



Edexcel - Pure Year 2 exam questions

Ch. 12: Vectors

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Ch. 12: Vectors

June 2022 Question 13 Paper 2

13. Relative to a fixed origin O

- the point A has position vector $4\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}$
- the point B has position vector $4\mathbf{j} + 6\mathbf{k}$
- the point C has position vector $-16\mathbf{i} + p\mathbf{j} + 10\mathbf{k}$

where p is a constant.

Given that A , B and C lie on a straight line,

(a) find the value of p .

(3)

The line segment OB is extended to a point D so that \vec{CD} is parallel to \vec{OA}

(b) Find $|\vec{OD}|$, writing your answer as a fully simplified surd.

(3)

ANSWER

Question	Scheme	Marks	AOs
13(a)	Attempts two of the relevant vectors $\pm \overline{AB} = \pm(-4\mathbf{i} + 7\mathbf{j} + \mathbf{k})$ $\pm \overline{AC} = \pm(-20\mathbf{i} + (p+3)\mathbf{j} + 5\mathbf{k})$ $\pm \overline{BC} = \pm(-16\mathbf{i} + (p-4)\mathbf{j} + 4\mathbf{k})$	M1	3.1a
	Uses two of the three vectors in such a way as to find the value of p . E.g. $p+3 = 5 \times 7$	dM1	2.1
	$p = 32$	A1	1.1b
		(3)	
(b)	Deduces that $\overline{OD} = \lambda \overline{OB} = 4\lambda \mathbf{j} + 6\lambda \mathbf{k}$ and attempts $\overline{CD} = 16\mathbf{i} + (4\lambda - 32)\mathbf{j} + (6\lambda - 10)\mathbf{k}$	M1	3.1a
	Correct attempt at λ using the fact that \overline{CD} is parallel to \overline{OA} $\overline{CD} = 16\mathbf{i} + (4\lambda - 32)\mathbf{j} + (6\lambda - 10)\mathbf{k}$ $\overline{OA} = 4\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}$ $4\lambda - 32 = -12 \Rightarrow \lambda = \dots \quad \text{OR} \quad 6\lambda - 10 = 20 \Rightarrow \lambda = \dots$	dM1	1.1b
	$ \overline{OD} = 5 \times \sqrt{4^2 + 6^2} = 10\sqrt{13}$	A1	1.1b
		(3)	

Video solution:

<https://youtu.be/8uADn2CLsVs>

June 2022 Question 9 Paper 1

9.

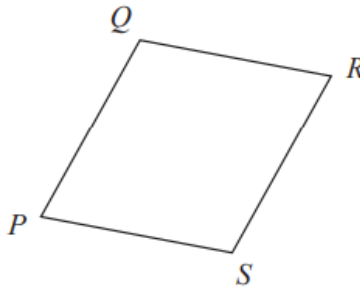


Figure 3

Figure 3 shows a sketch of a parallelogram $PQRS$.

Given that

- $\vec{PQ} = 2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$
- $\vec{QR} = 5\mathbf{i} - 2\mathbf{k}$

(a) show that parallelogram $PQRS$ is a rhombus.

(2)

(b) Find the exact area of the rhombus $PQRS$.

(4)

ANSWER

Question	Scheme	Marks	AOs
9(a)	Attempts both $ \overline{PQ} = \sqrt{2^2 + 3^2 + (-4)^2}$ and $ \overline{QR} = \sqrt{5^2 + (-2)^2}$	M1	3.1a
	States that $ \overline{PQ} = \overline{QR} = \sqrt{29}$ so $PQRS$ is a rhombus	A1	2.4
		(2)	
(b)	Attempts BOTH $\overline{PR} = \overline{PQ} + \overline{QR} = 7\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$ AND $\overline{QS} = -\overline{PQ} + \overline{PS} = 3\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$	M1	3.1a
	Correct $\overline{PR} = 7\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$ and $\overline{QS} = 3\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$	A1	1.1b
	Correct method for area $PQRS$. E.g. $\frac{1}{2} \times \overline{PR} \times \overline{QS} $	dM1	2.1
	$= \sqrt{517}$	A1	1.1b
		(4)	
			(6 marks)

November 2021 Question 6 Paper 1

6.

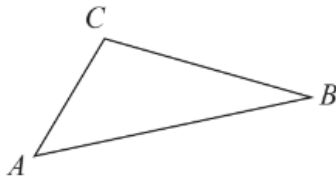


Figure 1

Figure 1 shows a sketch of triangle ABC .

Given that

- $\vec{AB} = -3\mathbf{i} - 4\mathbf{j} - 5\mathbf{k}$
- $\vec{BC} = \mathbf{i} + \mathbf{j} + 4\mathbf{k}$

(a) find \vec{AC}

(2)

(b) show that $\cos ABC = \frac{9}{10}$

(3)

ANSWER

Question	Scheme	Marks	AOs
6(a)	$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC} = -3\mathbf{i} - 4\mathbf{j} - 5\mathbf{k} + \mathbf{i} + \mathbf{j} + 4\mathbf{k} = \dots$	M1	1.1b
	$= -2\mathbf{i} - 3\mathbf{j} - \mathbf{k}$	A1	1.1b
		(2)	
(b)	At least 2 of $(AC^2) = 2^2 + 3^2 + 1^2, (AB^2) = 3^2 + 4^2 + 5^2, (BC^2) = 1^2 + 1^2 + 4^2$	M1	1.1b
	$2^2 + 3^2 + 1^2 = 3^2 + 4^2 + 5^2 + 1^2 + 1^2 + 4^2 - 2\sqrt{3^2 + 4^2 + 5^2}\sqrt{1^2 + 1^2 + 4^2} \cos ABC$	M1	3.1a
	$14 = 50 + 18 - 2\sqrt{50}\sqrt{18} \cos ABC$ $\Rightarrow \cos ABC = \frac{50 + 18 - 14}{2\sqrt{50}\sqrt{18}} = \frac{9}{10}^*$	A1*	2.1
		(3)	
	(b) Alternative		
	$AB^2 = 3^2 + 4^2 + 5^2, BC^2 = 1^2 + 1^2 + 4^2$	M1	1.1b
	$\overrightarrow{BA} \cdot \overrightarrow{BC} = (3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}) \cdot (\mathbf{i} + \mathbf{j} + 4\mathbf{k}) = 27 = \sqrt{3^2 + 4^2 + 5^2}\sqrt{1^2 + 1^2 + 4^2} \cos ABC$	M1	3.1a
	$27 = \sqrt{50}\sqrt{18} \cos ABC \Rightarrow \cos ABC = \frac{27}{\sqrt{50}\sqrt{18}} = \frac{9}{10}^*$	A1*	2.1
(5 marks)			

June 2018 Question 2 Paper 2

2. Relative to a fixed origin O ,

the point A has position vector $(2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k})$,

the point B has position vector $(4\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$,

and the point C has position vector $(a\mathbf{i} + 5\mathbf{j} - 2\mathbf{k})$, where a is a constant and $a < 0$

D is the point such that $\overrightarrow{AB} = \overrightarrow{BD}$.

(a) Find the position vector of D .

(2)

Given $|\overrightarrow{AC}| = 4$

(b) find the value of a .

(3)

ANSWER

Question	Scheme	Marks	AOs
2	$\vec{OA} = 2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$, $\vec{OB} = 4\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$, $\vec{OC} = a\mathbf{i} + 5\mathbf{j} - 2\mathbf{k}$, $a < 0$ $\vec{AB} = \vec{BD}$, $ \vec{AB} = 4$		
(a)	E.g. $\vec{OD} = \vec{OB} + \vec{BD} = \vec{OB} + \vec{AB}$ or $\vec{OD} = \vec{OB} + \vec{BD} = \vec{OB} + \vec{AB} = \vec{OB} + \vec{OB} - \vec{OA} = 2\vec{OB} - \vec{OA}$ or $\vec{OD} = \vec{OB} + \vec{BD} = \vec{OB} + \vec{AB} = \vec{OA} + \vec{AB} + \vec{AB} = \vec{OA} + 2\vec{AB}$		
	$= \begin{pmatrix} 4 \\ -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 4 \\ -2 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} \left\{ = \begin{pmatrix} 4 \\ -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 2 \\ -5 \\ 7 \end{pmatrix} \right\}$ or $= \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} + 2 \left(\begin{pmatrix} 4 \\ -2 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} \right) \left\{ = \begin{pmatrix} 2 \\ 3 \\ -4 \end{pmatrix} + 2 \begin{pmatrix} 2 \\ -5 \\ 7 \end{pmatrix} \right\}$	M1	3.1a
	$= \begin{pmatrix} 6 \\ -7 \\ 10 \end{pmatrix} \text{ or } 6\mathbf{i} - 7\mathbf{j} + 10\mathbf{k}$	A1	1.1b
		(2)	
(b)	$(a-2)^2 + (5-3)^2 + (-2--4)^2$	M1	1.1b
	$\{ \vec{AC} = 4 \Rightarrow\} (a-2)^2 + (5-3)^2 + (-2--4)^2 = (4)^2$ $\Rightarrow (a-2)^2 = 8 \Rightarrow a = \dots$ or $\Rightarrow a^2 - 4a - 4 = 0 \Rightarrow a = \dots$	dM1	2.1
	$(\text{as } a < 0 \Rightarrow) a = 2 - 2\sqrt{2}$ (or $a = 2 - \sqrt{8}$)	A1	1.1b
		(3)	
(5 marks)			