

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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**Tuesday 15 January 2019**

Morning (Time: 2 hours 30 minutes)

Paper Reference **4MB1/02**

**Mathematics B**

**Paper 2**



**You must have:** Ruler graduated in centimetres and millimetres, protractor, 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 TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

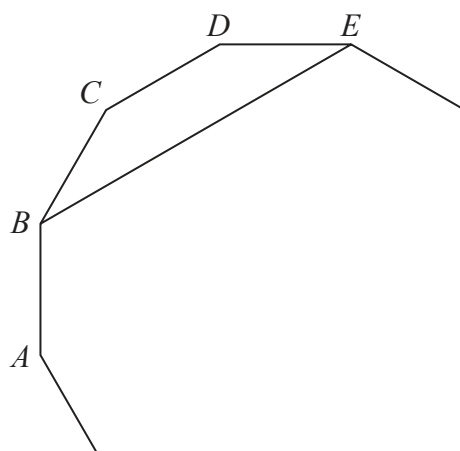


Diagram NOT  
accurately drawn

Figure 1

Figure 1 shows part of a regular 12-sided polygon.

The vertices  $B$  and  $E$  of the polygon are joined with a straight line.

Calculate the size, in degrees, of  $\angle ABE$ .

Give reasons for each stage of your working.

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(Total for Question 1 is 4 marks)

2



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2 Solve the simultaneous equations

$$\begin{aligned}3x - 2y &= 7 \\ x + 6y &= 15\end{aligned}$$

Show clear algebraic working.

(Total for Question 2 is 4 marks)



- 3 The original price of each 6-day ski pass is reduced by 15% in a sale.

In the sale the price of each 6-day ski pass is \$272

- (a) Calculate the original price of each 6-day ski pass.

(2)

The price of each 3-day ski pass is £110

The exchange rate is £1 = \$1.70

- (b) Calculate how much Andrew will save by buying one 6-day ski pass in the sale rather than two 3-day ski passes.

(3)

(Total for Question 3 is 5 marks)



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4 (a) Express 56 as the product of its prime factors. (1)

Trains to Watson leave Denby station every 56 minutes.  
Trains to Barbe leave Denby station every 24 minutes.

A train to Watson and a train to Barbe both leave Denby station at 12 00.

(b) Find the next time that a train to Watson and a train to Barbe leave Denby station at the same time. (3)

(Total for Question 4 is 4 marks)



5 (a) On the grid opposite, draw the graph of  $y = 3x + 2$  for the values of  $x$  from 0 to 5 (2)

(b) Show, by shading on the grid, the region  $R$  defined by all of the inequalities

$$y \leq 3x + 2 \quad \text{and} \quad y \geq 4 \quad \text{and} \quad 8 \leq 4x \leq 18$$

Label the region  $R$ .

(3)

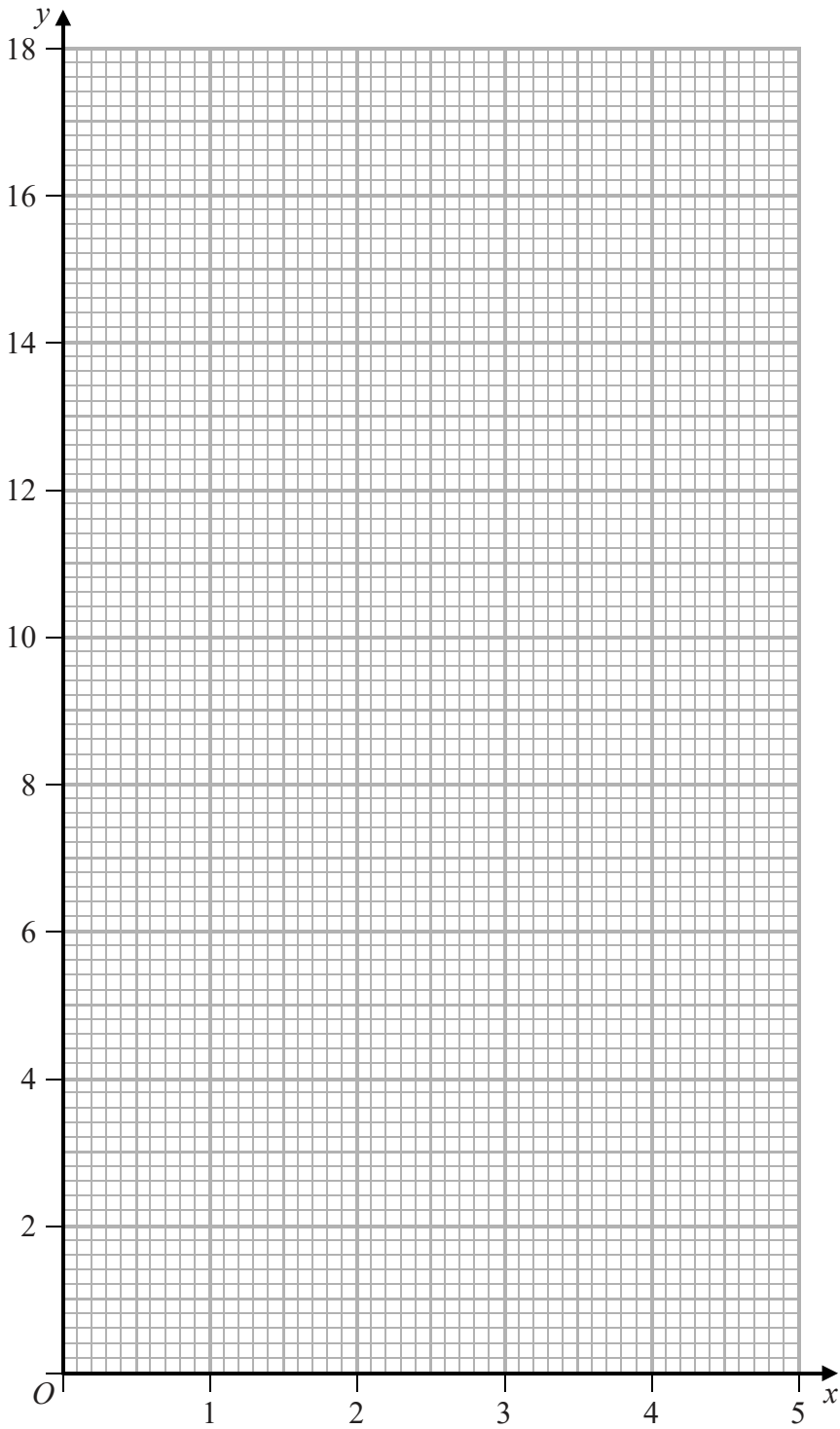
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Question 5 continued



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(Total for Question 5 is 5 marks)

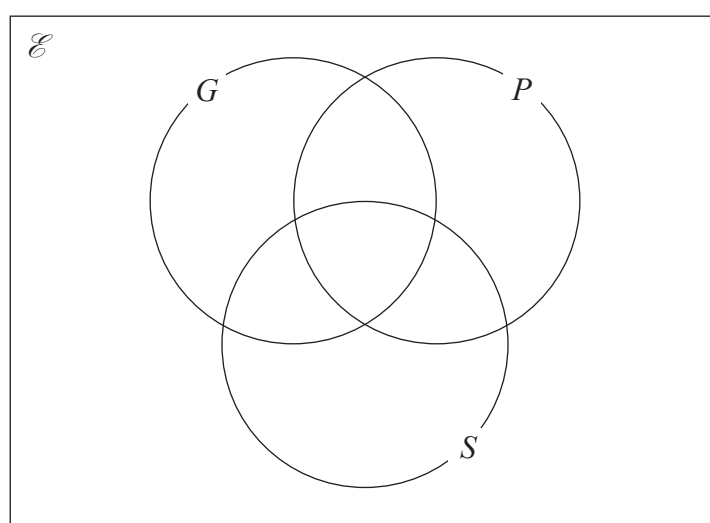


- 6 One day, 80 customers at a health spa were asked if they used any of the gym ( $G$ ), the pool ( $P$ ) and the sauna ( $S$ ).

Of these 80 customers

- 34 had used the gym
- 60 had used the pool
- 30 had used the sauna
- 20 had used the gym and the pool but not the sauna
- 17 had used the pool and the sauna but not the gym
- 6 had used the gym, the pool and the sauna
- no one had used the gym and the sauna but not the pool.

- (a) Using this information, complete the Venn diagram to show the number of elements in each appropriate subset.



(3)

- (b) Find (i)  $n([G \cup P \cup S]')$

(ii)  $n(G \cup S)$

(iii)  $n(P \cap S')$

(3)





Question 6 continued

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(Total for Question 6 is 6 marks)



- 7 Vincent plays a game in which he can score 0, 1, 2, 3 or 4 each time he plays the game. The score he gets in a game is independent of the score he got in the previous games. The table gives information about the probability of getting each score in a game.

<b>Score</b>	0	1	2	3	4
<b>Probability</b>	$x$	$3x$	$x$	0.2	0.1

Vincent plays the game 150 times.

- (a) Calculate the number of times he would expect to score 1 (4)

Vincent plays the game another two times and records his two scores. He adds these two scores together to get his Total.

- (b) Calculate the probability that Vincent's Total is greater than 6 (3)

Given that for these two games Vincent has a Total greater than 6 points,

- (c) calculate the probability that he got a score of 4 in the first of these two games. (3)



Question 7 continued

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(Total for Question 7 is 10 marks)



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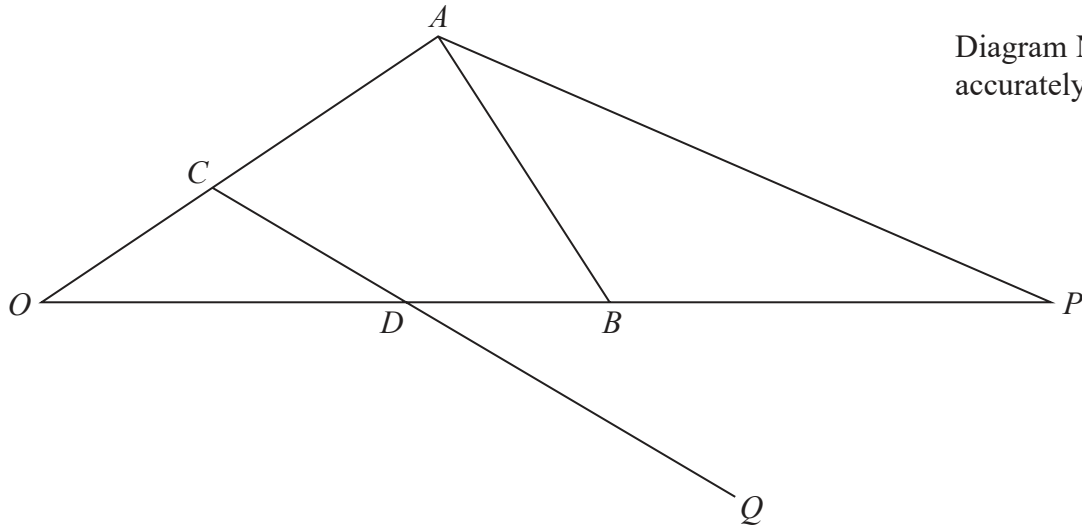


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Figure 2

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

The point  $C$  lies on  $OA$  such that  $\vec{OC} = \frac{1}{3}\vec{OA}$

The point  $D$  lies on  $OB$  such that  $\vec{OD} = \frac{2}{3}\vec{OB}$

(a) Find  $\vec{CD}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

(2)

The point  $P$  is such that  $ODBP$  is a straight line and  $AP$  is parallel to  $CD$ .

(b) Find  $\vec{OP}$  in terms of  $\mathbf{b}$ .

(4)

The point  $Q$  is such that  $\vec{CD} = \vec{DQ}$

(c) Show that  $A$ ,  $B$  and  $Q$  are collinear.

(4)



Question 8 continued

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 10 marks)



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9 The vertices of triangle  $A$  are the points with coordinates  $(0, 0)$ ,  $(1, 0)$  and  $(0, 2)$

(a) On the grid opposite, draw and label triangle  $A$ .

(1)

Triangle  $A$  is transformed to triangle  $B$  under the transformation with matrix  $\mathbf{M}$  where

$$\mathbf{M} = \begin{pmatrix} 3 & -4 \\ 4 & 3 \end{pmatrix}$$

(b) On the grid, draw and label triangle  $B$ .

(3)

The transformation with matrix  $\mathbf{M}$  is equivalent to an enlargement with centre the origin, with scale factor  $k$  followed by an anticlockwise rotation of  $\theta^\circ$  about the origin.

(c) Calculate the value of  $k$ .

(2)

(d) Calculate the value, to one decimal place, of  $\theta$ .

(2)

Triangle  $B$  is transformed to triangle  $C$  under a reflection in the  $x$ -axis.

(e) On the grid, draw and label triangle  $C$ .

(1)

Triangle  $A$  is transformed to triangle  $C$  under the transformation with matrix  $\mathbf{T}$ .

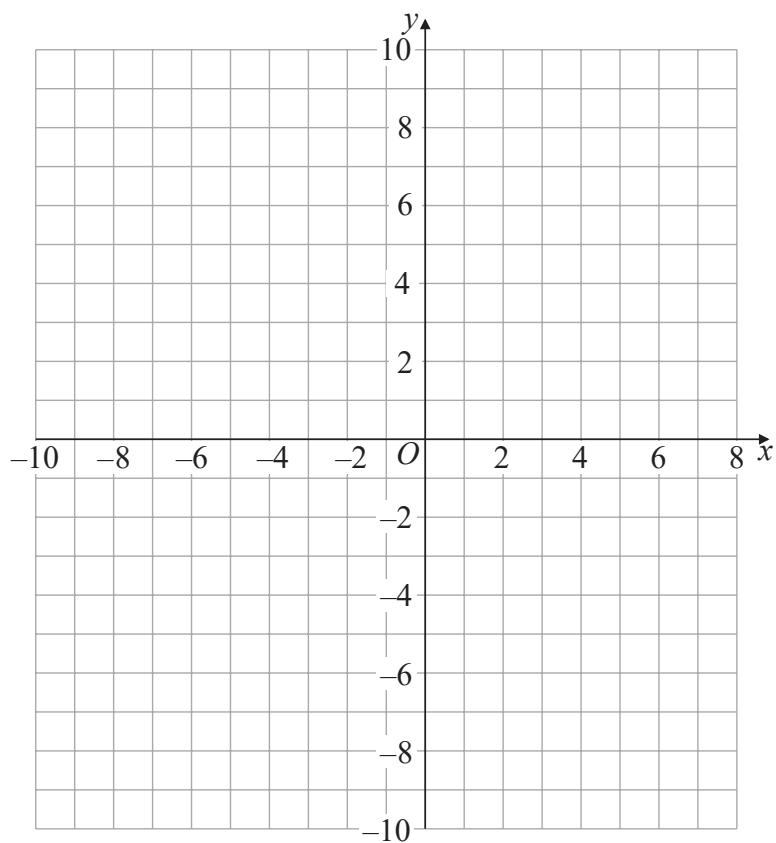
(f) Find matrix  $\mathbf{T}$ .

(2)





Question 9 continued



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

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Question 9 continued

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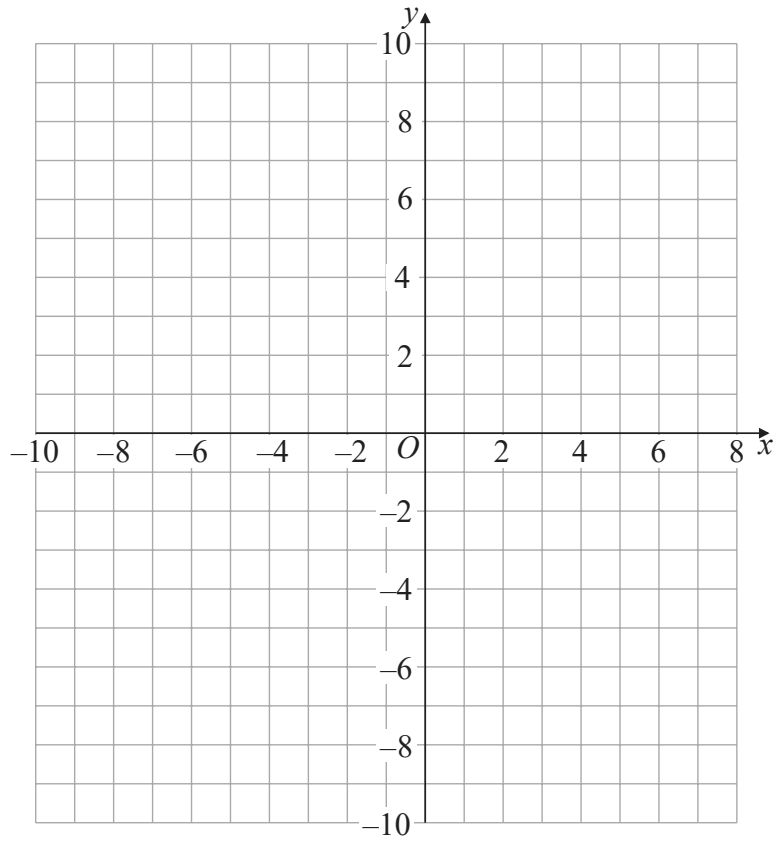
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Question 9 continued

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(Total for Question 9 is 11 marks)



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- 10 A rocket is launched from a point which is 5 m above horizontal ground. The rocket moves vertically upwards so that at time  $t$  seconds, the height,  $h$  metres, of the rocket above the ground is given by

$$h = 5 + 3t + 9t^2 - t^3$$

At time  $t$  seconds, the velocity of the rocket is  $v$  m/s and the acceleration of the rocket is  $a$  m/s<sup>2</sup>

- (a) Find an expression for  $v$  in terms of  $t$ . (2)
- (b) Find an expression for  $a$  in terms of  $t$ . (1)
- (c) Find the time when the rocket stops accelerating upwards. (2)

The rocket is instantaneously at rest when it is at point  $A$ .

- (d) Show that the height, in metres to one decimal place, of  $A$  above the ground is 131.2 m. (6)

The rocket now falls vertically downwards and hits the ground.

- (e) Find the total distance, to the nearest metre, travelled by the rocket at the instant it hits the ground. (2)

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



Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 13 marks)



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11

$$f(x) = 4x^3 - 13x - 6$$

(a) Use the factor theorem to show that  $(2x + 1)$  is a factor of  $f(x)$ . (2)

(b) Hence factorise  $f(x)$  fully. (4)

The curve  $C$  has equation  $y = f(x)$

(c) Find the coordinates of the points of intersection of  $C$  with the  $x$ -axis. (2)

(d) Find the coordinates, to 2 decimal places, of the turning points of  $C$ . (5)

The table below gives the coordinates of three points on  $C$ .

$x$	-2	0.5	1.5
$y$	-12	-12	-12

(e) On the grid opposite, draw the curve  $C$  for  $-2 \leq x \leq 2$ .  
Clearly label the coordinates of the turning points of  $C$  and the coordinates of the points of intersection with the  $x$ -axis and the  $y$ -axis. (3)

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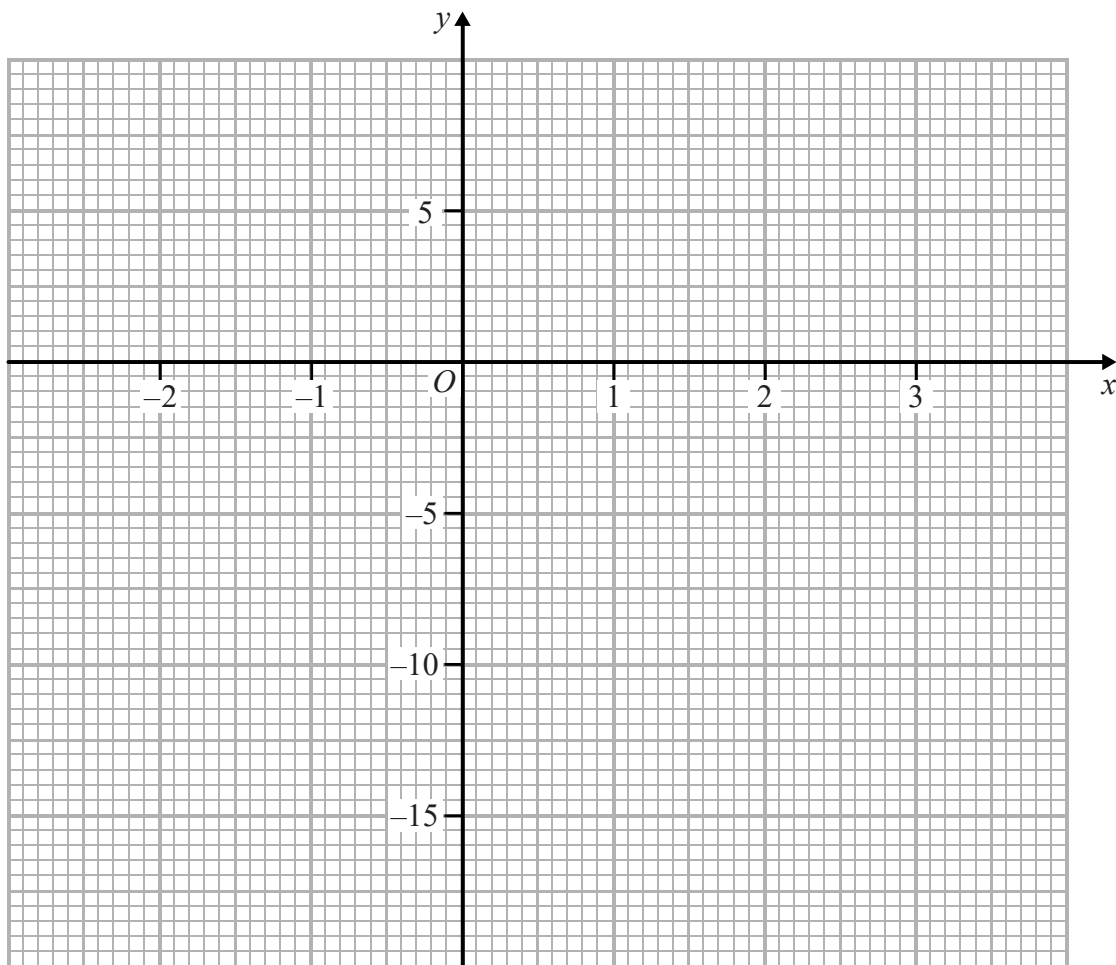
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Question 11 continued



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Question 11 continued

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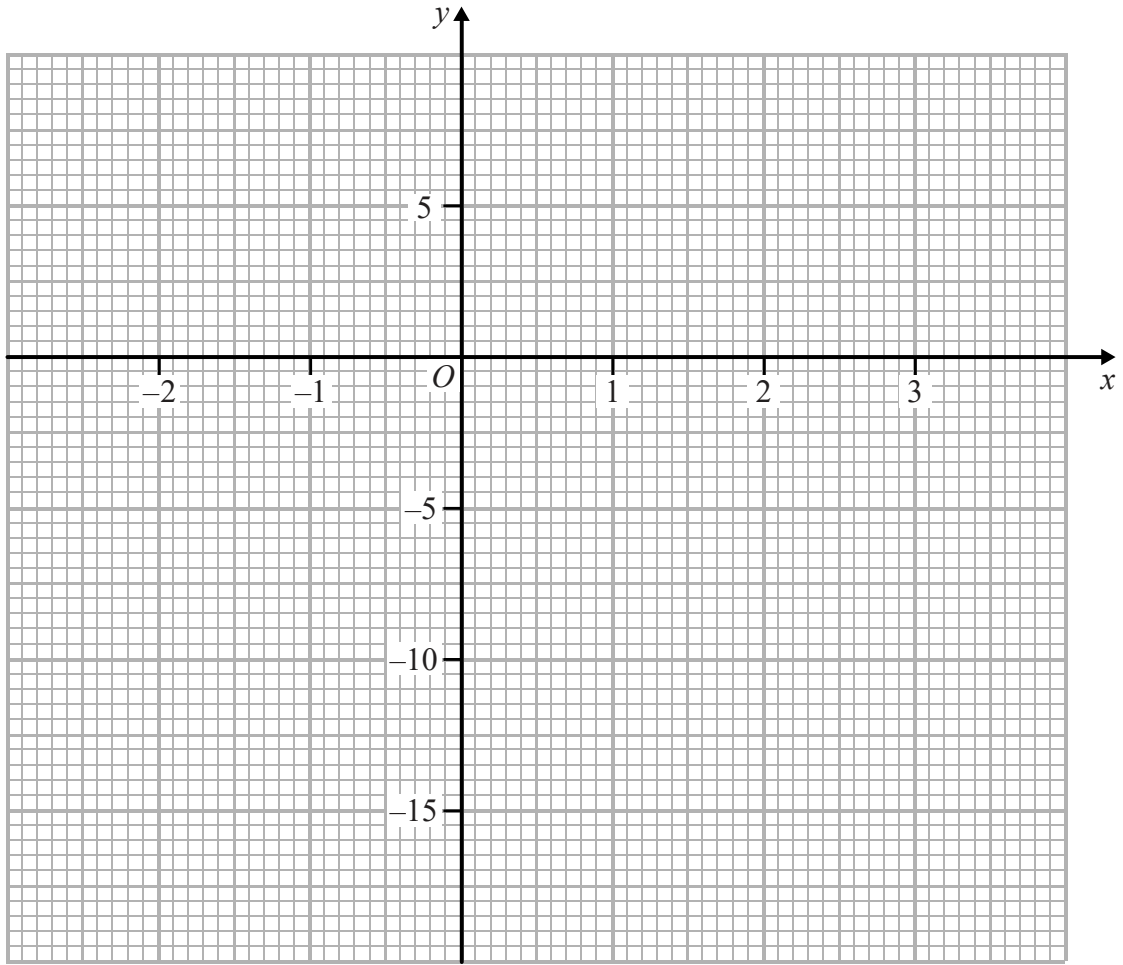
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Question 11 continued

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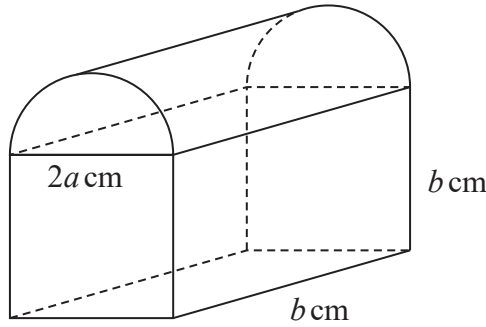


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Figure 3

Figure 3 shows a solid silver paperweight made from a cuboid and a half cylinder. The cuboid is  $2a$  cm wide,  $b$  cm long and  $b$  cm high. The plane face of the half cylinder coincides with the top face of the cuboid. The total surface area of the paper weight is  $A$  cm<sup>2</sup>

- (a) Find an expression for  $A$  in terms of  $\pi$ ,  $a$  and  $b$ . (2)

Given that  $a = 6\sqrt{5}$  and that the surface area of the paperweight can be written as

$$(2b^2 + 6ab + 60\pi\sqrt{15}) \text{ cm}^2$$

- (b) show that the exact value of  $b$  is  $10\sqrt{3} - 6\sqrt{5}$  (5)

The paperweight is melted down to form a different cuboid. This second cuboid is  $2a$  cm wide,  $b$  cm long and  $h$  cm high, as shown in Figure 4.

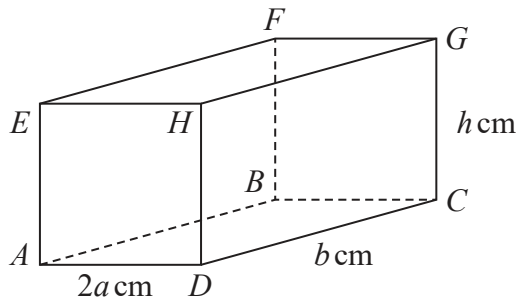


Diagram NOT accurately drawn

Figure 4

- (c) Calculate the size, to the nearest degree, of angle  $GAC$ . (5)

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Question 12 continued

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$$\left[ \begin{array}{l} \text{Volume of cylinder } \pi r^2 h \\ \text{Curved surface area of cylinder } 2\pi r h \end{array} \right]$$



Question 12 continued

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Question 12 continued

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(Total for Question 12 is 12 marks)

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**TOTAL FOR PAPER IS 100 MARKS**



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