

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

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Candidate Number

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Wednesday 13 January 2021

Afternoon (Time: 2 hours 30 minutes)

Paper Reference **4MB1/02R**

Mathematics B

Paper 2R



You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- **Calculators may be used.**

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Without sufficient working, correct answers may be awarded no marks.

Turn over ►

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Pearson

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 \mathcal{E} is the universal set and A , B and C are three sets such that

$$\mathcal{E} = \{\text{even numbers between 5 and 31}\}$$

$$A = \{\text{factors of 24}\}$$

$$B = \{8, 16\}$$

$$C = \{\text{multiples of 6}\}$$

The Venn diagram on the opposite page can be used to show these sets.

(a) Complete the Venn diagram for the sets \mathcal{E} , A , B and C

(3)

List the elements of the set

(b) $A \cap C$

(1)

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

(1)

Find

(d) $n([A \cup B]')$

(1)

(e) $n([A \cap B] \cup C)$

(1)

A number is selected at random from \mathcal{E}

(f) Find the probability that the number is in set B

(2)

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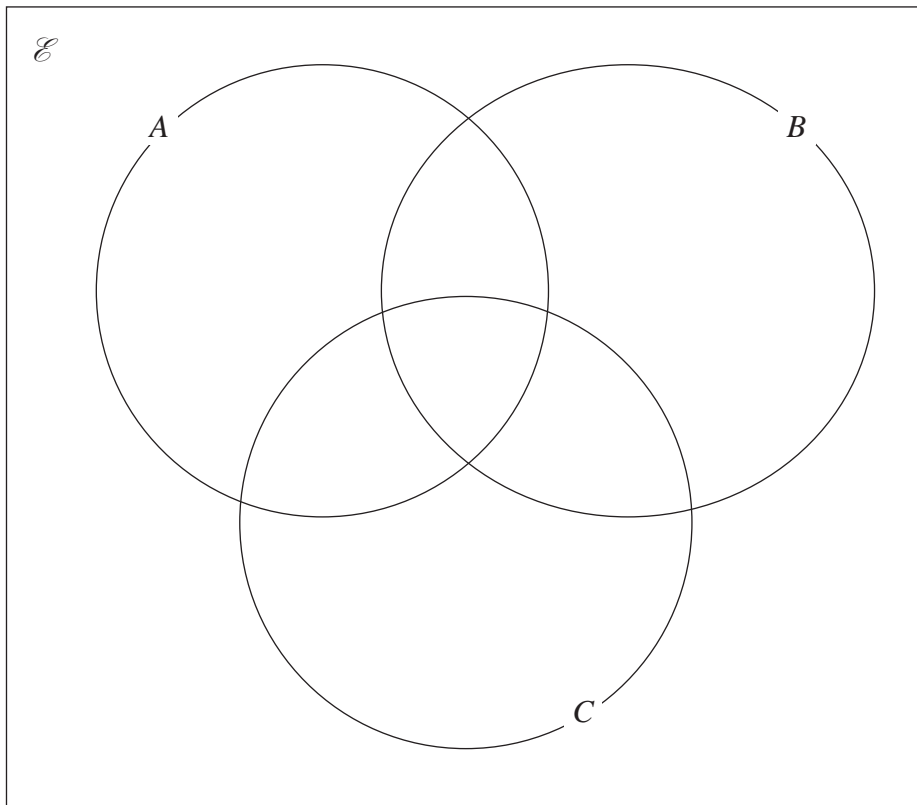
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Question 1 continued



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Handwriting practice area consisting of 15 horizontal dotted lines.

Turn over for a spare copy of the Venn diagram.



Question 1 continued

Area with horizontal dotted lines for writing.

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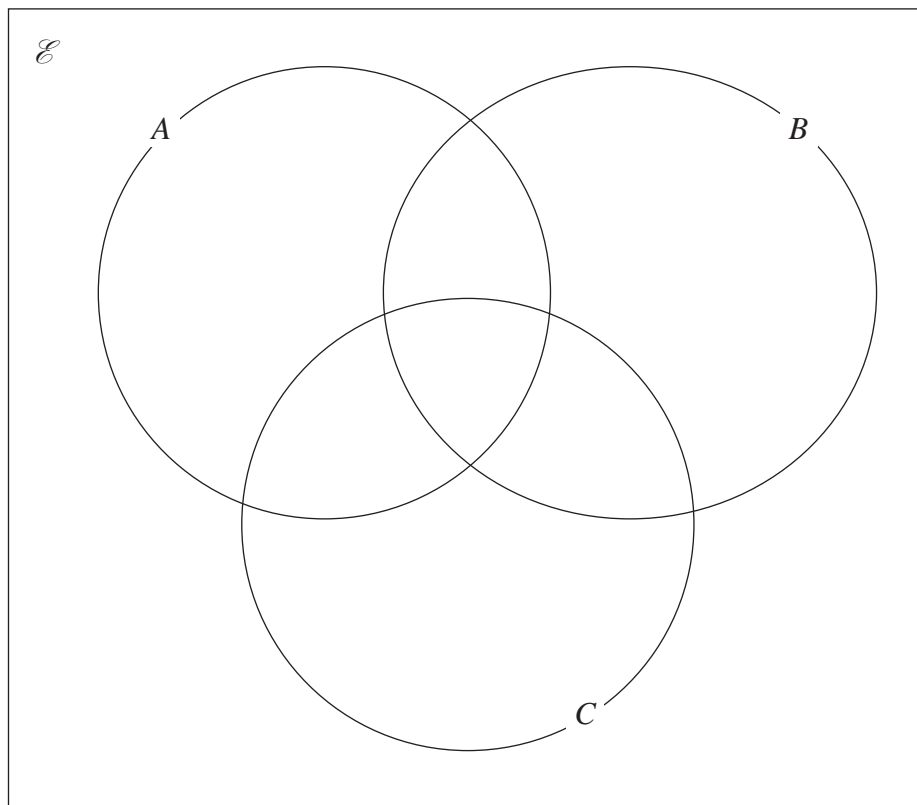
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Question 1 continued

Only use this Venn diagram if you wish to replace your answer to part (a)



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(Total for Question 1 is 9 marks)



Question 2 continued

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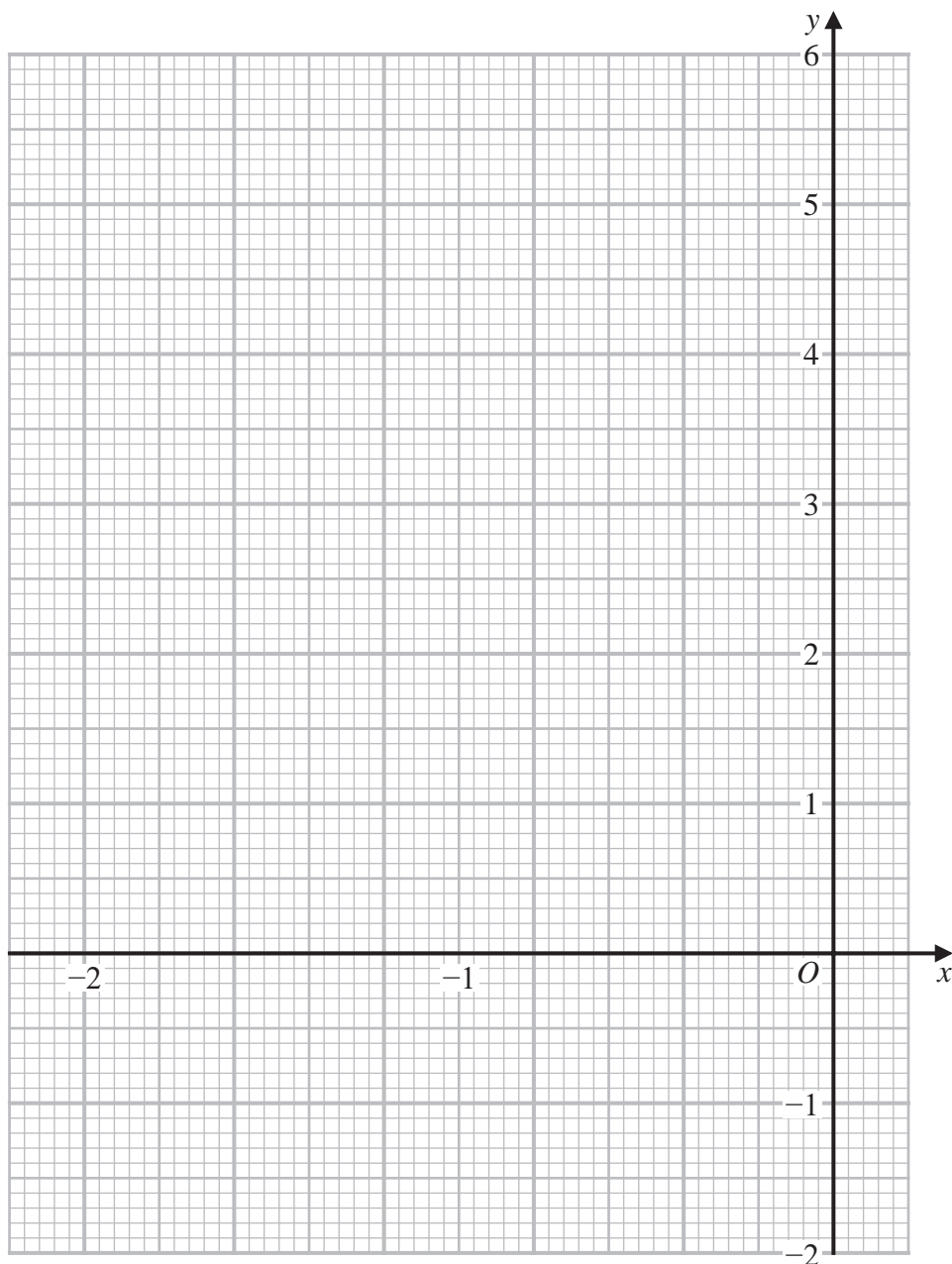
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(Total for Question 2 is 8 marks)



Question 3 continued



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



Question 3 continued

Area with horizontal dotted lines for writing.

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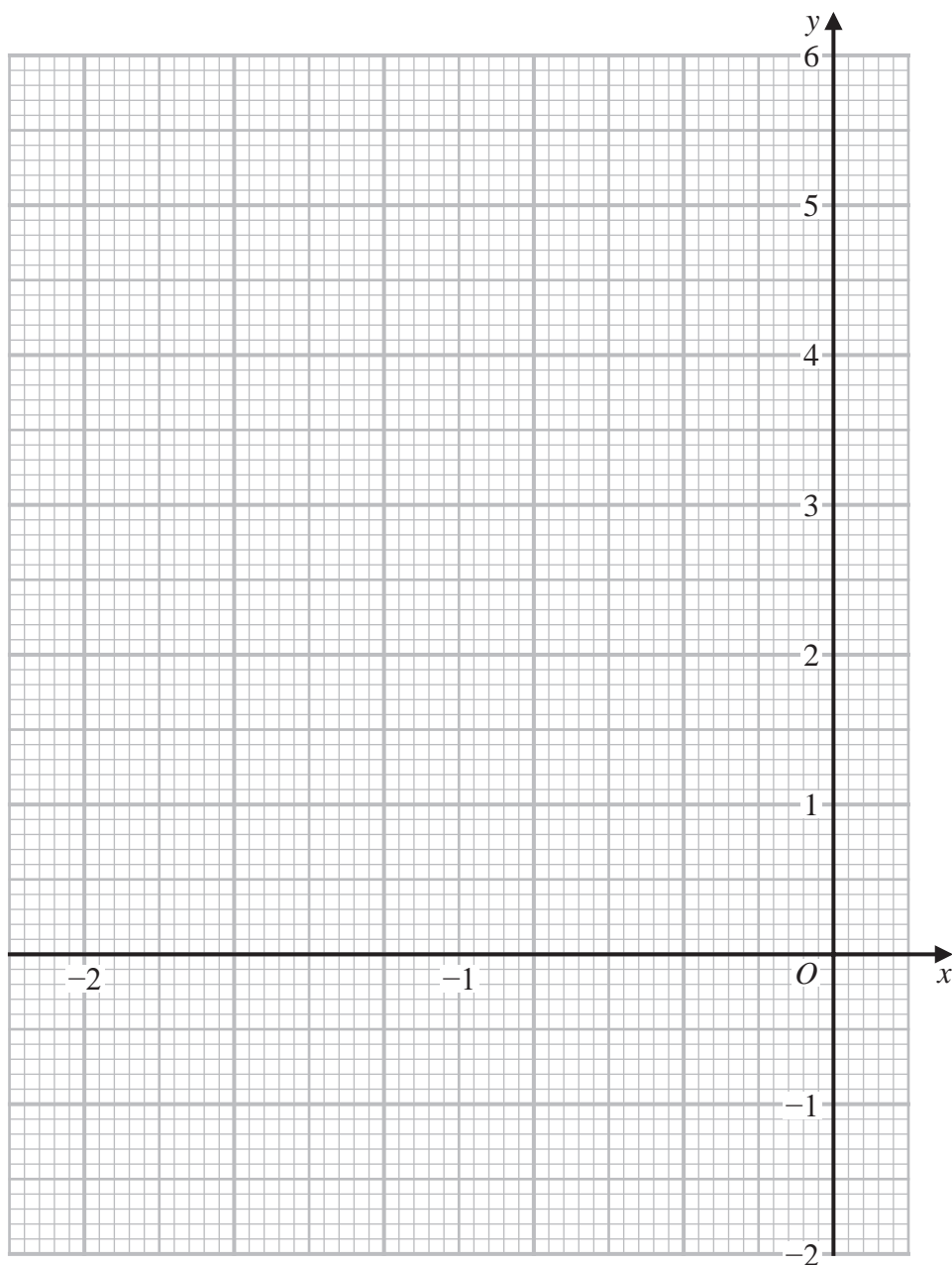
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Question 3 continued

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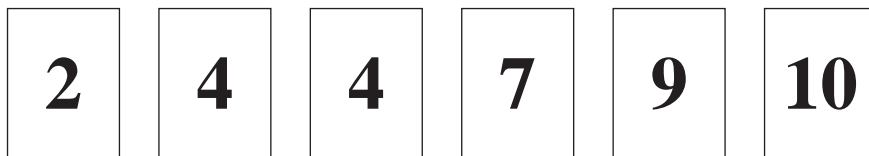
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(Total for Question 3 is 6 marks)



- 4 Ramesh, Maya, Kalil, Chen and Andreia each have a bag containing an identical set of six cards.

There is a number on each of the six cards.
Here are the cards in each of the bags.



Ramesh takes at random **one** of the six cards in his bag.

- (a) Write down the probability that the number on the card Ramesh takes is a prime number. (1)

Maya takes at random from her bag **two** of the six cards in her bag.

- (b) Find the probability that neither of the two cards has a number **4** on it. (2)

Kalil takes at random from his bag **two** of the six cards in his bag.

- (c) Find the probability that the total of the two numbers on the cards is 11 (2)

Chen takes at random **one** card at a time, without replacement, from her bag until she gets a card with a number **4** on it. She then stops taking cards from her bag.

- (d) Find the probability that Chen stops taking cards from her bag before she takes the fourth card. (2)

Andreia puts another card with a number on it into her bag so that she has seven cards in her bag.

The mean of the numbers on the seven cards in Andreia's bag is 8

- (e) Find the value of the number on the card that Andreia put into her bag. (2)

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Question 4 continued

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Question 4 continued

Area with horizontal dotted lines for writing.

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Question 4 continued

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(Total for Question 4 is 9 marks)



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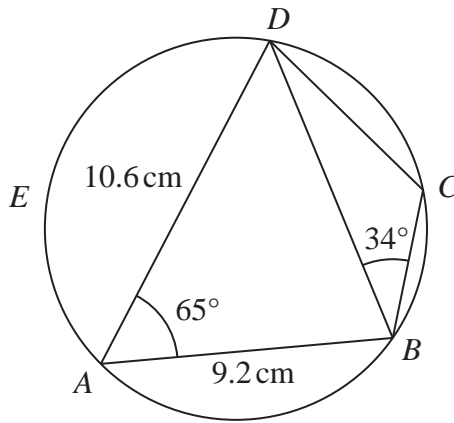


Diagram **NOT** accurately drawn

Figure 1

In Figure 1, $ABCDE$ is a circle.

$$AB = 9.2 \text{ cm} \quad AD = 10.6 \text{ cm} \quad \angle BAD = 65^\circ \quad \angle CBD = 34^\circ$$

- (a) Calculate the length, in cm to 3 significant figures, of BD . (2)
 - (b) Explain why $\angle BCD = 115^\circ$ (1)
 - (c) Calculate the length, in cm to 3 significant figures, of BC . (2)
- The point E is such that $\triangle BDE$ is isosceles, with $DE = BE$.
- (d) Calculate the area, in cm^2 to 3 significant figures, of the quadrilateral $BCDE$. (4)

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$$\left[\begin{array}{l} \text{Cosine rule } a^2 = b^2 + c^2 - 2bc \cos A \\ \text{Sine rule } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \\ \text{Area of triangle} = \frac{1}{2} ab \sin C \end{array} \right]$$

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Question 5 continued

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Question 5 continued

Area with horizontal dotted lines for writing.

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Question 5 continued

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(Total for Question 5 is 9 marks)



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6 The two functions, f and g , are defined for all values of x as

$$f : x \mapsto 3x + 1$$

$$g : x \mapsto x^2 - 2$$

(a) Find (i) $g(-3)$ (ii) $fg(1)$ (2)

(b) Write down the range of g (1)

(c) Express the composite function gf in the form $gf : x \mapsto \dots$ (1)

The function h is defined as

$$h : x \mapsto \frac{2x - 1}{x + 3} \quad \text{where } x \neq -3$$

(d) Solve the equation $h(x) = 1$ (2)

(e) (i) Express the inverse function h^{-1} in the form $h^{-1} : x \mapsto \dots$

(ii) Write down the value of x that must be excluded from the domain of h^{-1} (4)

(f) Find the exact values of p for which

$$4gf(p) = fh^{-1}(1)$$

Show your working clearly.

Give your values in the form $\frac{a \pm \sqrt{b}}{c}$ where a , b and c are integers.

(3)

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

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Question 6 continued

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Question 6 continued

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Question 6 continued

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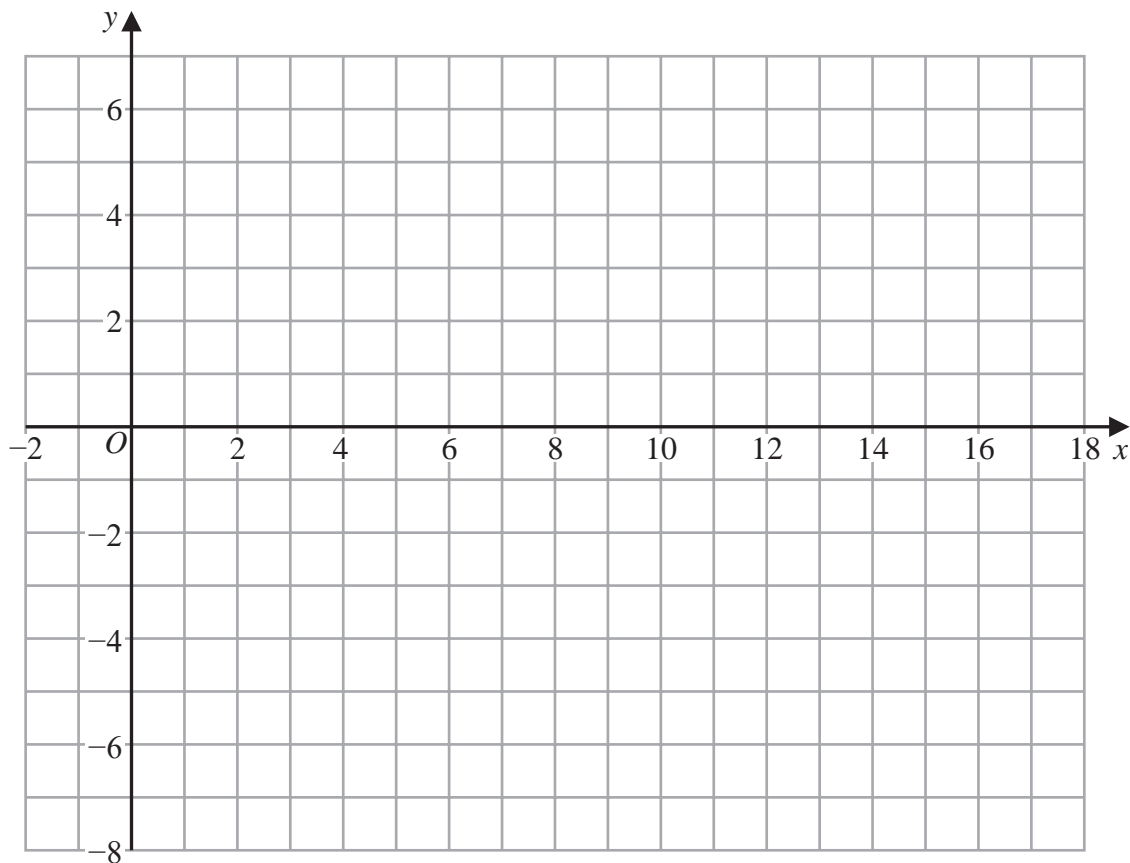
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(Total for Question 6 is 13 marks)



Question 7 continued



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



Question 7 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

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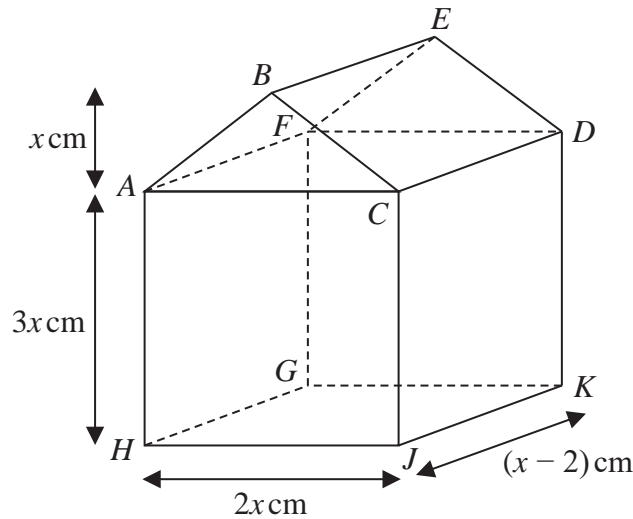


Figure 2

Figure 2 shows a solid right pentagonal prism $ABCDEFGHJK$ which is made by fixing a solid right triangular prism $ABCDEF$ onto a solid cuboid $ACDFGHJK$.

The triangle ABC is isosceles with $BA = BC$ and the height of the triangle is x cm.

- $AH = FG = CJ = DK = 3x$ cm
- $AC = HJ = FD = GK = 2x$ cm
- $HG = JK = AF = CD = (x - 2)$ cm

The volume of the pentagonal prism is 1008 cm^3

(a) Show that $x^3 - 2x^2 - 144 = 0$ (4)

Given that $f(x) = x^3 - 2x^2 - 144$

(b) use the factor theorem to show that $(x - 6)$ is a factor of $f(x)$ (2)

(c) (i) Find the value of p , the value of q and the value of r so that

$$f(x) = (x - 6)(px^2 + qx + r)$$

(ii) Hence explain why the equation $f(x) = 0$ has only one solution. (4)

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

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Question 8 continued

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Area with horizontal dotted lines for writing.



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Question 8 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

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Question 8 continued

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Area with horizontal dotted lines for writing.

(Total for Question 8 is 10 marks)



9 The equation of a curve C is $y = x(2x - 3)(x + 2)$

The point P lies on C

The x coordinate of P is a

Find the range of values of a for which the gradient of C at P is at least -2

Show clear algebraic working.

(7)

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Question 9 continued

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Area with horizontal dotted lines for writing.

(Total for Question 9 is 7 marks)



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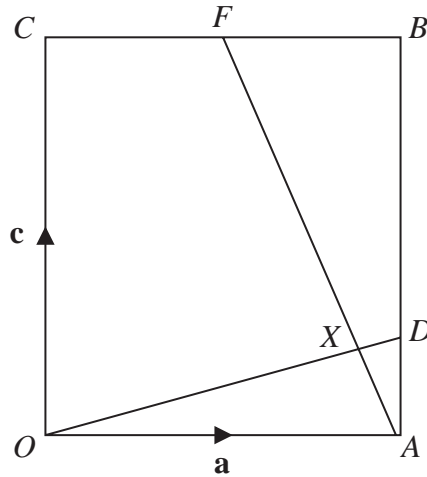


Diagram NOT accurately drawn

Figure 3

Figure 3 shows a rectangle $OABC$ in which $\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$

F is the midpoint of CB and D is the point on AB such that $AD:DB = 2:3$

(a) Find

- (i) \vec{CF} in terms of \mathbf{a}
- (ii) \vec{AD} in terms of \mathbf{c}

(2)

The lines OD and AF intersect at the point X

Given that $\vec{OX} = \lambda \vec{OD}$ and $\vec{AX} = \mu \vec{AF}$, where λ and μ are scalars,

(b) find the value of λ and the value of μ

(7)

Given that $OX:XD = n:1$

(c) find the value of n

(1)

Given also that $|\mathbf{a}| = 12 \text{ cm}$ and $|\mathbf{c}| = 12.5 \text{ cm}$,

(d) find the area, in cm^2 , of quadrilateral $XDBF$

(4)

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Question 10 continued

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Area with horizontal dotted lines for writing.



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Question 10 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

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Question 10 continued

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Area with horizontal dotted lines for writing.

(Total for Question 10 is 14 marks)



Question 11 continued

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Area with horizontal dotted lines for writing.



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