adamjee maths

A-LEVEL MATHS / EDEXCEL / FREE RESOURCES

Vectors

Question paper

10 questions

Exam questions and marking instructions remain credited to their board.

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10. Given that

- $\overrightarrow{PQ} = 2\mathbf{i} + 8\mathbf{j} - 2\mathbf{k}$
- $\overrightarrow{QR} = 6\mathbf{i} + 6\mathbf{k}$

(a) find $\overrightarrow{PR}$.

(2)

(b) Hence show that triangle PQR is both right-angled and isosceles.

(4)

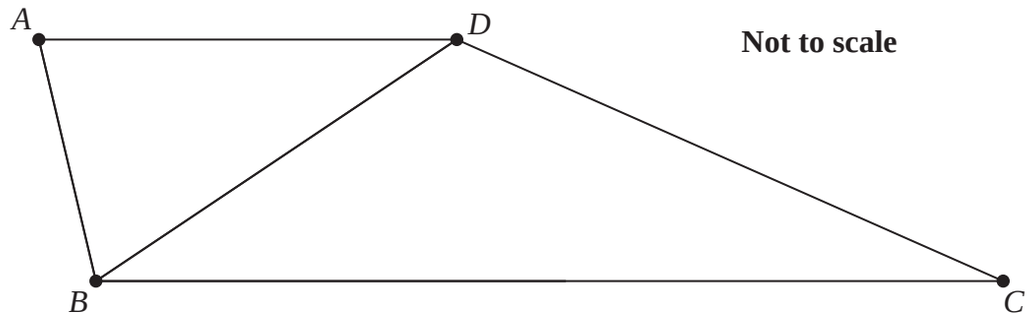
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Question 10 continued

(Total for Question 10 is 6 marks)

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14.



Not to scale

Figure 4

In this question you must show detailed reasoning.

Figure 4 shows a trapezium $ABCD$ where AD is parallel to BC

Given that

- $\overrightarrow{AB} = 2\mathbf{a} + 3\mathbf{b}$
- $\overrightarrow{BC} = 15\mathbf{a} - 5\mathbf{b}$
- $\overrightarrow{DB} = -4\mathbf{a} + k\mathbf{b}$ where k is an integer

(a) show that $k = 5$

(3)

Given also that

- the point N lies on BC such that $BN : NC = 1 : 4$
- AN intersects BD at X

(b) find $BX : XD$

(5)

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Question 14 continued

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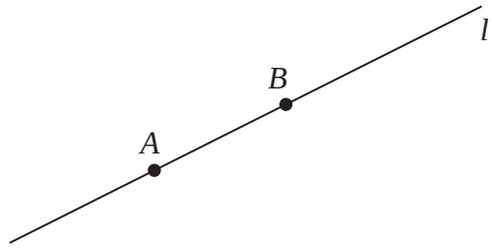


Figure 2

Figure 2 shows a sketch of the straight line l.

Line l passes through the points A and B.

Relative to a fixed origin O

- the point A has position vector $2\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}$
- the point B has position vector $5\mathbf{i} + 6\mathbf{j} + 8\mathbf{k}$

(a) Find $\overrightarrow{AB}$

(1)

Given that a point P lies on l such that

$$|\overrightarrow{AP}| = 2|\overrightarrow{BP}|$$

(b) find the possible position vectors of P.

(4)

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Question 7 continued

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3. Relative to a fixed origin O

- the point A has position vector $5\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$
- the point B has position vector $2\mathbf{i} + 4\mathbf{j} + a\mathbf{k}$

where a is a positive integer.

(a) Show that $|\overrightarrow{OA}| = \sqrt{38}$

(1)

(b) Find the smallest value of a for which

$$|\overrightarrow{OB}| > |\overrightarrow{OA}|$$

(2)

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Question 3 continued

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6. Relative to a fixed origin O,

- A is the point with position vector $12\mathbf{i}$
- B is the point with position vector $16\mathbf{j}$
- C is the point with position vector $(50\mathbf{i} + 136\mathbf{j})$
- D is the point with position vector $(22\mathbf{i} + 24\mathbf{j})$

(a) Show that AD is parallel to BC.

(2)

Points A, B, C and D are used to model the vertices of a running track in the shape of a quadrilateral.

Runners complete one lap by running along all four sides of the track.

The lengths of the sides are measured in metres.

Given that a particular runner takes exactly 5 minutes to complete 2 laps,

(b) calculate the average speed of this runner, giving the answer in kilometres per hour.

(4)

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Question 6 continued

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Question 6 continued

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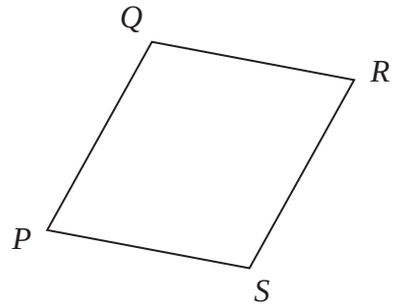


Figure 3

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

Given that

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

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

(2)

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

(4)

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Question 9 continued

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Question 9 continued

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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 $\overrightarrow{CD}$ is parallel to $\overrightarrow{OA}$

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

(3)

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Question 13 continued

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3. Relative to a fixed origin O

- point A has position vector $2\mathbf{i} + 5\mathbf{j} - 6\mathbf{k}$
- point B has position vector $3\mathbf{i} - 3\mathbf{j} - 4\mathbf{k}$
- point C has position vector $2\mathbf{i} - 16\mathbf{j} + 4\mathbf{k}$

(a) Find $\overrightarrow{AB}$

(2)

(b) Show that quadrilateral $OABC$ is a trapezium, giving reasons for your answer.

(2)

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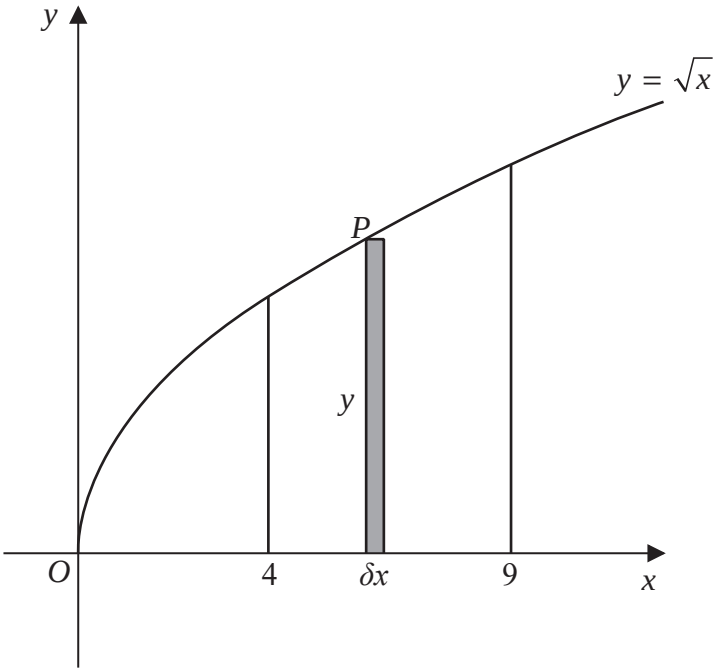


Figure 3

Figure 3 shows a sketch of the curve with equation $y = \sqrt{x}$

The point $P(x, y)$ lies on the curve.

The rectangle, shown shaded on Figure 3, has height y and width δx.

Calculate

$$\lim_{\delta x \to 0} \sum_{x=4}^{9} \sqrt{x}\, \delta x$$

(3)

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Question 5 continued

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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)

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Question 2 continued

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