


Please check the examination details below before entering your candidate information

Candidate surname					Other names				
<b>Pearson Edexcel International GCSE</b>		Centre Number				Candidate Number			
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Time 2 hours 30 minutes		Paper reference		<b>4MB1/02</b>					
<b>Mathematics B</b>								▲ ▲	
<b>PAPER 2</b>									
<p><b>You must have:</b> Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.</p>								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.
- Good luck with your examination.

Turn over ►

P66009A

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Answer ALL TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The table gives the area, in  $\text{km}^2$ , and the population of each of three countries in 2017

Country	Area ( $\text{km}^2$ )	Population
Greenland	$2.166 \times 10^6$	$5.617 \times 10^4$
Sri Lanka	$6.561 \times 10^4$	$2.144 \times 10^7$
China	$9.597 \times 10^6$	$1.368 \times 10^9$

- (a) Write  $5.617 \times 10^4$  as an ordinary number. (1)
- (b) Calculate by how many people the population of China in 2017 was greater than the population of Sri Lanka in 2017  
Give your answer in standard form. (2)
- (c) Work out the number of people per  $\text{km}^2$  for Greenland in 2017  
Give your answer, to 3 significant figures, in standard form. (2)

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**Question 1 continued**

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**(Total for Question 1 is 5 marks)**



2 The curve  $C$  has equation

$$y = x^3 + ax^2 + bx + 8$$

where  $a$  and  $b$  are constants.

The gradient of  $C$  at the point  $(2, 6)$  is  $9.8$

Find the value of  $a$  and the value of  $b$ .

Show clear algebraic working.

(5)

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**Question 2 continued**

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**(Total for Question 2 is 5 marks)**

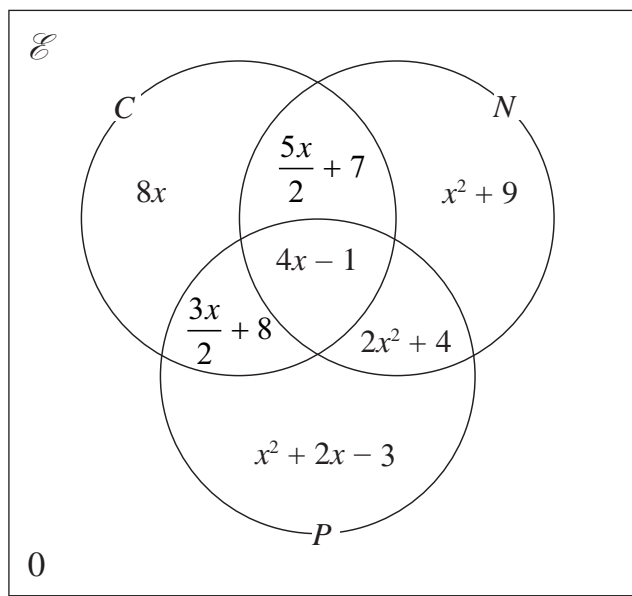


3 The principal of a college wishes to introduce three new evening classes.

The classes are Cake decorating ( $C$ ), Needlework ( $N$ ) and Photography ( $P$ ).

In a survey, 160 people who attend evening classes at the college were asked which of these new evening classes they would like to attend.

Information about the results of the survey is shown in the Venn diagram. The expression in terms of  $x$ , where  $x$  is a positive integer, in each subset represents the number of people in that subset.



(a) (i) Show that  $2x^2 + 9x - 68 = 0$

(ii) Hence find the value of  $x$ .

(4)

One of the people surveyed is selected at random.

Given that this person would like to attend Photography,

(b) calculate the exact value of the probability that this person would also like to attend Cake decorating but not Needlework.

(2)

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**Question 3 continued**

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**(Total for Question 3 is 6 marks)**



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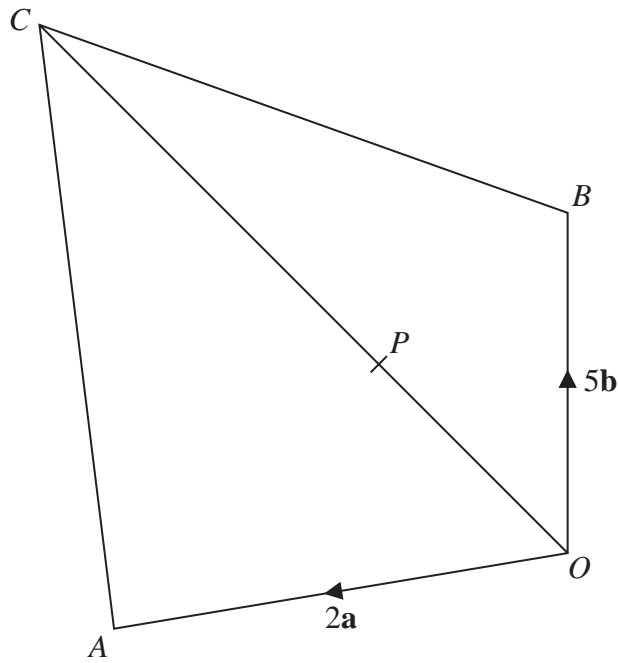


Diagram **NOT** accurately drawn

**Figure 1**

In Figure 1,  $OACB$  is a quadrilateral in which  $\vec{OA} = 2\mathbf{a}$  and  $\vec{OB} = 5\mathbf{b}$

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

(1)

$P$  is the point on  $OC$  such that  $OP : PC = 1 : 4$

Given that  $\vec{BC} = 6\mathbf{a} + 5\mathbf{b}$

(b) (i) prove that  $A, P$  and  $B$  are collinear,

(ii) find a value of  $m$  and a value of  $n$  such that  $AP : PB = m : n$

(5)

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**Question 4 continued**

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**(Total for Question 4 is 6 marks)**



5 Solve the simultaneous equations

$$2x^2 = 11 - 3y^2$$
$$4x - y = 5$$

Show clear algebraic working.

(6)

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**Question 5 continued**

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**(Total for Question 5 is 6 marks)**



6 The curve  $C$  has equation

$$y = x^2 + 2x + \frac{4}{x} \quad x \neq 0$$

(a) Complete the table of values for  $C$

$x$	-4	-2	-1	-0.5	0.5	1	2	4
$y$				-8.75		7	10	25

(2)

(b) On the grid opposite, plot the points from your completed table.

(1)

The curve has one turning point and this has coordinates (1, 7)

(c) Use your points to draw the graph of  $y = x^2 + 2x + \frac{4}{x} \quad x \neq 0$

(1)

(d) Using your graph, find an estimate, to one decimal place, for the solution of the equation

$$x^2 + 2x + \frac{4}{x} = 0$$

(1)

(e) By drawing a suitable line on the grid estimate, to one decimal place, the solutions of the equation

$$x^2 + 2x + \frac{4}{x} = 5x + \frac{3}{2}$$

(3)

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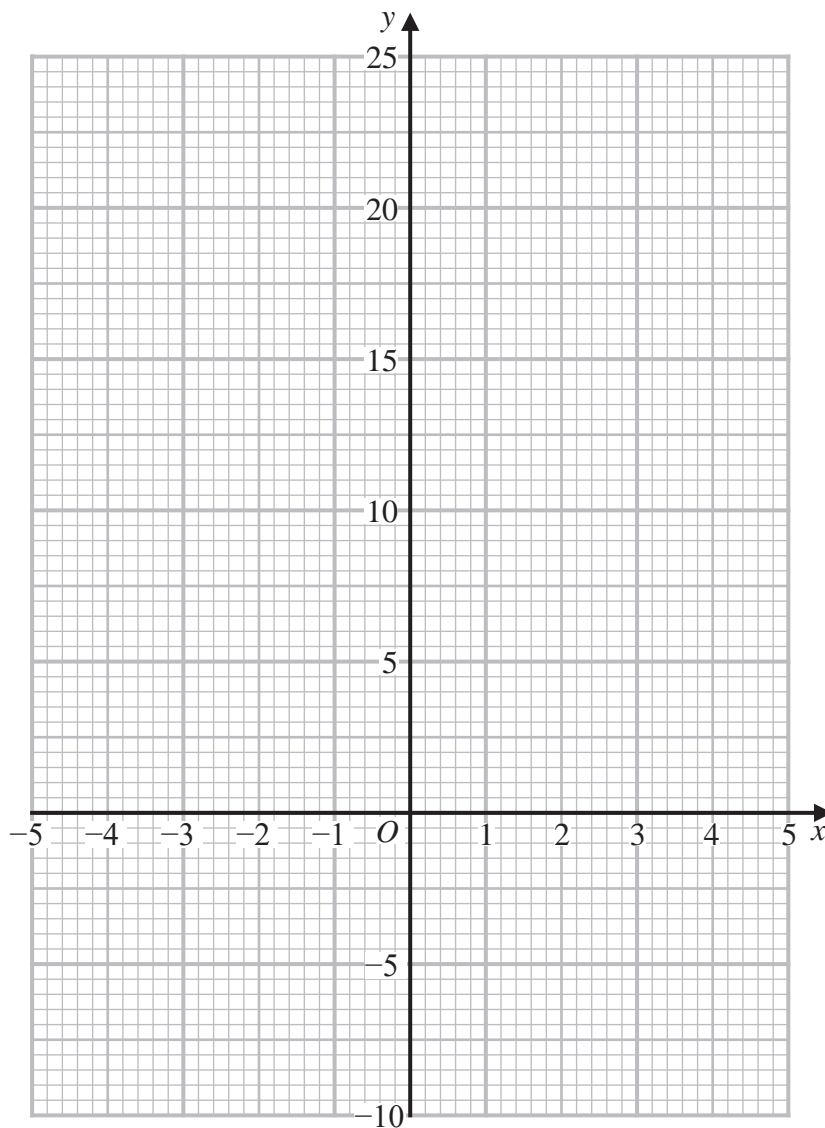
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Question 6 continued



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



**Question 6 continued**

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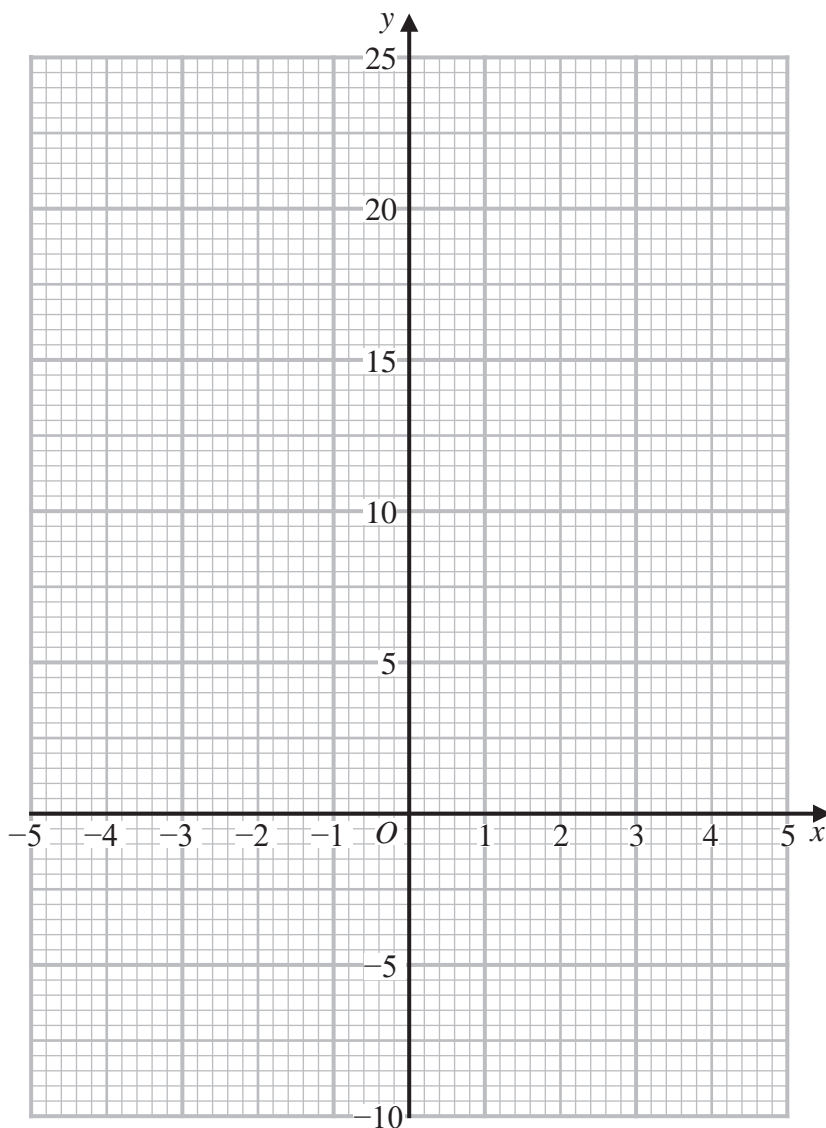
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Question 6 continued

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(Total for Question 6 is 8 marks)



7 Lillian and Graham are co-owners of a small company.

Lillian has invested \$55 000 in the company.  
Graham has invested \$25 000 in the company.

This year Lillian receives 20% of the profit made by the company in 2020  
The rest of the profit made by the company in 2020 is shared between Lillian and Graham in the same proportions as the amounts of money they invested in the company.

(a) Show that this year Lillian receives, in total, 75% of the profit made by the company in 2020

(2)

In 2020, the company made a profit of \$2000

Lillian puts all the money that she receives from the profit made by the company in 2020 in an account that pays interest at a fixed rate of 4.8% per year.

(b) Calculate the interest she receives in one year.

(2)

Graham goes to a travel agent to change his share of the profit from dollars (\$) into pounds (£).

The table gives information about the exchange rates that are available.

Exchange rate
1 euro = \$1.20
1 euro = £ $x$
\$1 = £0.76

Graham has to decide whether to

(i) change his dollars into euros **and** then change the euros into pounds

or

(ii) change his dollars straight into pounds.

He calculates that if he chooses to do (i) he will receive £20 more than if he chooses to do (ii)

(c) Calculate the value of  $x$ .

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**Question 7 continued**

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**Question 7 continued**

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**Question 7 continued**

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**(Total for Question 7 is 9 marks)**



- 8 There are 45 young people in a youth club.

The table below gives information about the heights of these young people.

Height ( $h$ cm)	Frequency
$140 < h \leq 150$	5
$150 < h \leq 155$	8
$155 < h \leq 160$	11
$160 < h \leq 165$	6
$165 < h \leq 170$	12
$170 < h \leq 190$	3

- (a) Find the class interval that contains the median. (1)
- (b) Calculate an estimate of the mean height, in cm to one decimal place, of these young people. (4)

One of the young people is selected at random.

The incomplete probability tree diagram on the opposite page gives information about the eye colour and the hair colour of this young person.

- (c) Complete the probability tree diagram. (1)

Given that, for these young people, hair colour is independent of height

- (d) calculate the probability that the young person selected has fair hair and a height of more than 160 cm. (3)

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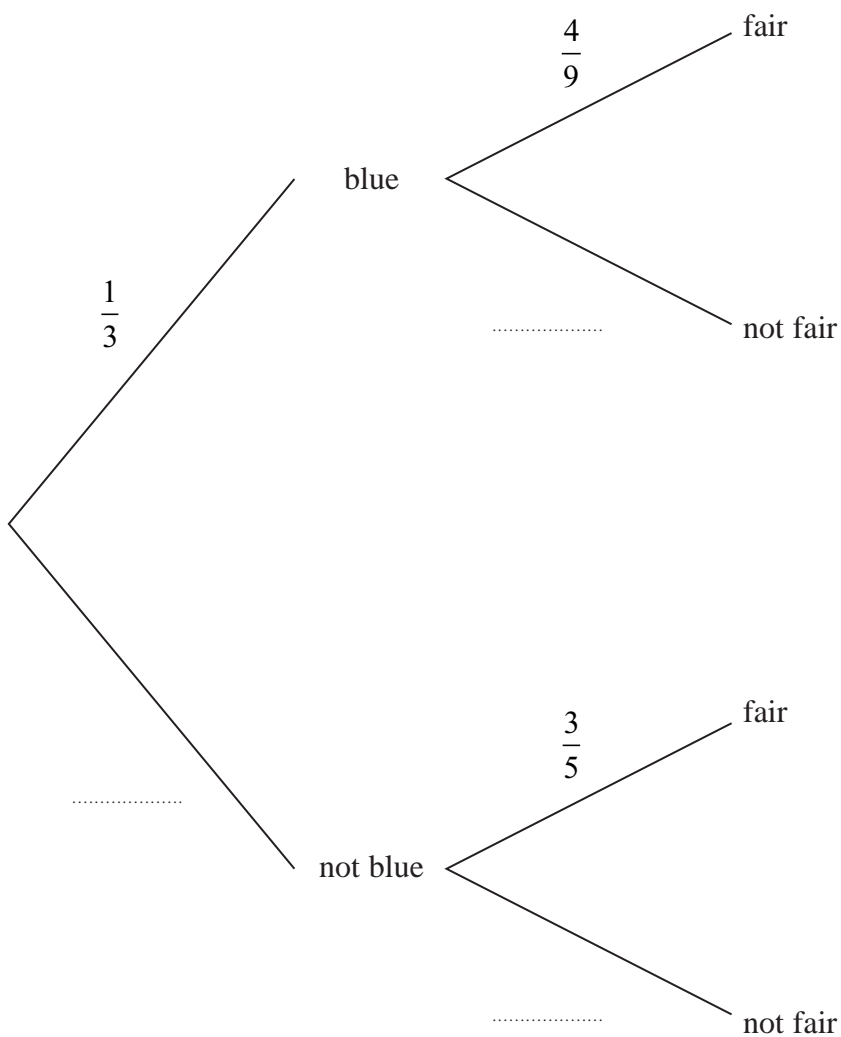
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Question 8 continued

Eye colour

Hair colour



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**Question 8 continued**

Handwriting practice area with 25 horizontal dotted lines.

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**Question 8 continued**

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**(Total for Question 8 is 9 marks)**



9 The grid opposite shows triangle  $A$ .

Triangle  $A$  is transformed to triangle  $B$  by a reflection in the line with equation  $x = 1$

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

(2)

Triangle  $B$  is transformed to triangle  $C$  under the translation  $\begin{pmatrix} 7 \\ -3 \end{pmatrix}$

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

(2)

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

$$\mathbf{M} = \begin{pmatrix} 2 & 0 \\ 0 & -2 \end{pmatrix}$$

(c) On the grid, draw and label triangle  $D$ .

(3)

(d) Describe fully the **single** transformation that maps triangle  $A$  onto triangle  $D$ .

(3)

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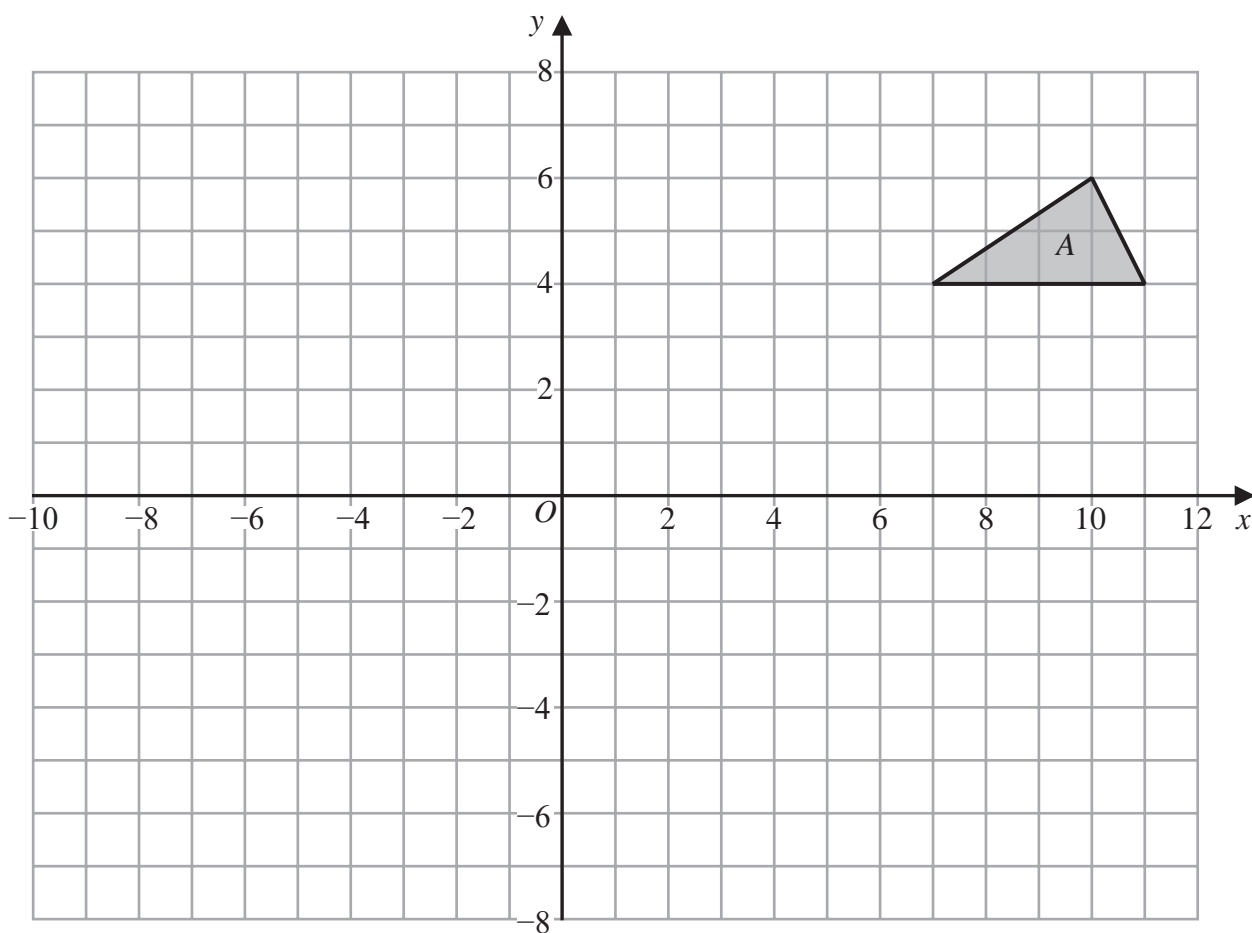
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Question 9 continued



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



**Question 9 continued**

Handwriting practice area consisting of 25 horizontal dotted lines for writing.

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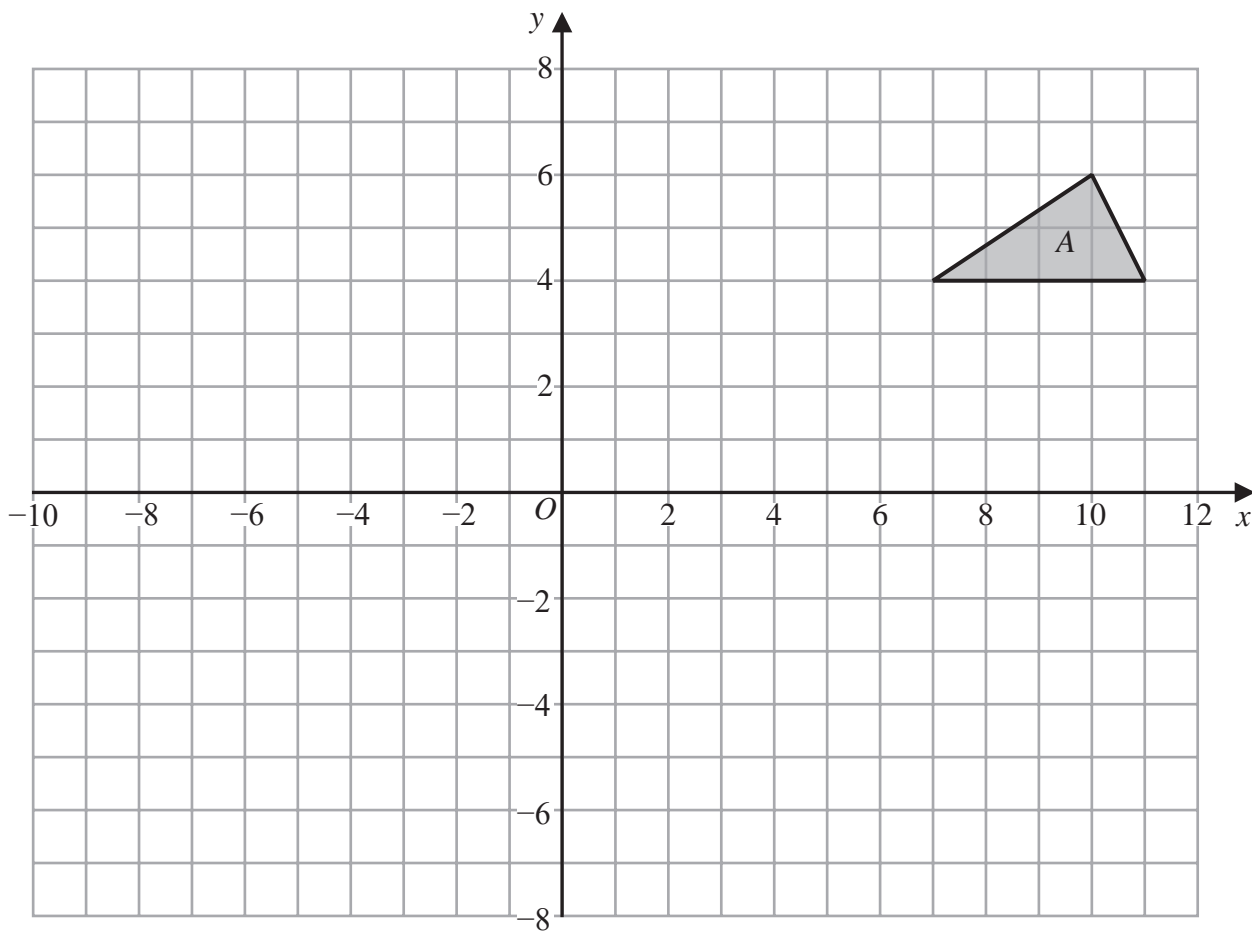
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Question 9 continued

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(Total for Question 9 is 10 marks)



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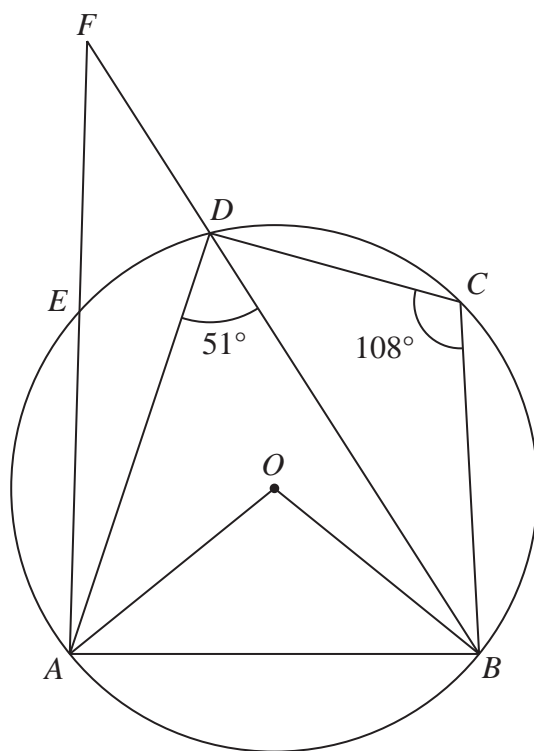


Figure 2

Figure 2 shows the circle  $ABCDE$  with centre  $O$ .

The chords  $AE$  and  $BD$  intersect outside the circle at the point  $F$ .

$$\angle BCD = 108^\circ \quad \angle ADB = 51^\circ$$

- (a) Giving your reasons, show that  $\angle OBD = 18^\circ$  (5)

Given that  $AE = 4.9$  cm,  $EF = 3.5$  cm and  $DF = 3.0$  cm,

- (b) calculate the area, in  $\text{cm}^2$  to 3 significant figures, of  $\triangle ABF$ . (5)

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$$\left[ \begin{array}{l} \text{Sine Rule } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \\ \text{Area of triangle} = \frac{1}{2} ab \sin C \end{array} \right]$$



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**Question 10 continued**

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Question 10 continued

Handwriting practice area with horizontal dotted lines.

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**Question 10 continued**

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**(Total for Question 10 is 10 marks)**



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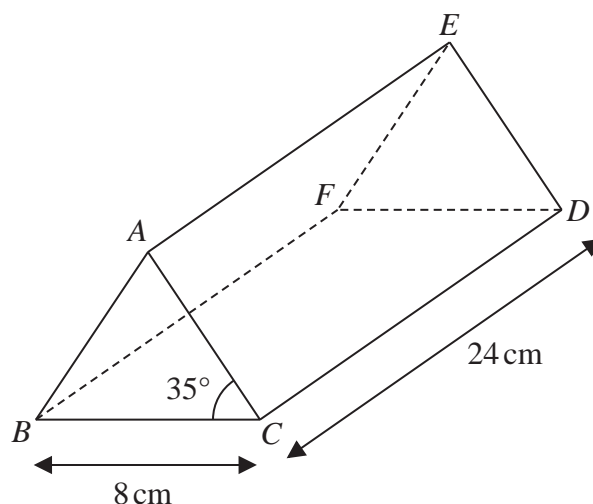
Diagram **NOT**  
accurately drawn

Figure 3

Figure 3 shows a solid right triangular prism  $ABCDEF$ .

A cross section  $ABC$  of the prism is an isosceles triangle in which  $AB = AC$ .

$$\angle ACB = 35^\circ \quad CB = 8 \text{ cm} \quad CD = 24 \text{ cm}$$

(a) Calculate the total surface area, in  $\text{cm}^2$  to 3 significant figures, of the prism.

(5)

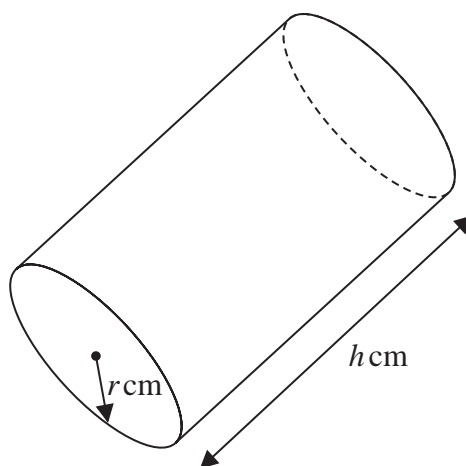
Diagram **NOT**  
accurately drawn

Figure 4

Figure 4 shows a solid right circular cylinder with radius  $r$  cm and length  $h$  cm.

The total surface area of the cylinder is  $(224 + 60\sqrt{3})\pi \text{ cm}^2$

Given that  $r = 3\sqrt{3} + 2$

(b) find the exact value of  $h$ .

Show your working clearly and give your answer in the form  $a\sqrt{27}$  where  $a$  is an integer.

(6)

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## Question 11 continued

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$$\left[ \begin{array}{l} \text{Area of triangle} = \frac{1}{2} ab \sin C \\ \text{Curved surface area of cylinder} = 2 rh \end{array} \right]$$



P 6 6 0 0 9 A 0 3 3 4 0

**Question 11 continued**

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**Question 11 continued**

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**(Total for Question 11 is 11 marks)**



12 The function  $f$  is defined by

$$f(x) = 4 - \frac{7}{x+3}$$

(a) Write down the value of  $x$  that must be excluded from any domain of function  $f$  (1)

(b) Find  $f(-1)$  (1)

The function  $g$  is defined as

$$g : x \mapsto 2x^2 + 4x - 1 \text{ where } x \geq -1$$

Given that  $fg^{-1}(x) = 1.2$

(c) find the value of  $x$  (7)

The function  $h$  is defined as

$$h : x \mapsto x + 2 \text{ for all values of } x \geq -3$$

Given that the function  $m$  is such that  $m(x) = gh(x) + 3$

(d) express  $m(x)$  in the form  $a(x + b)^2$  where  $a$  and  $b$  are integers. (4)

(e) Find the domain of  $m^{-1}$  (2)

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**Question 12 continued**

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**Question 12 continued**

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**Question 12 continued**

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**Question 12 continued**

Area for writing answers, consisting of multiple horizontal dotted lines.

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**(Total for Question 12 is 15 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

