

Instructions

- ## Information

- ## Advice

- Turn over** ►

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** The table shows information about 5 lakes in the Lake District.

Name	Surface area (m ²)	Volume (m ³)
Windermere	1.5×10^7	3.1×10^8
Ullswater	8.9×10^6	2.2×10^8
Thirlmere	3.3×10^6	5.0×10^7
Wastwater	2.9×10^6	1.1×10^8
Ennerdale Water	3.0×10^6	5.4×10^7

- (a) Write 3.3×10^6 as an ordinary number.

(1)

Elter Water is another lake and has a volume of 500 000 m³

- (b) Write 500 000 in standard form.

(1)

- (c) Calculate the difference, in standard form, between Windermere's surface area and Wastwater's surface area.

(2)

Volume of water in Windermere = $k \times$ volume of water in Thirlmere

- (d) Work out the value of k

(2)

The area of circle C is equal to the surface area of Ullswater.

- (e) Find, in metres to 2 significant figures, the radius of C

(2)

$x = 4 \times 10^{6n}$ where n is an integer.

- (f) Find, in standard form, an expression for x^{-2} in terms of n

(3)

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Question 1 continued

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(Total for Question 1 is 11 marks)



2

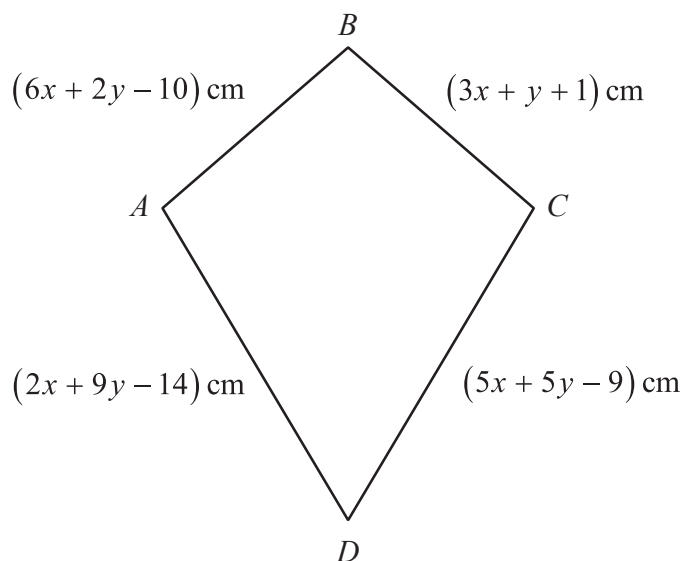


Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows a kite $ABCD$ where $AB = BC$

$$AB = (6x + 2y - 10) \text{ cm}$$

$$BC = (3x + y + 1) \text{ cm}$$

$$AD = (2x + 9y - 14) \text{ cm}$$

$$CD = (5x + 5y - 9) \text{ cm}$$

Calculate the length, in cm, of the perimeter of the kite.

(6)

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3 $\mathcal{E}$ is the universal set and A and B are two other sets.

$$\mathcal{E} = \{6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21\}$$

$$A = \{7, 8, 9, 10, 11, 12, 13, 14, 15\}$$

$$B = \{12, 13, 14, 15, 16, 17, 18, 19, 20\}$$

List the members of the set

(a) $A \cap B$ (1)

(b) $A' \cap B$ (1)

(c) $(A \cup B)'$ (2)

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(Total for Question 3 is 4 marks)



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$$x^{\frac{1}{3}} = 10x^{-\frac{1}{3}} - 3$$

Given that $y = x^{\frac{1}{3}}$

(a) show that $y^2 + 3y - 10 = 0$ (2)

(b) (i) Solve the equation $y^2 + 3y - 10 = 0$ (2)

(ii) Hence find the solutions to $x^{\frac{1}{3}} = 10x^{-\frac{1}{3}} - 3$ (2)

$$\left[\text{Solutions of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right]$$

(Total for Question 4 is 6 marks)



5 A solid square-based cuboid is made of steel.

The mass of the cuboid is 1500 grams, to the nearest 50 grams.

The length of the side of the square base of the cuboid is 12 cm, to 2 significant figures.

The density of the steel is 7.98 g/cm^3 , to 3 significant figures.

Given that

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

- (a) show that the lower bound of the height of the cuboid is 1.2 cm to one decimal place.
Show your working clearly.

(4)

Another solid square-based cuboid is made of wood.

The length of the side of the square base of this cuboid is 13 cm, to 2 significant figures.

The height of the cuboid is 2.4 cm, to one decimal place.

- (b) Find, in cm^2 to one decimal place, the lower bound of the surface area of the cuboid.
Show your working clearly.

(3)

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Question 5 continued

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(Total for Question 5 is 7 marks)



6 The table gives information about the time, in minutes, spent in a supermarket by 65 customers.

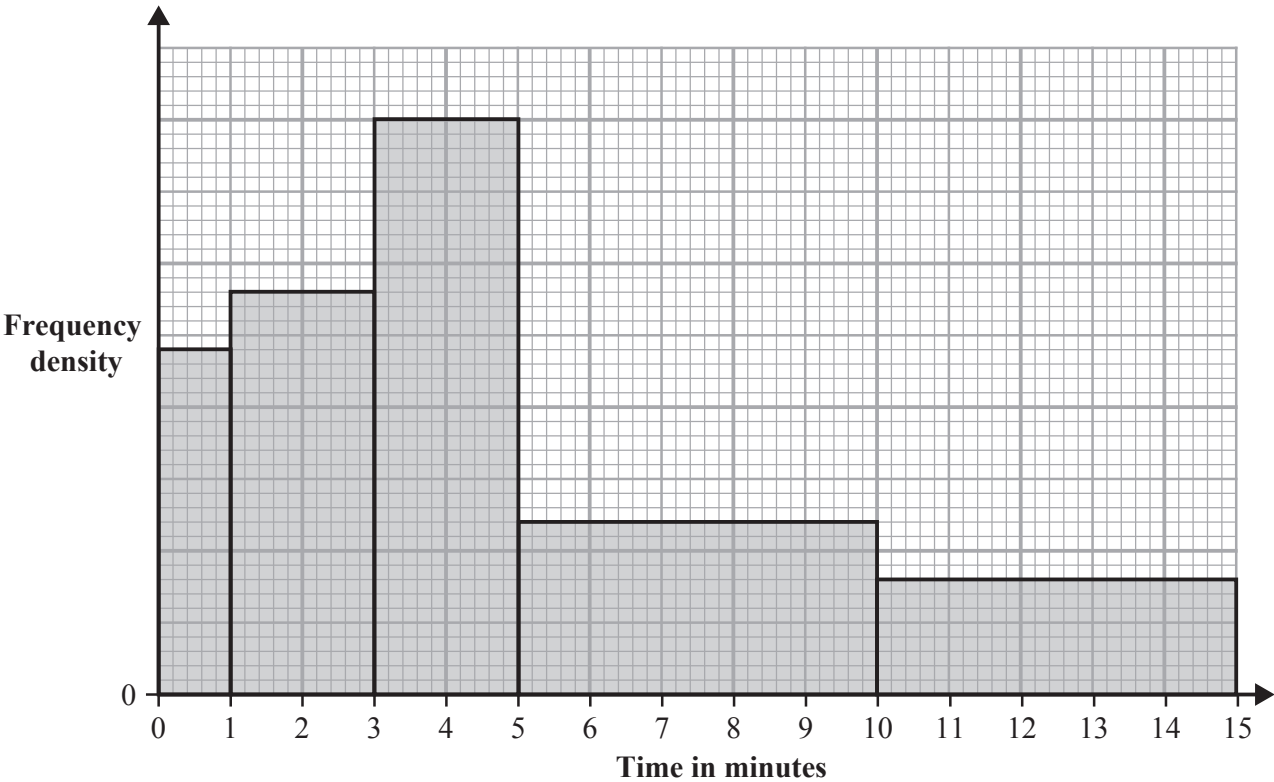
Time (t minutes)	Frequency
$0 < t \leq 15$	15
$15 < t \leq 25$	21
$25 < t \leq 30$	20
$30 < t \leq 40$	8
$40 < t \leq 60$	1

- (a) Write down the class interval that contains the median time. (1)
- (b) Calculate an estimate for the mean time spent by these 65 customers in the supermarket.
Give your answer to one decimal place. (4)

One of the 65 customers is chosen at random.

- (c) Calculate the probability that the customer spent more than 30 minutes in the supermarket. (1)

The histogram below shows information about the time, in minutes, spent in the checkout queue for each of these 65 customers.



There were 15 customers who spent between 5 and 10 minutes in the queue.

- (d) Calculate the number of these 65 customers who spent more than 3 minutes in the queue. (3)

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Question 6 continued

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(Total for Question 6 is 9 marks)



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(3)

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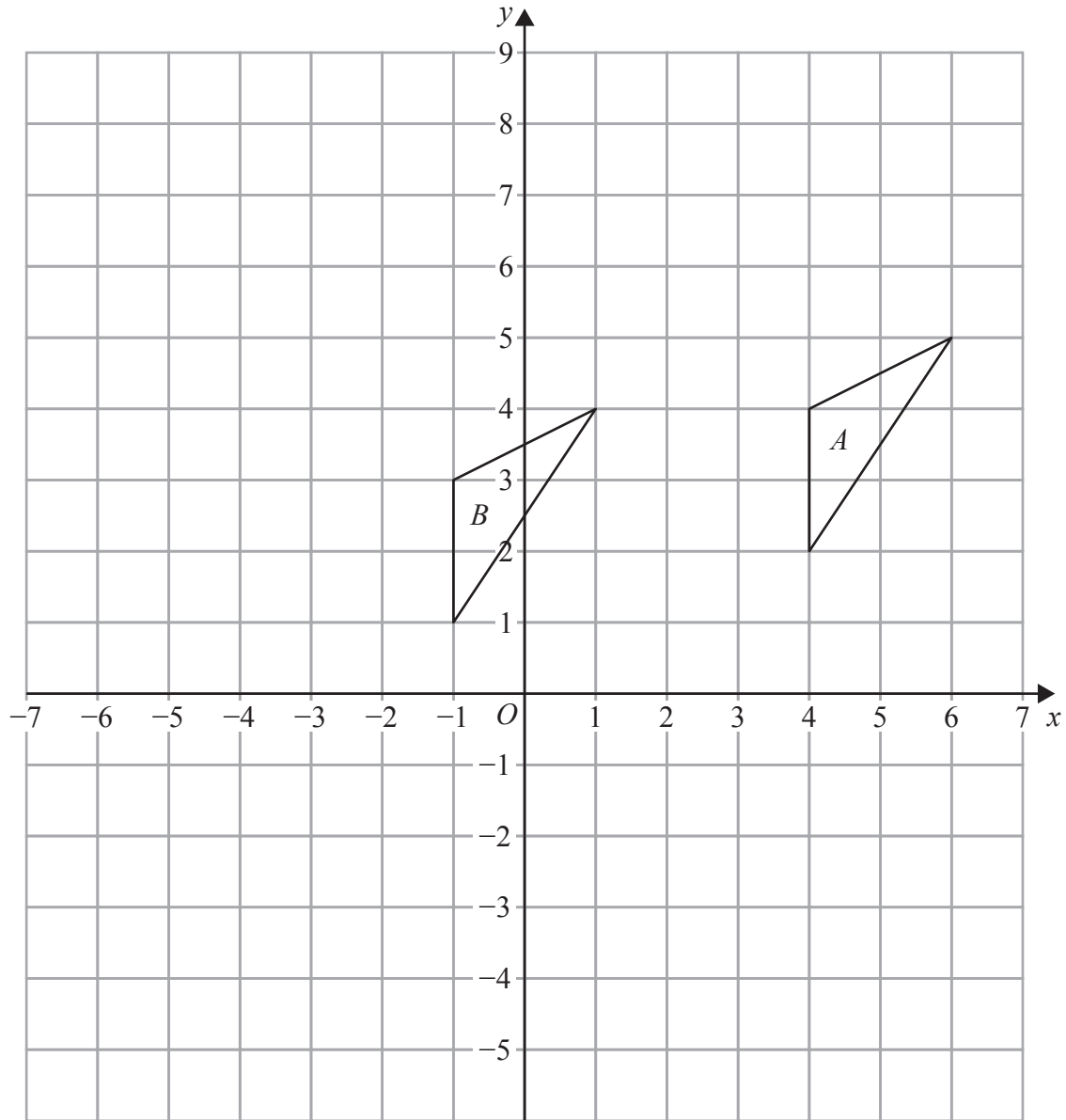
(1)

(5)

12



Question 7 continued



Turn over for a spare grid if you need to redraw your triangles.



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Question 7 continued

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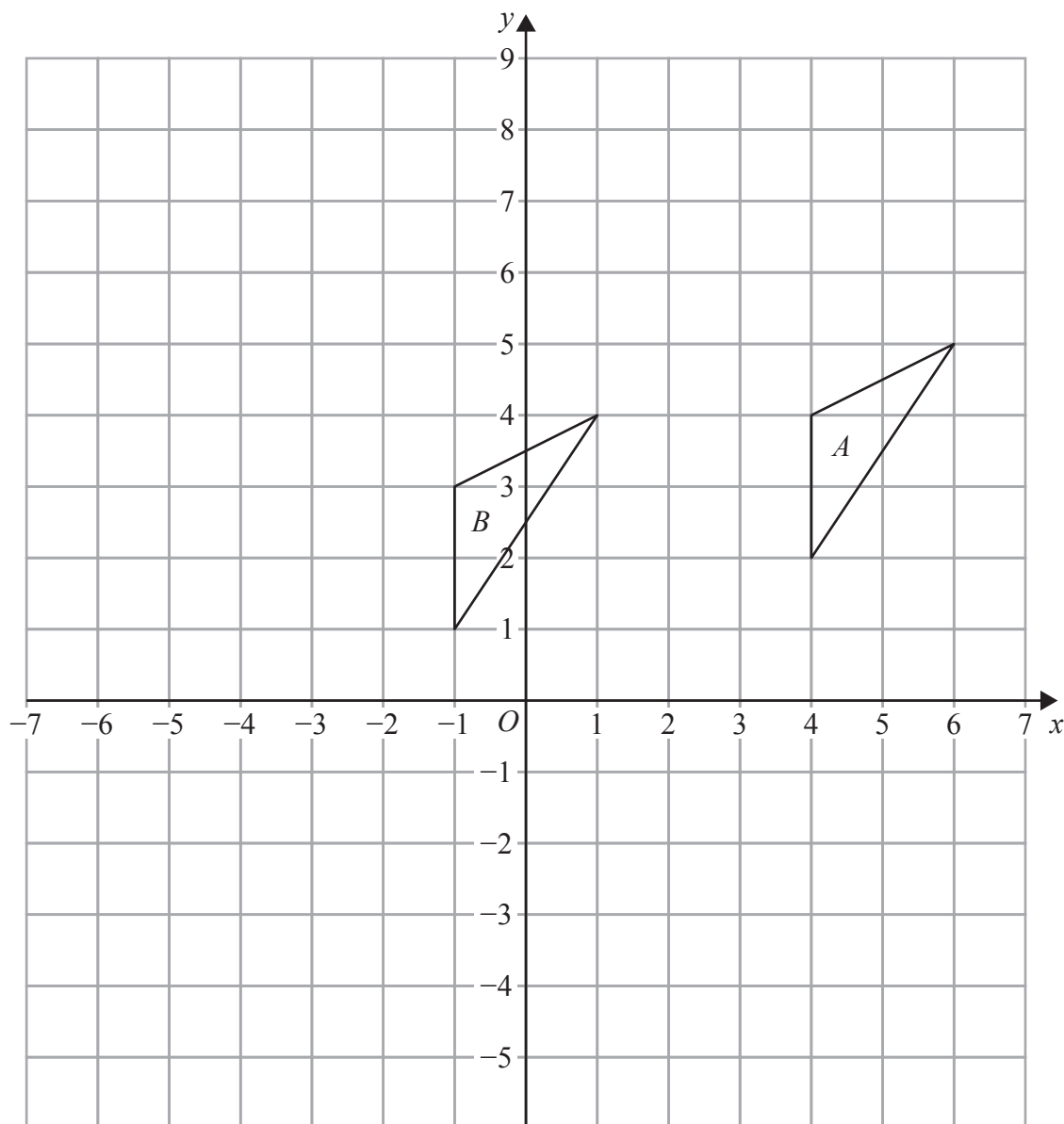
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Question 7 continued

Only use this grid if you need to redraw your triangles.



(Total for Question 7 is 11 marks)



- 8 (a) Complete the table of values for $y = x^2 - 4x - 4$

x	-2	-1	0	1	2	3	4	5
y	8		-4	-7		-7	-4	

(2)

- (b) On the grid opposite, plot the points from your completed table and join them to form a smooth curve.
- (c) By drawing a suitable straight line on your grid, find estimates to one decimal place, for the solutions of the equation $x^2 - 4x - 4 = -2x + 1$ in the range $-2 \leq x \leq 5$
- (d) By drawing a suitable straight line on your grid, find an estimate to the nearest whole number, of the gradient of the curve $y = x^2 - 4x - 4$ at the point where $x = -1$

(2)

(3)

(2)

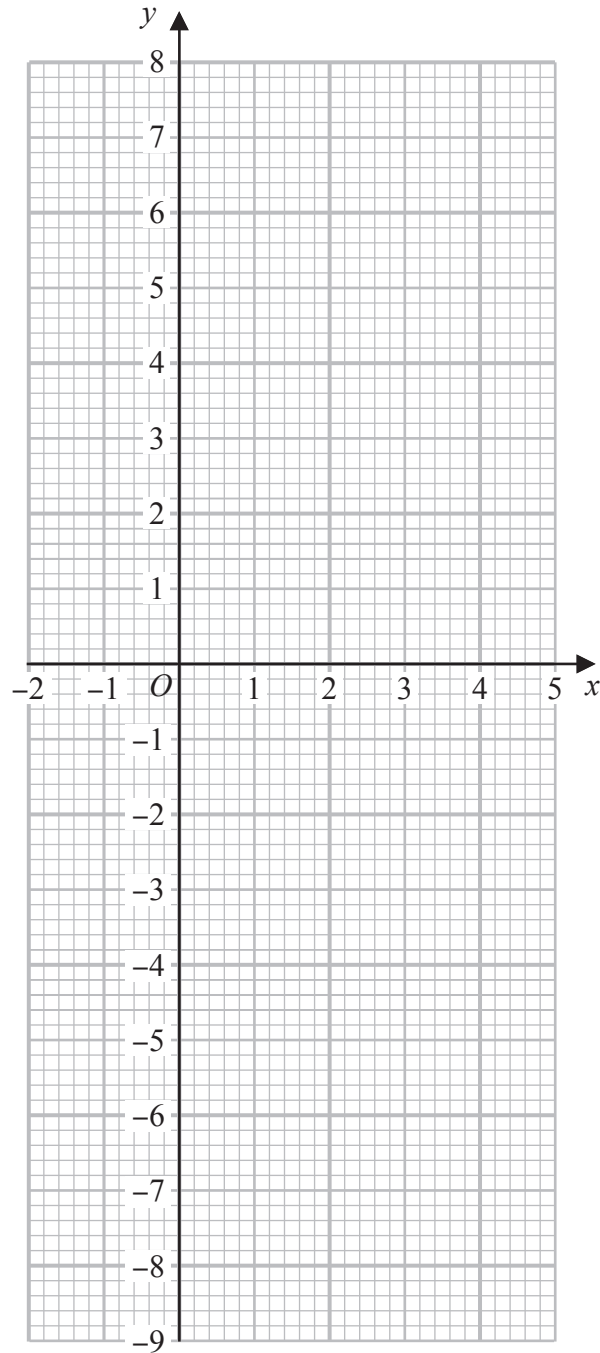
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Question 8 continued



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Question 8 continued

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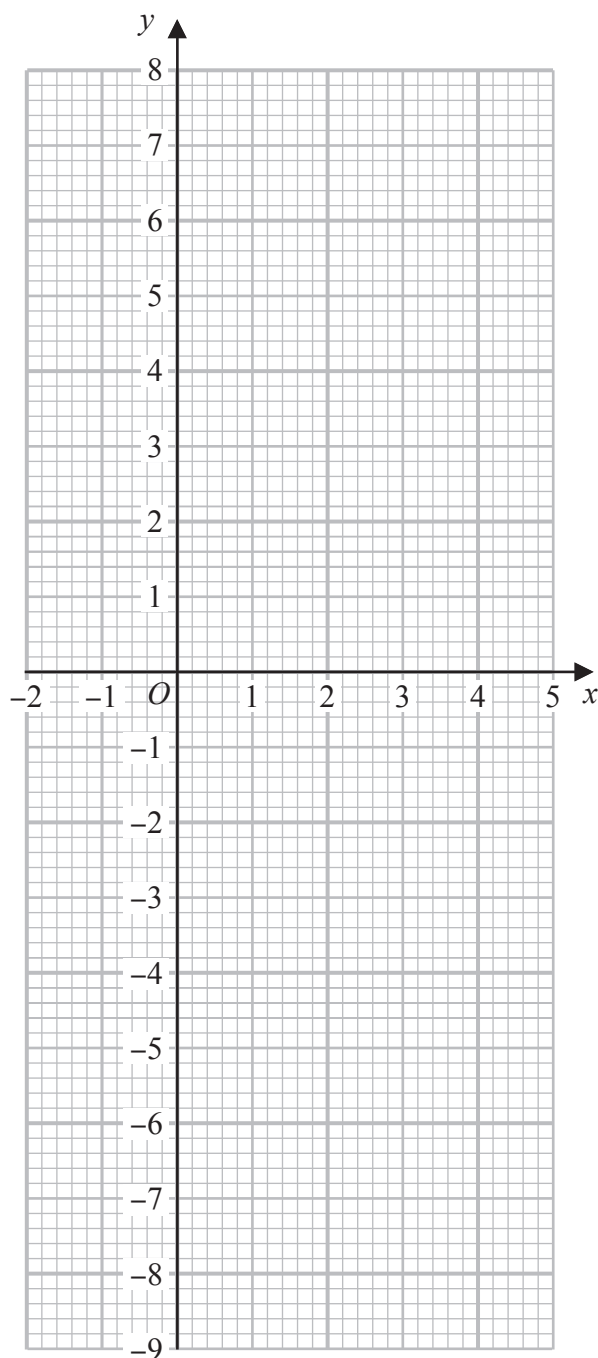
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Question 8 continued

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(Total for Question 8 is 9 marks)



9

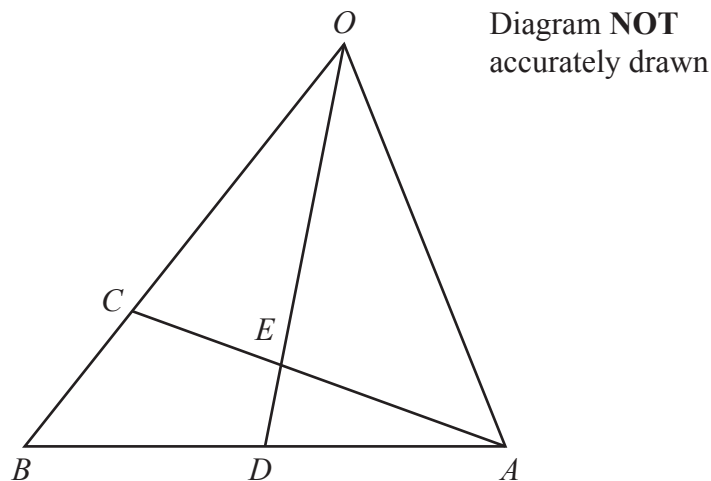


Figure 2

Figure 2 shows triangle OAB with $\vec{OA} = 4\mathbf{a}$ and $\vec{OB} = 3\mathbf{b}$

The point C lies on OB such that $\vec{OC} = 2\mathbf{b}$

The point D is the midpoint of AB

The point E lies on AC such that OED is a straight line.

(a) Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, simplifying your answer where possible,

$$(i) \vec{CA} \quad (ii) \vec{AB} \quad (iii) \vec{OD} \quad (4)$$

Given that $CE = \lambda CA$

(b) use a vector method to find the value of λ (4)

The point P is such that $\vec{OP} = \mu \vec{OD}$ where $\mu > 1$ and $\vec{AP}$ is parallel to $\vec{OB}$

Given that the area of triangle OCE is 8 cm^2

(c) find the area, in cm^2 , of triangle APE (4)

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Question 9 continued

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Question 9 continued

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Question 9 continued

Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 9 is 12 marks)



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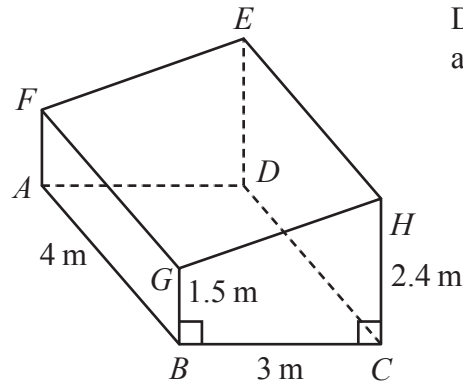
Diagram **NOT**
accurately drawn**Figure 3**

Figure 3 shows a solid right prism $ABCDEFGH$

The base of the prism, $ABCD$, is a rectangle and is horizontal.
Trapezium $BCHG$ is a cross section of the prism.

$$AB = 4 \text{ m} \quad BC = 3 \text{ m} \quad CH = 2.4 \text{ m} \quad GB = 1.5 \text{ m}$$

$$\angle GBC = \angle BCH = \angle ABG = \angle DCH = 90^\circ$$

- (a) Calculate the volume, in m^3 , of the prism. (2)
- (b) Calculate the angle of depression, in degrees to one decimal place, of G from E (3)
- (c) Calculate the length, in metres to 3 significant figures, of AH (2)
- The point P lies on the line GH such that $GP = \frac{2}{3}GH$
- The point Q lies on the line BC such that $BQ = \frac{2}{3}BC$
- (d) Calculate, in degrees to one decimal place, $\angle APQ$ (4)

$$\left[\text{Area of trapezium} = \frac{1}{2}(a + b)h \right]$$



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Question 10 continued

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Question 10 continued

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11 The function f is defined as $f : x \mapsto 2x^2 + 3x$

(a) Find $f(-2)$ (1)

(b) Find the value of x such that $\frac{df(x)}{dx} = 0$ (3)

The function g is defined as $g : x \mapsto 4 - \frac{x+7}{x+3}$

(c) State the value of x that must be excluded from any domain of the function g (1)

(d) Find $fg(5)$ (2)

The function h is such that

$$\text{gh}(x) = \frac{3x - 4}{x - 1} \quad x > 1$$

(e) Find $h(x)$ in its simplest form.
Show clear algebraic working.

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Question 11 continued

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TOTAL FOR PAPER IS 100 MARKS



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