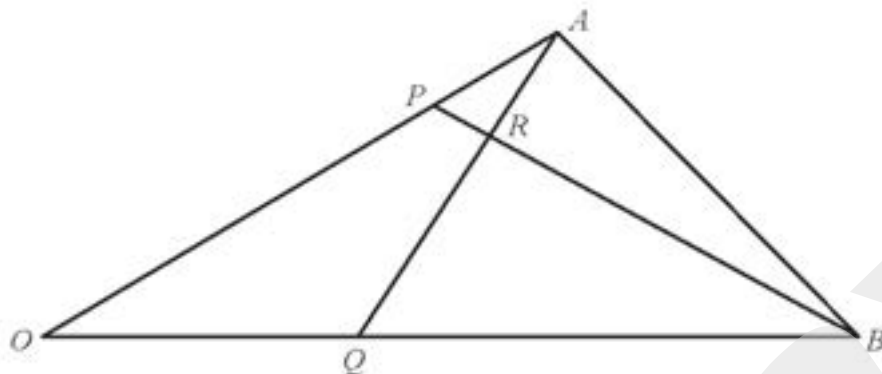
Vectors \mathbf{a} , \mathbf{b} and \mathbf{c} are such that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$.

(i) Show that $|\mathbf{a}| = |\mathbf{b} + \mathbf{c}|$. [2]

(ii) Given that $\lambda\mathbf{a} + \mu\mathbf{b} = 7\mathbf{c}$, find the value of λ and of μ . [3]

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12.



The position vectors of points A and B relative to an origin O are \mathbf{a} and \mathbf{b} respectively. The point P is such that $\overrightarrow{OP} = \mu\overrightarrow{OA}$. The point Q is such that $\overrightarrow{OQ} = \lambda\overrightarrow{OB}$. The lines AQ and BP intersect at the point R .

(i) Express \overrightarrow{AQ} in terms of λ , \mathbf{a} and \mathbf{b} . [1]

(ii) Express \overrightarrow{BP} in terms of μ , \mathbf{a} and \mathbf{b} . [1]

It is given that $3\overrightarrow{AR} = \overrightarrow{AQ}$ and $8\overrightarrow{BR} = 7\overrightarrow{BP}$.

(iii) Express \overrightarrow{OR} in terms of λ , \mathbf{a} and \mathbf{b} . [2]

(iv) Express \vec{OR} in terms of μ , \mathbf{a} and \mathbf{b} .

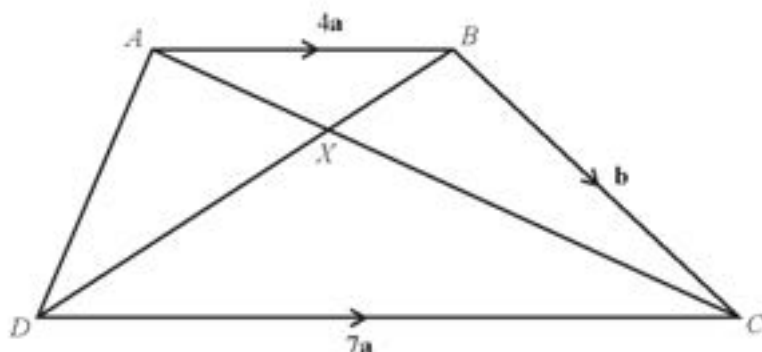
[2]

(v) Hence find the value of μ and of λ .

[3]

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7.



In the diagram $\vec{AB} = 4\mathbf{a}$, $\vec{BC} = \mathbf{b}$ and $\vec{DC} = 7\mathbf{a}$. The lines AC and DB intersect at the point X. Find, in terms of \mathbf{a} and \mathbf{b} ,

(i) \vec{DA} , [1]

(ii) \vec{DB} . [1]

Given that $\vec{AX} = \lambda\vec{AC}$, find, in terms of \mathbf{a} , \mathbf{b} and λ ,

(iii) \vec{AX} , [1]

(iv) \vec{DX} . [2]

Given that $\vec{DX} = \mu\vec{DB}$,

(v) find the value of λ and of μ . [4]

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3.

Vectors \mathbf{a} , \mathbf{b} and \mathbf{c} are such that $\mathbf{a} = \begin{pmatrix} 2 \\ y \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 5 \end{pmatrix}$.

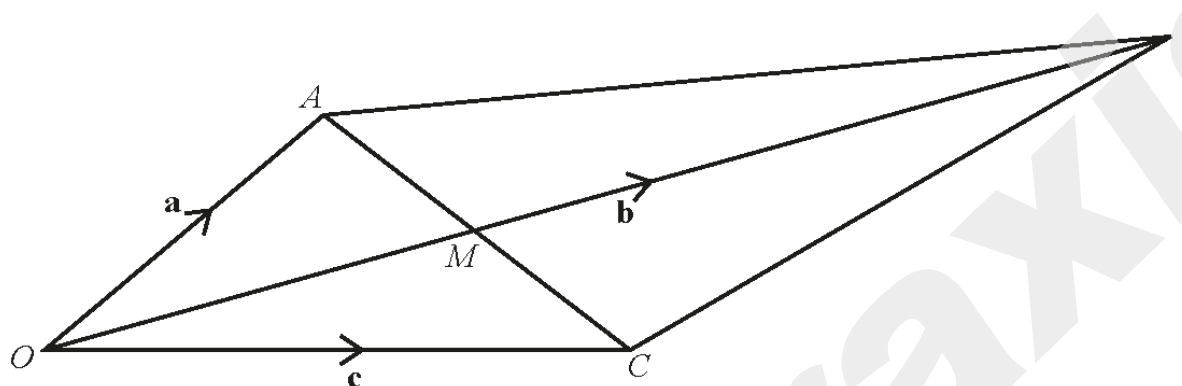
(i) Given that $|\mathbf{a}| = |\mathbf{b} - \mathbf{c}|$, find the possible values of y . [3]

(ii) Given that $\mu(\mathbf{b} + \mathbf{c}) + 4(\mathbf{b} - \mathbf{c}) = \lambda(2\mathbf{b} - \mathbf{c})$, find the value of μ and of λ . [3]

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5.

(a)



The diagram shows a figure $OACB$, where $\vec{OA} = \mathbf{a}$, $\vec{OB} = \mathbf{b}$ and $\vec{OC} = \mathbf{c}$. The lines AC and OB intersect at the point M where M is the midpoint of the line AC .

(i) Find, in terms of \mathbf{a} and \mathbf{c} , the vector \vec{OM} . [2]

(ii) Given that $OM:MB = 2:3$, find \mathbf{b} in terms of \mathbf{a} and \mathbf{c} . [2]

(b) Vectors \mathbf{i} and \mathbf{j} are unit vectors parallel to the x -axis and y -axis respectively.

The vector \mathbf{p} has a magnitude of 39 units and has the same direction as $-10\mathbf{i} + 24\mathbf{j}$.

(i) Find \mathbf{p} in terms of \mathbf{i} and \mathbf{j} . [2]

(ii) Find the vector \mathbf{q} such that $2\mathbf{p} + \mathbf{q}$ is parallel to the positive y -axis and has a magnitude of 12 units. [3]

(iii) Hence show that $|\mathbf{q}| = k\sqrt{5}$, where k is an integer to be found. [2]

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3.

Vectors \mathbf{i} and \mathbf{j} are unit vectors parallel to the x -axis and y -axis respectively.

(a) The vector \mathbf{v} has a magnitude of $3\sqrt{5}$ units and has the same direction as $\mathbf{i} - 2\mathbf{j}$. Find \mathbf{v} giving your answer in the form $a\mathbf{i} + b\mathbf{j}$, where a and b are integers. [2]

(b) The velocity vector \mathbf{w} makes an angle of 30° with the positive x -axis and is such that $|\mathbf{w}| = 2$. Find \mathbf{w} giving your answer in the form $\sqrt{c}\mathbf{i} + d\mathbf{j}$, where c and d are integers. [2]