Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

General Certificate of Secondary Education
November 2009

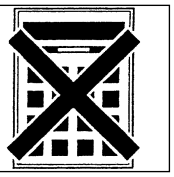
MATHEMATICS (SPECIFICATION A) **4306/1H**
Higher Tier
Paper 1 Non-calculator

H

Thursday 5 November 2009 9.00 am to 11.00 am

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.



Time allowed: 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper. This must be tagged securely to this answer booklet.

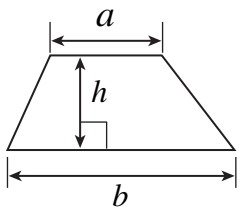
Advice

- In all calculations, show clearly how you work out your answer.

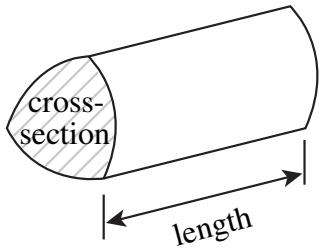
For Examiner's Use	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$

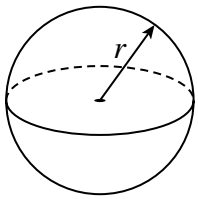


Volume of prism = area of cross-section × length



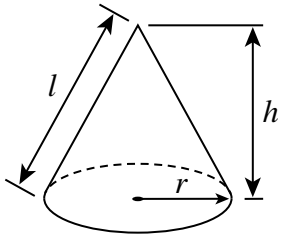
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



Volume of cone = $\frac{1}{3}\pi r^2 h$

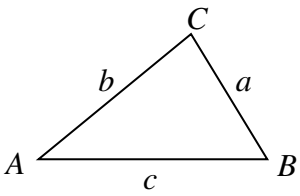
Curved surface area of cone = $\pi r l$



In any triangle ABC

Area of triangle = $\frac{1}{2}ab\sin C$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$



Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Areas outside the box will not be scanned for marking

Answer **all** questions in the spaces provided.

1 Here is a recipe for Bolognese sauce,

minced beef ..... 400 g
chopped tomatoes ..... 600 g
mushrooms ..... 20 g
chicken stock ..... 120 m*l*

Ann has only 300 g of minced beef.

How much of the other ingredients should she use?

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Answer chopped tomatoes ..... g

mushrooms ..... g

chicken stock ..... m*l* *(3 marks)*

2 Work out the value of $\frac{a(3b + 1)}{5}$ when $a = -2$ and $b = 3$

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Answer ..... *(3 marks)*

6

Areas outside the box will not be scanned for marking

3 In a school, there are 200 students in Year 11.
110 of these students are girls.

What percentage of these students are boys?

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Answer ..... % *(3 marks)*

4 (a) The cost of a newspaper is x pence.
The cost of a magazine is £1.25 more than the newspaper.
The cost of three of these magazines is the same as the cost of eight of these newspapers.

Show **clearly** that $3x + 375 = 8x$

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(2 marks)

4 (b) Solve $3x + 375 = 8x$

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Answer x = ... *(2 marks)*

Areas outside the box will not be scanned for marking

5 (a) Members of a Fitness Club were asked at what time of day they usually went to the gym. The two-way table shows some of the results.

Time of day	Males	Females	Total
Morning	19		67
Afternoon / Evening			
Total		65	160

Fill in **all** the missing values in the table.

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(3 marks)

5 (b) The manager of the Fitness Club wants to find out for how long each day members use the treadmill.

Write a suitable question with a response section that will enable him to find out this information.

Question .....

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Response section .....

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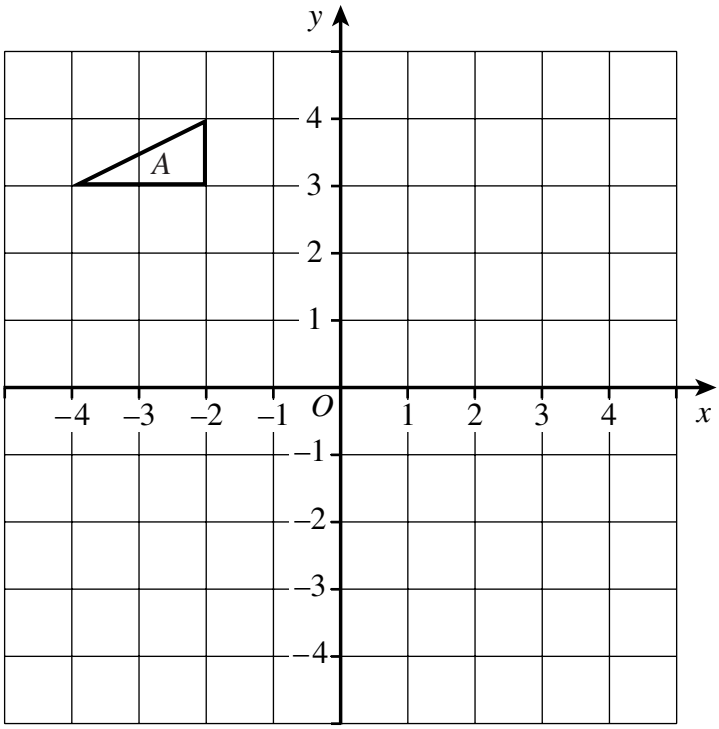
(2 marks)

12

Areas outside the box will not be scanned for marking

6 The diagram shows a triangle *A*, with vertices at (–4, 3), (–2, 3) and (–2, 4).



6 (a) Draw the image of triangle *A* when it is reflected in the line $y = 1$
Label your image *B*.

(2 marks)

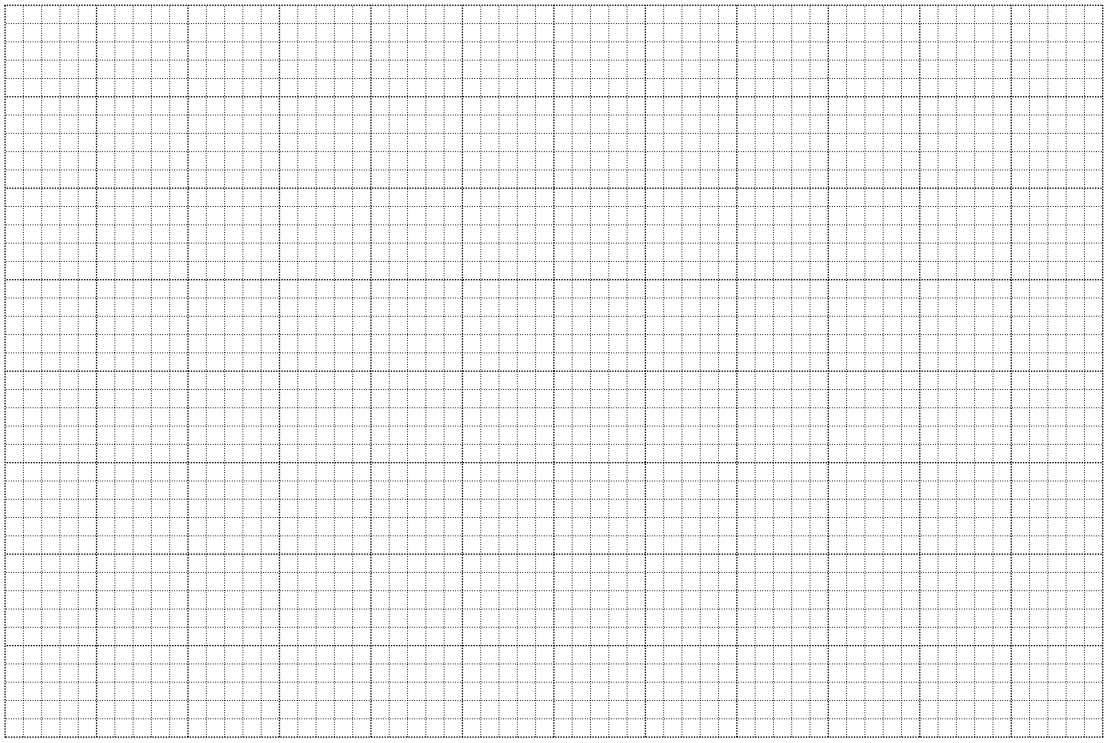
6 (b) Draw the image of triangle *A* when it is rotated 90° clockwise about the origin.
Label your image *C*.

(3 marks)

Areas outside the box will not be scanned for marking

7 The line $y = x - 3$ crosses the line $y = 2$ at the point P.

Find the coordinates of the point P.
You may use the graph paper to help you.



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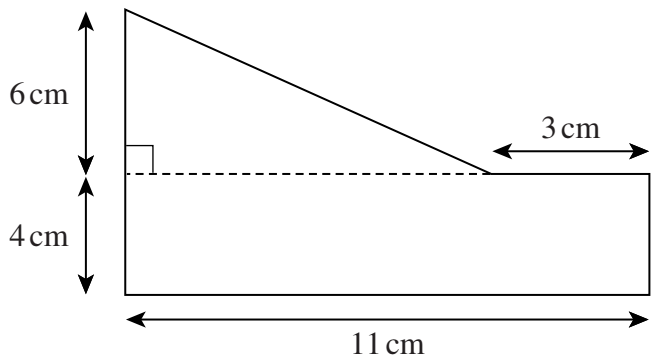
Answer (..... , ...) *(3 marks)*

Turn over for the next question

8

Areas outside the box will not be scanned for marking

8 The diagram shows a shape made from a rectangle and a right-angled triangle.



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Calculate the area of the shape.
State the units of your answer.

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Answer ..... *(5 marks)*

9 Use approximations to estimate the value of $\dfrac{397.8 \times 3.06}{0.524}$

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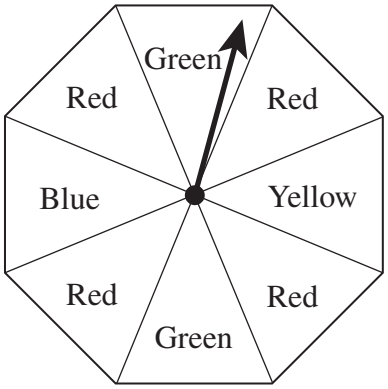
Answer ..... *(3 marks)*

Areas outside the box will not be scanned for marking

10 (a) Oscar has a spinner with eight sections.
Four of the sections are Red, two are Green, one is Blue and one is Yellow.
He spins the spinner 200 times.
His results are shown in the table.

Colour	Red	Green	Blue	Yellow
Frequency	105	48	22	25



10 (a) (i) Explain why the relative frequency of Green is 0.24

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(1 mark)

10 (a) (ii) Do the results suggest that the spinner is fair?
Explain your answer.

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(2 marks)

10 (b) Matilda has a spinner with six sections.
Three of the sections are Pink, two are White and one is Black.
She spins the spinner 10 times.
Her results are shown in a table.

Colour	Pink	White	Black
Frequency	2	5	3

She says her spinner is **not** fair.

Explain why Matilda could be wrong.

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(1 mark)

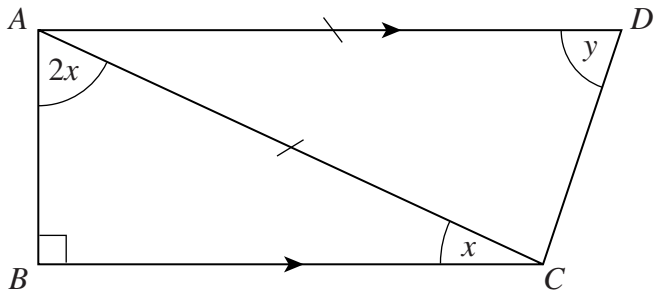
12

Turn over ▶

Areas outside the box will not be scanned for marking

11 *ABCD* is a trapezium with *AD* parallel to *BC*.
Triangle *ABC* is right-angled at *B*.
Triangle *ADC* is isosceles with *AD* = *AC*
Angle *BAC* = 2*x*
Angle *BCA* = *x*
Angle *ADC* = *y*

Not drawn accurately



11 (a) Work out the size of angle *x*.

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Answer ..... degrees *(2 marks)*

11 (b) Work out the size of angle *y*.

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Answer ..... degrees *(3 marks)*

Areas outside the box will not be scanned for marking

12 (a) Show **clearly** that $(n + 1)^2 + (n - 1)^2 \equiv 2n^2 + 2$

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(3 marks)

12 (b) Explain why $(n + 1)^2 + (n - 1)^2$ is always even for any integer value of n.

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(2 marks)

13 Work out $1\frac{7}{8} \times 2\frac{2}{5}$

Give your answer in its simplest form.

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Answer ..... *(3 marks)*

13

Areas outside the box will not be scanned for marking

14 x, y and z represent lengths.

For each expression, put a tick in a box to show whether it represents a length, an area, a volume or none of these.

Expression	Length	Area	Volume	None of these
$3x + y + 2z$				
$x + z^2$				
$x^3 + 5y^2z$				

(3 marks)

15 You are given that $x = 5^m$ and $y = 5^p$

Write each of the following as a single power of 5

15 (a) $\frac{x}{y}$

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Answer ..... *(1 mark)*

15 (b) y^2

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Answer ..... *(1 mark)*

Areas outside the box will not be scanned for marking

16 Solve the simultaneous equations $3x - 2y = 9$
$x + 4y = 10$

You **must** show your working.
Do **not** use trial and improvement.

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Answer $x =$ ..... , $y =$ ..... *(3 marks)*

Turn over for the next question

8

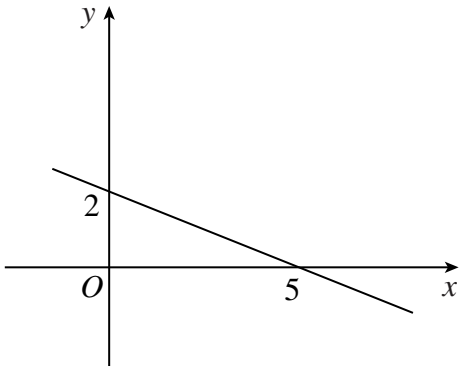
Areas outside the box will not be scanned for marking

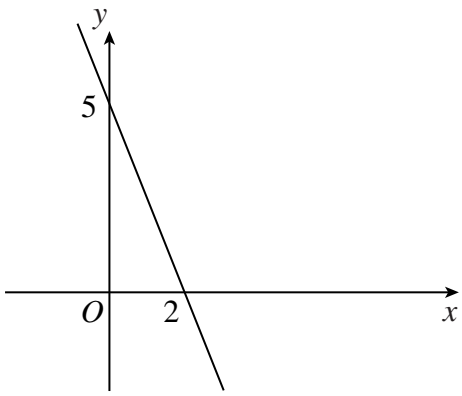
17 Each of these equations represents the graph of a straight line.

A: $5y + 10 = 2x$	B: $5x + 2y = 10$	C: $2y + 10 = 5x$	D: $2x + 5y = 10$

The four graphs are shown in the diagrams below.

Which equation represents which graph?





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This is equation .....

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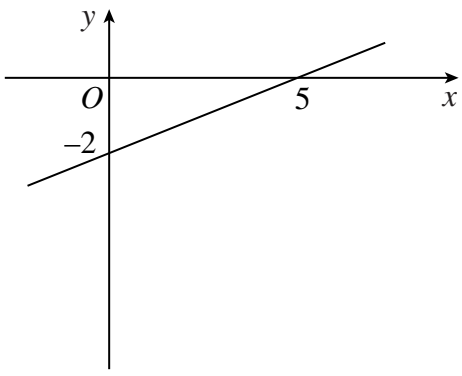
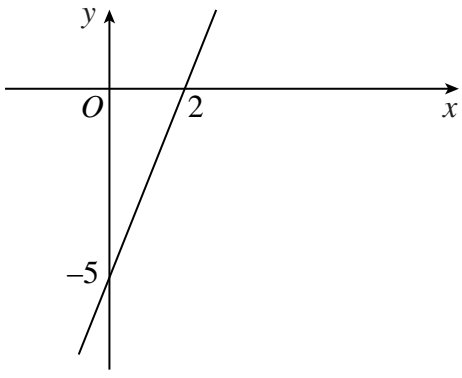
This is equation .....





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This is equation .....

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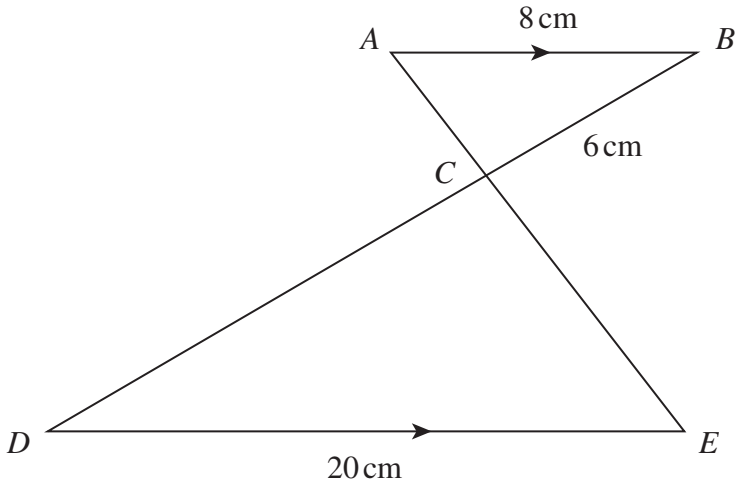
This is equation .....

(3 marks)

Areas outside the box will not be scanned for marking

18 In the diagram, *AB* is parallel to *DE*.
AB = 8 cm, *BC* = 6 cm and *DE* = 20 cm



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18 (a) Explain why triangles *ABC* and *EDC* are similar.
You **must** give reasons for any statements you make.

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(3 marks)

18 (b) Work out the length of *DC*.

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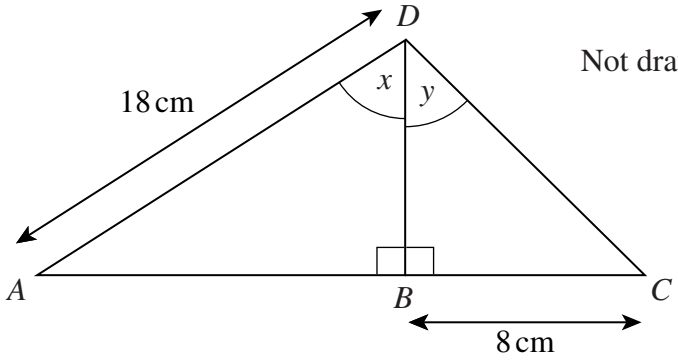
Answer ..... cm *(3 marks)*

9

Turn over ▶

Areas outside the box will not be scanned for marking

19 The diagram shows two right-angled triangles *ABD* and *CBD*.
AD = 18 cm and *BC* = 8 cm
cos *x* = tan *y*



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Work out the length of *BD*.

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Answer ..... cm *(3 marks)*

20 Make x the subject of the formula $y = \dfrac{w + x}{x - 2}$

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Answer ..... *(4 marks)*

Areas outside the box will not be scanned for marking

21 (a) Convert $\frac{7}{11}$ to a recurring decimal.

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Answer ..... *(2 marks)*

21 (b) Prove that the recurring decimal 0.3939... can be written as $\frac{13}{33}$

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(3 marks)

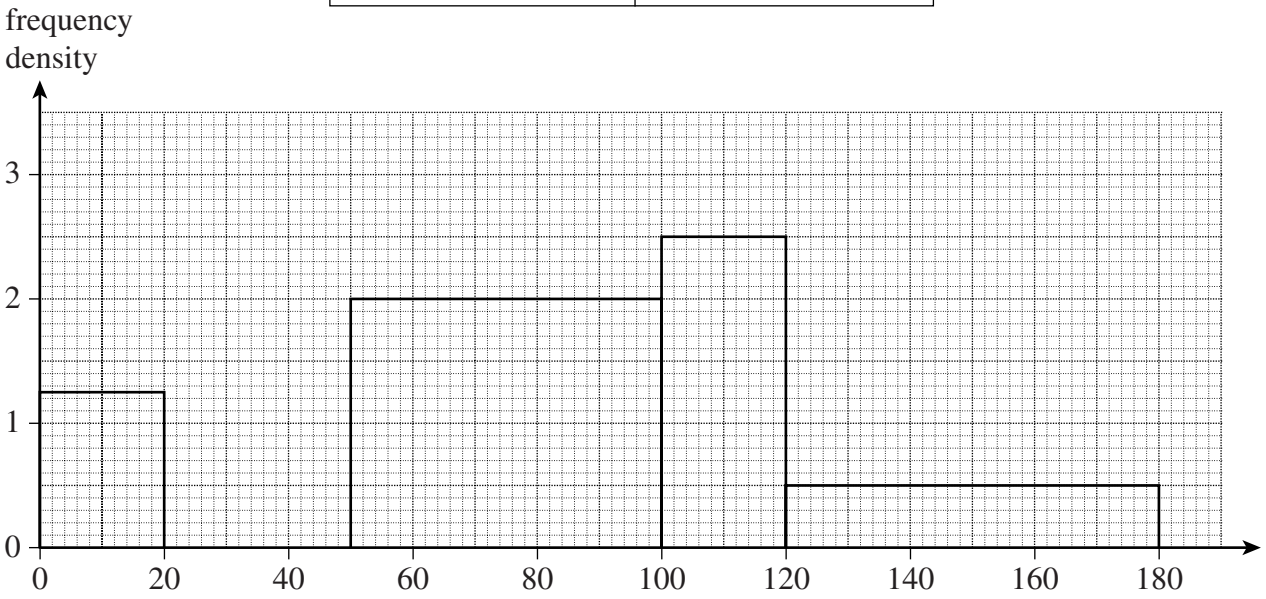
Turn over for the next question

12

Areas outside the box will not be scanned for marking

22 The histogram and the frequency table show some information about how much time vehicles spent in a car park.

Time (minutes)	Number of vehicles
$0 < t \leqslant 20$	25
$20 < t \leqslant 50$	45
$50 < t \leqslant 100$	
$100 < t \leqslant 120$	50
$120 < t \leqslant 180$	30



22 (a) Complete the histogram and fill in the missing number in the frequency table.

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(2 marks)

22 (b) Fifty vehicles were in the car park for more than T minutes.

Calculate an estimate of the value of T.

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Answer T = ... minutes *(3 marks)*

Areas outside the box will not be scanned for marking

23 Grace buys a packet of ten hyacinth bulbs.
They all look the same.

Seven of the bulbs will produce Pink flowers, three will produce Blue flowers.
A bulb is taken at random and planted.
A second bulb is taken at random and planted.

Calculate the probability that the two bulbs will produce **at least one** Blue flower.

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Answer ..... *(3 marks)*

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Areas outside the box will not be scanned for marking

24 y is inversely proportional to x.
z is directly proportional to the square root of y.
When $x = 8$, $y = 9$
When $y = 16$, $z = 20$

Use this information to find the value of z when $x = 2$

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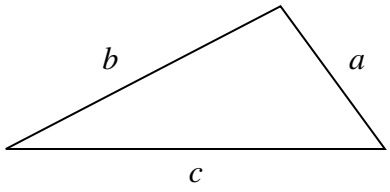
Answer ..... *(6 marks)*

Areas outside the box will not be scanned for marking

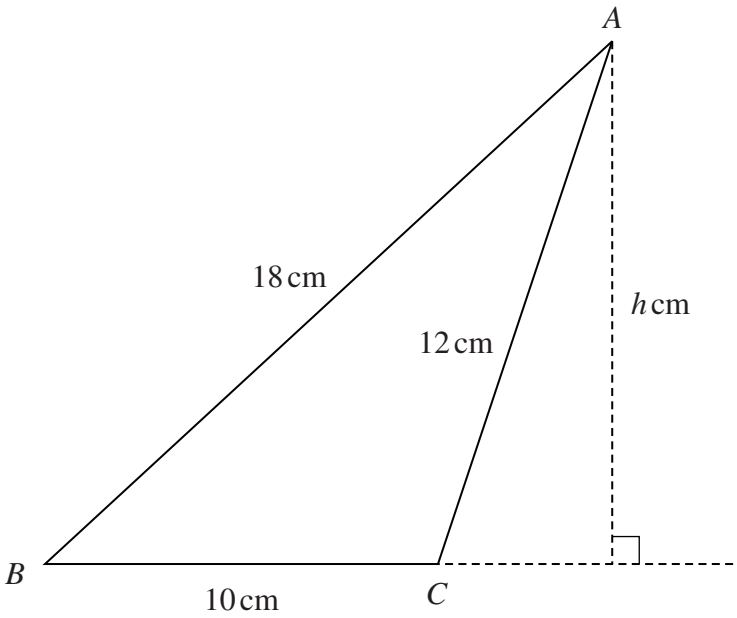
25 Hero's formula for the area of a triangle with sides of length a, b and c is

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where $s = \frac{1}{2}(a + b + c)$



The diagram shows triangle ABC in which $AB = 18\,\text{cm}$, $AC = 12\,\text{cm}$ and $BC = 10\,\text{cm}$.
The perpendicular distance from A to BC is h cm.



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Calculate the value of h.
Give your answer in the form $p\sqrt{2}$, where p is an integer.
You **must** show your working.

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Answer ..... cm *(6 marks)*

END OF QUESTIONS

12

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