

Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
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20 – 21	
TOTAL	



General Certificate of Secondary Education
Higher Tier
June 2011

Mathematics (Specification A)

4306/1H

Paper 1 Non-calculator

H

Monday 6 June 2011 1.30 pm to 3.30 pm

For this paper you must have:

- mathematical instruments.

You may **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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

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

Advice

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



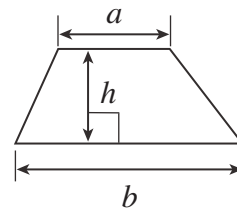
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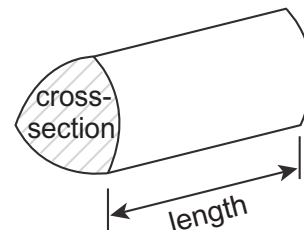
4306/1H

Formulae Sheet: Higher Tier

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

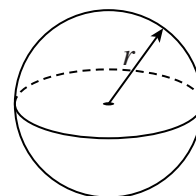


Volume of prism = area of cross-section \times length



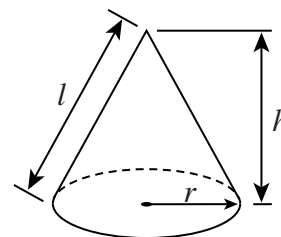
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

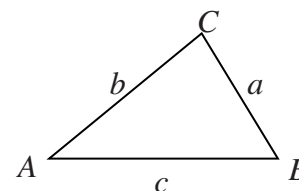


In any triangle ABC

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

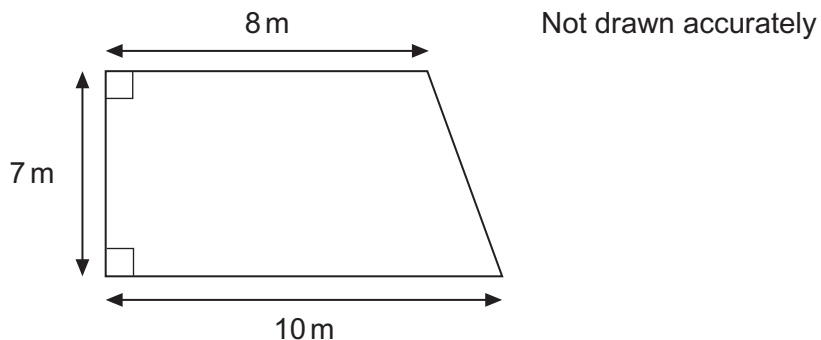
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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



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

- 1** The diagram shows a garden in the shape of a trapezium.



Calculate the area of the garden.

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Answerm² (2 marks)

- 2 (a)** Expand $c(c - 3)$

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Answer (2 marks)

- 2 (b)** Factorise $3d + 12$

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Answer (1 mark)



- 3** Kim is using number machines to calculate the output for a two-stage operation when the input is -3

She has these four operations that she can use.

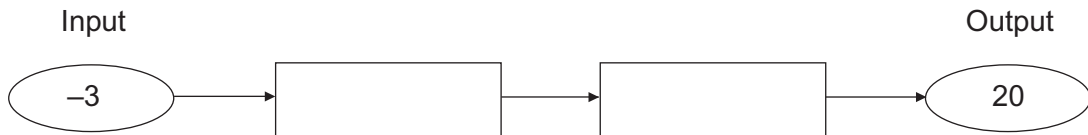
$$+7$$

$$-7$$

$$\times 5$$

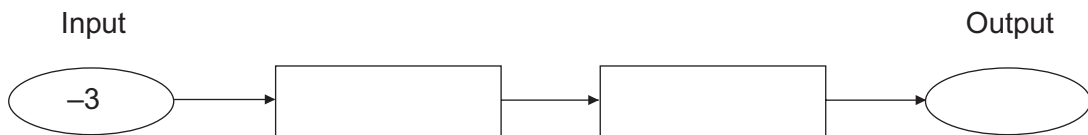
$$\times -5$$

- 3 (a)** Use **two** of these operations so that the output is 20



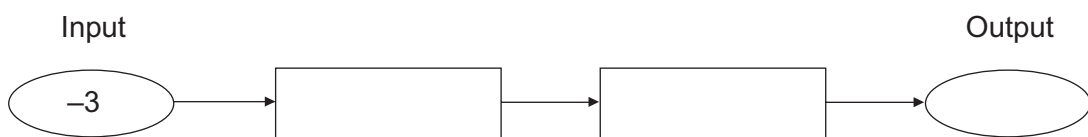
(1 mark)

- 3 (b)** Use **two** of these operations so that the output is negative.



(1 mark)

- 3 (c)** Use **two** of these operations so that the output is the maximum possible.



(2 marks)



- 4** The heights of players in a school basketball squad, in centimetres, are

187	179	184	186	190
186	181	194	188	177

- 4 (a)** Complete an ordered stem-and-leaf diagram to represent this data.
Remember to complete the key.

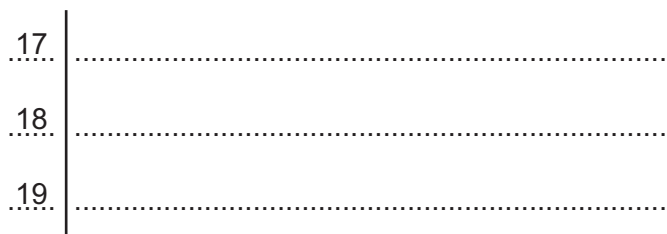
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Key | represents cm



(3 marks)

- 4 (b)** Write down the median height.

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Answer cm (1 mark)

- 4 (c)** Another player of height 188 cm joins the squad.

Explain why the median height will not change.

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(1 mark)



5 Use approximations to estimate the value of

$$\frac{5.87 \times \sqrt{101.7}}{1.96^2}$$

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Answer (3 marks)

6 Lewis is buying a caravan.
The cash price is £8000.
He buys it on credit in the following way.

A deposit of 15% of the cash price
plus
24 monthly instalments of £350

6 (a) Show that the total credit price of the caravan is £9600.

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(3 marks)

6 (b) Lewis pays £1600 extra buying the caravan on credit.

What is £1600 as a percentage of £8000?

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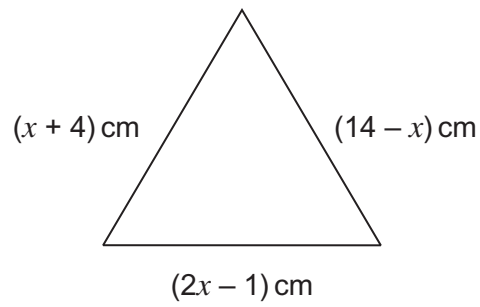
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Answer % (2 marks)



- 7 This triangle is equilateral.



Not drawn accurately

- 7 (a) Work out the value of x .

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Answer cm (3 marks)

- 7 (b) Hence, or otherwise, work out the perimeter of the triangle.

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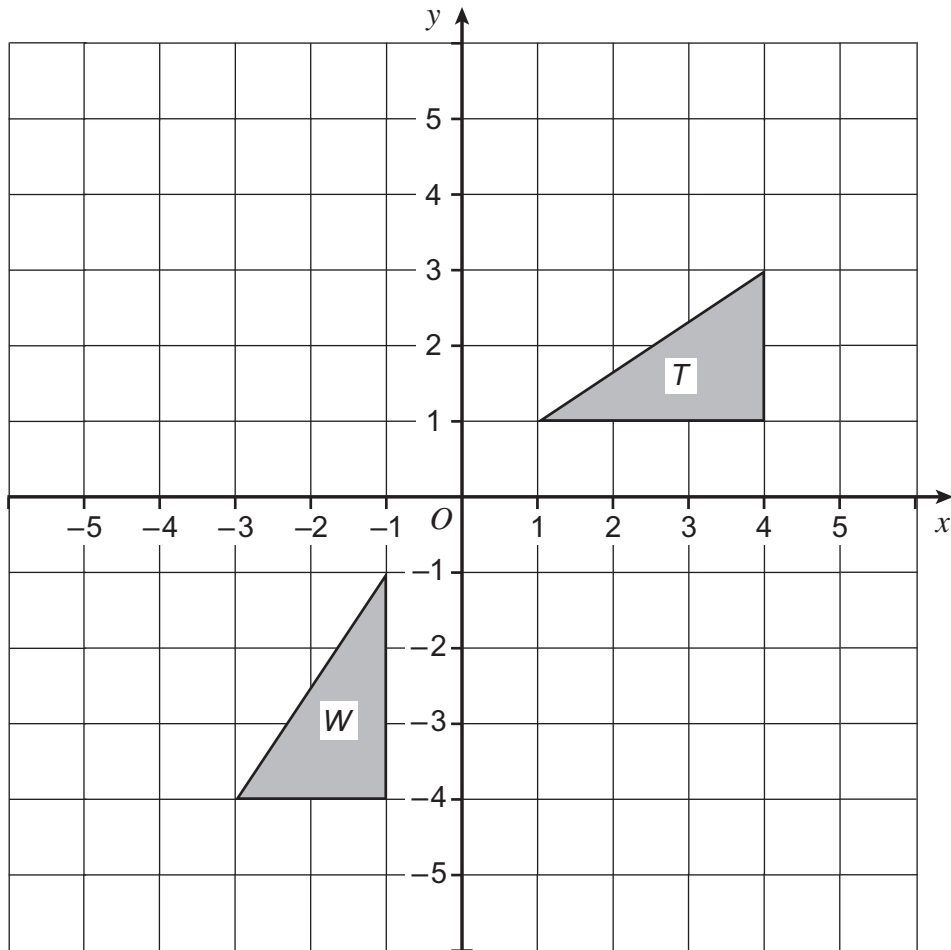
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Answer cm (1 mark)

Turn over for the next question



8

Triangles T and W are drawn on the grid.

- 8 (a) Draw the image of T after a 90° anticlockwise rotation about $(0, 1)$.

(3 marks)

- 8 (b) Describe fully the **single** transformation that maps triangle T onto triangle W .

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(2 marks)



9 (a) Simplify $m^6 \times m^4$

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Answer (1 mark)

9 (b) Simplify $\frac{h^{12}}{h^4}$

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Answer (1 mark)

10 Ruth, Sally and Jenny share £500 between them.
Jenny receives the smallest amount of £120
The ratio of Sally's share to Jenny's share is 4 : 3

Work out the ratio of Ruth's share to Sally's share.
Give your answer in its simplest form.

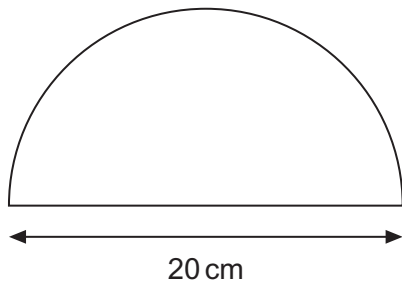
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Answer (4 marks)



11

These shapes have the same perimeter.
The semicircle has a diameter of 20 cm.
The rectangle has a length of 15 cm.



Not drawn
accurately

Work out the width of the rectangle, marked x on the diagram.
Use $\pi = 3.14$ in your calculations.

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Answer cm (4 marks)



- 12** Paul has two six-sided dice.
He knows that one is fair and one is biased.
Describe how he can find out which is the biased dice.

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(4 marks)

- 13 (a)** Solve the equation $5 + \frac{w}{6} = 2$

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Answer $w =$ (2 marks)

- 13 (b)** Make x the subject of the formula $y = 3x + 7$

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Answer (2 marks)

- 13 (c)** n is an integer.
List the values of n such that $-16 < 4n \leq 12$

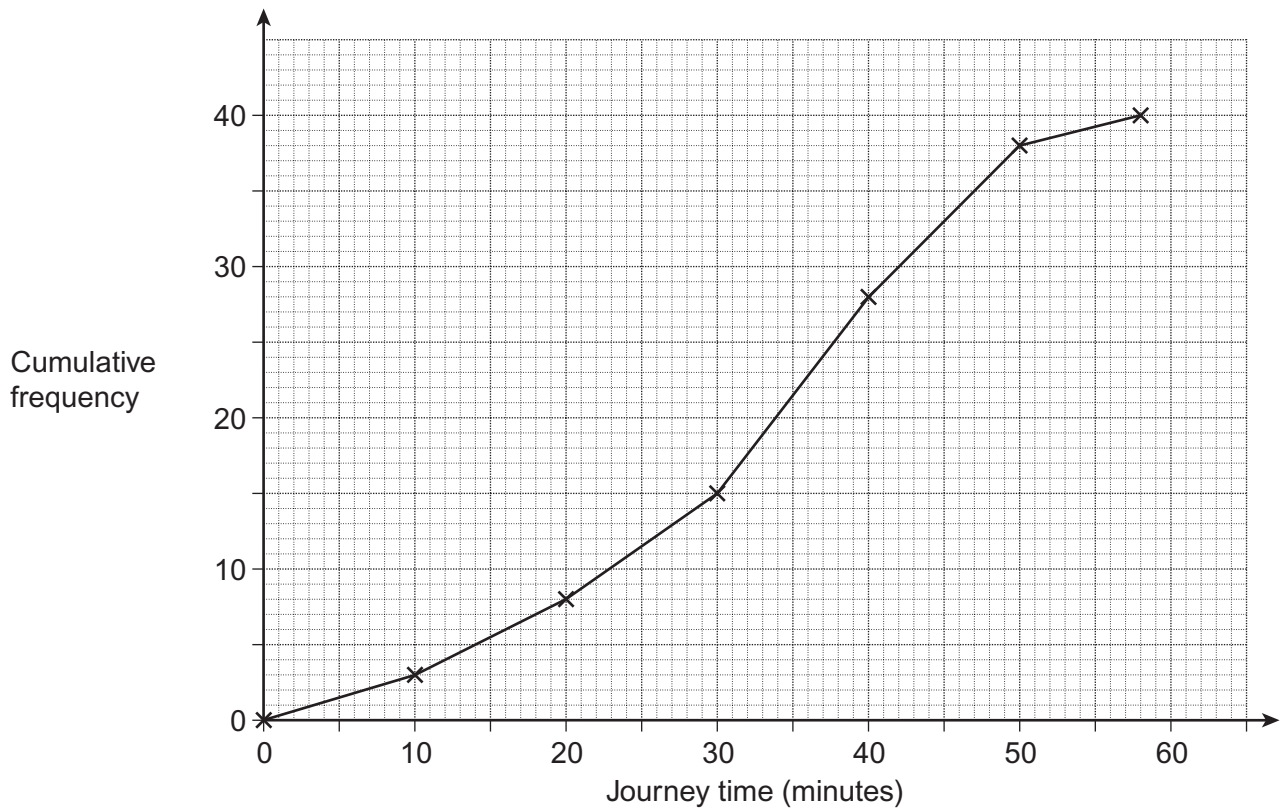
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Answer (2 marks)

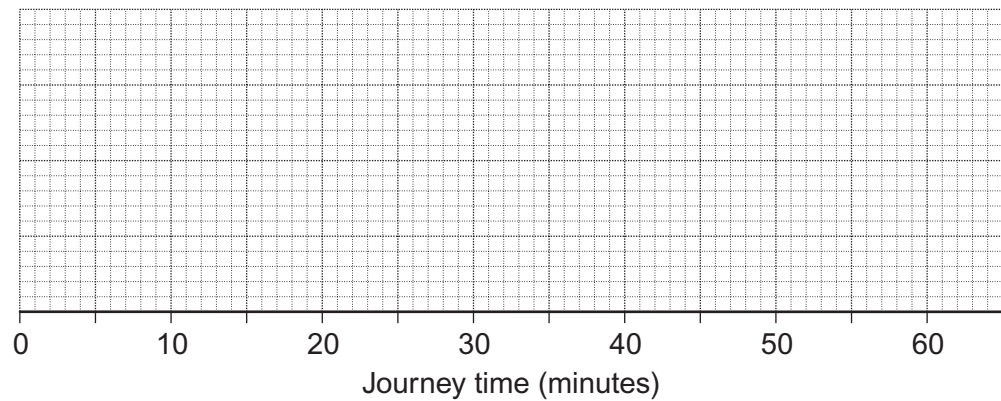


- 14** The cumulative frequency diagram shows the journey times, in minutes, of 40 people travelling to work.



- 14 (a)** The shortest journey time was 7 minutes.

Use the cumulative frequency diagram to draw a box plot of this information.



(3 marks)

- 14 (b)** Estimate the number of people who take longer than 45 minutes to travel to work.

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Answer

(1 mark)



- 14 (c)** Is it better to use the cumulative frequency diagram or the box plot to work out the answer to part (b)?
Give a reason for your answer.

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(1 mark)

- 15** Solve the simultaneous equations

$$\begin{aligned} 3x - 2y &= 5 \\ x &= y + 3 \end{aligned}$$

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

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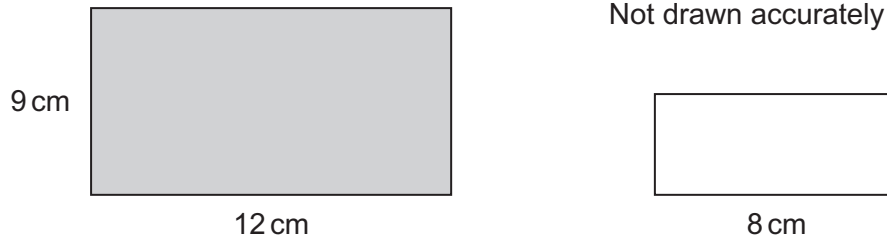
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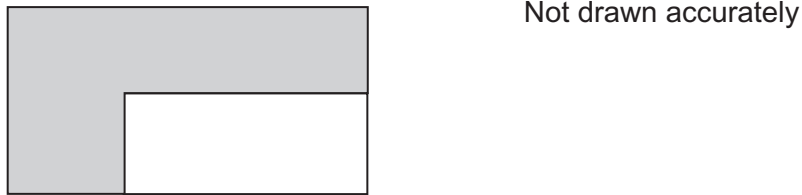
Answer (3 marks)



16 The diagram shows two similar rectangles.



The smaller rectangle is placed over the shaded rectangle, as shown.



Work out the shaded area that can still be seen.
State the units of your answer.

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Answer (5 marks)



17 (a) Work out $\frac{3 \times 10^7}{6 \times 10^4}$

Give your answer in standard form.

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Answer (2 marks)

17 (b) Work out $(4 \times 10^3)^2$

Give your answer in standard form.

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Answer (2 marks)

18 Write down the value of

18 (a) 19^0

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Answer (1 mark)

18 (b) 2^{-4}

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Answer (1 mark)



19

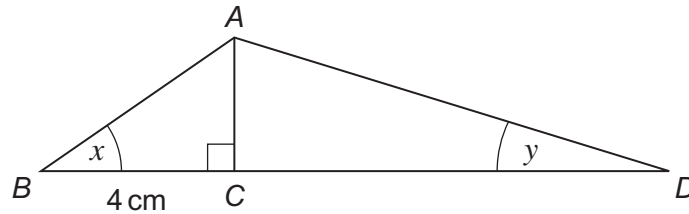
In the diagram, BCD is a straight line and angle ACB is a right angle.

$$BC = 4 \text{ cm}$$

$$\tan x = 0.6$$

$$\sin y = \frac{1}{3}$$

Not drawn accurately



Work out the length of AD .

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Answer cm (3 marks)



20 (a) Factorise $4n^2 + 8n + 3$

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Answer (2 marks)

20 (b) Using the answer to part (a), or otherwise, work out the prime factors of 483

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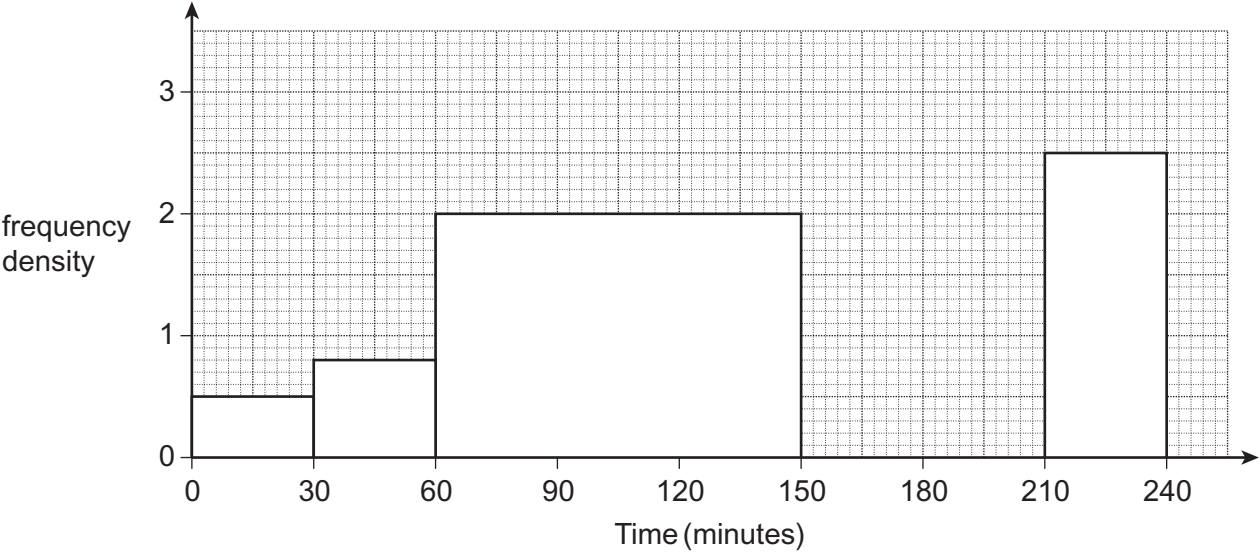
Answer (2 marks)

Turn over for the next question



21 The time shoppers spent in a shopping-centre car park is recorded.
The frequency table and the histogram show this information in different ways.

Time (minutes)	Number of vehicles
$0 < t \leq 30$	15
$30 < t \leq 60$	
$60 < t \leq 150$	180
$150 < t \leq 210$	90
$210 < t \leq 240$	75



21 (a) Fill in the missing number in the frequency table and complete the histogram.

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(2 marks)

21 (b) Estimate how many vehicles were in the car park for between 120 and 180 minutes.

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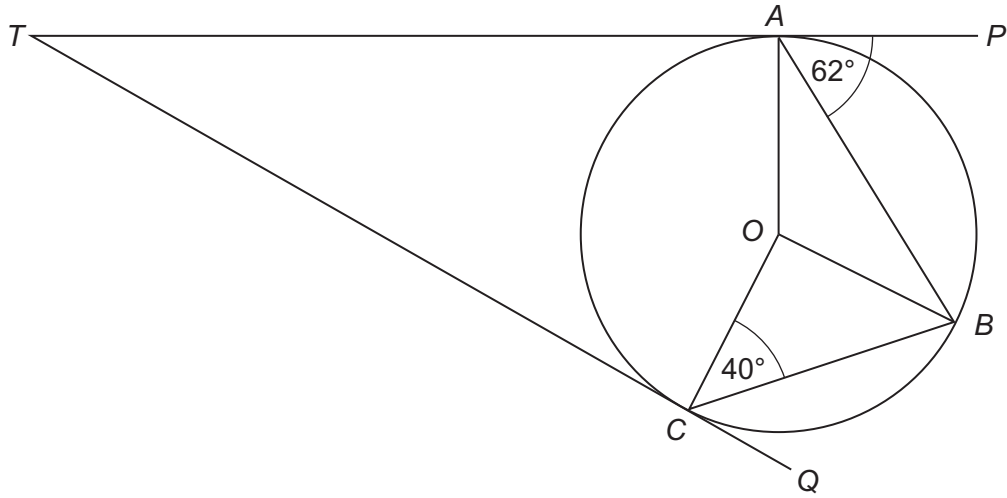
Answer (2 marks)



22

In the diagram, TAP and TCQ are tangents to a circle, centre O .
 B lies on the circumference of the circle.
 Angle $BAP = 62^\circ$
 Angle $OCB = 40^\circ$

Not drawn accurately



22 (a)

Work out the size of angle AOC .
 Show your working.

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Answer degrees (3 marks)

22 (b)

Work out the size of angle ATC .
 Show your working.

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Answer degrees (2 marks)



- 23** Show clearly that the mean and median of $\sqrt{3}$, $\sqrt{12}$, $\sqrt{48}$ and $\sqrt{75}$ are equal.

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(5 marks)

- 24** Given that $x^2 + ax + b \equiv (x - 5)^2 + a$

work out the values of a and b .

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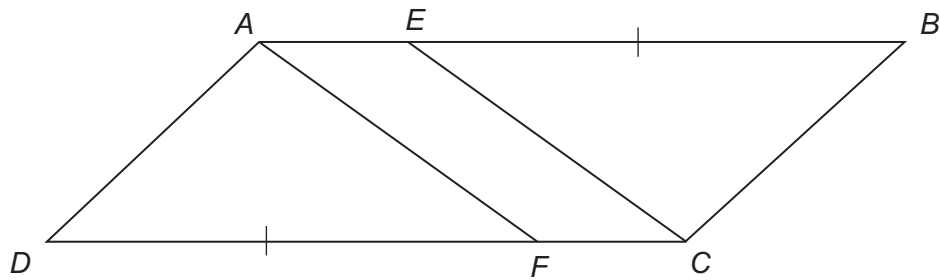
Answer $a =$ $b =$ (3 marks)



25

 $ABCD$ is a parallelogram. E and F are points on AB and CD such that $BE = DF$

Not drawn accurately



25 (a) Prove that triangles BCE and DAF are congruent.

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(4 marks)

25 (b) Deduce that EC is parallel to AF .

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(2 marks)

END OF QUESTIONS



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