

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier
November 2011

Mathematics (Specification A)

4306/2H

H

Paper 2 Calculator

Monday 14 November 2011 9.00 am to 11.00 am

For this paper you must have:

- mathematical instruments
- 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.

For Examiner's Use

Examiner's Initials

Pages

Mark

3

4–5

6–7

8–9

10–11

12–13

14–15

16–17

18–19

20–21

TOTAL



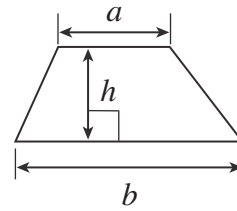
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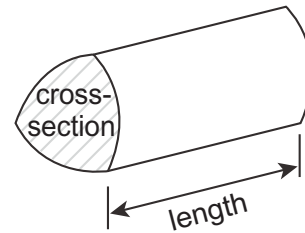
4306/2H

Formulae Sheet: Higher Tier

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

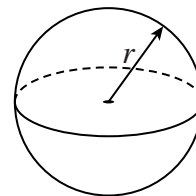


Volume of prism = area of cross-section \times length



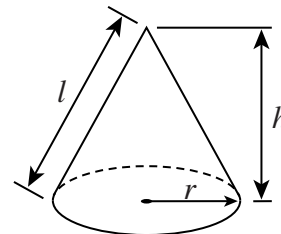
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

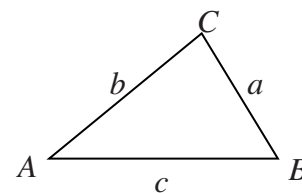


In any triangle ABC

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** All workers in a company are given a pay rise of 2.5%.

What is the new salary of a manager who earns £34 600 per year?

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Answer £ (3 marks)

- 2** Here is some information about a group of 40 teenagers.

- There are 4 more boys than girls.
- One-third of the girls are vegetarians.

Use this information to complete the two-way table.

	Boys	Girls	Total
Vegetarian			10
Non-vegetarian			30
Total			40

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(3 marks)

Turn over for the next question



3 Given that $v = u + at$

3 (a) work out the value of v if $u = 3$, $a = -10$ and $t = 7$

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Answer (2 marks)

3 (b) work out the value of a if $v = 7.3$, $u = 5.1$ and $t = 5$

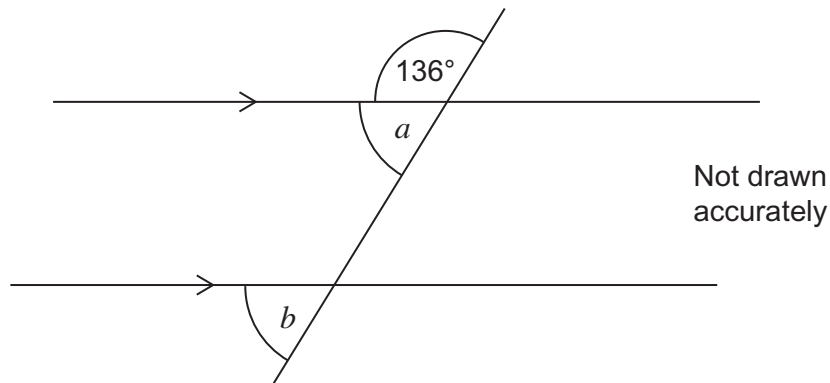
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Answer (2 marks)

4



4 (a) Work out the value of angle a .

.....

Answer degrees (1 mark)

4 (b) (i) Work out the value of angle b .

Answer degrees (1 mark)

4 (b) (ii) Choose the correct word from the list to complete the sentence.

opposite **alternate** **corresponding** **interior**

Angle a and angle b are angles. (1 mark)



- 5** Julia has a 'pay as you go' contract for her mobile phone.
Voice calls cost 7p per minute.
Texts cost 10p each.

- 5 (a)** In August, Julia paid £15
She made 120 minutes of voice calls.
How many texts did she send?

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Answer (2 marks)

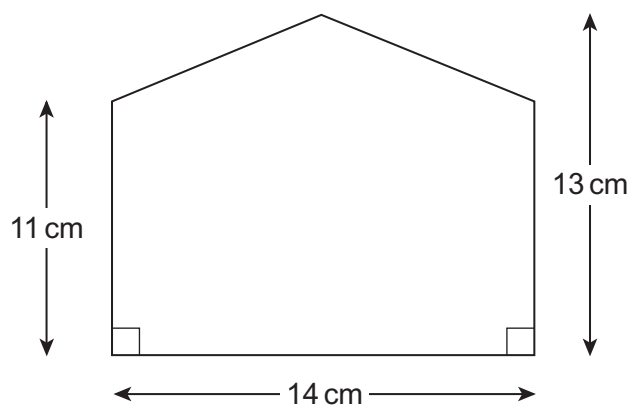
- 5 (b)** In September, Julia made 140 minutes of voice calls.
She sent twice the number of texts that she sent in August.
How much did she pay that month?

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Answer £ (2 marks)

- 6** This shape is symmetrical.



Work out the area of the shape.

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Answer cm^2 (3 marks)



7 (a) Expand $6(3x - 2)$

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Answer (1 mark)

7 (b) Expand and simplify $4(2x + 1) - 3(x - 4)$

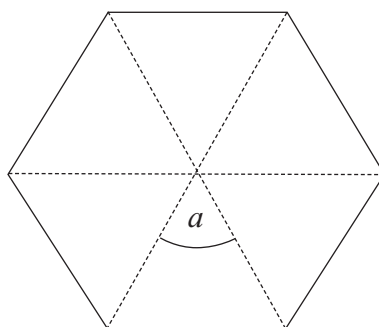
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Answer (2 marks)

8 (a) The diagram shows a regular hexagon.



8 (a) (i) Show clearly why angle $a = 60^\circ$.

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(1 mark)

8 (a) (ii) Work out the sum of the interior angles of a hexagon.

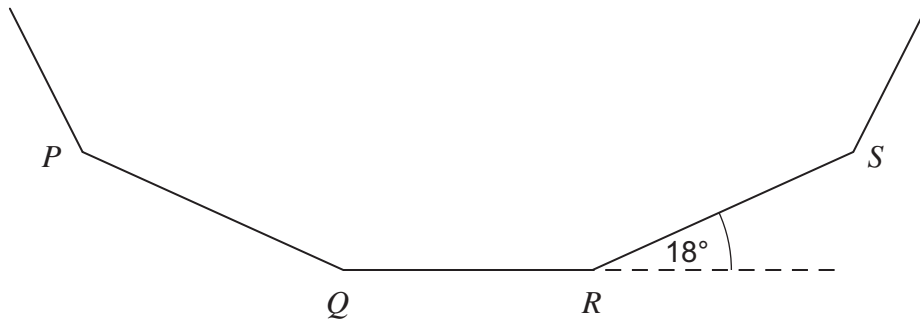
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Answer degrees (2 marks)



- 8 (b)** P, Q, R and S are four vertices of a regular polygon.
Each exterior angle is 18°



Not drawn
accurately

Work out the number of sides of the polygon.

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Answer (2 marks)

- 9 (a)** Two numbers a and b are less than 15
The Least Common Multiple (LCM) of a and b is 24

Give one possible pair for the two numbers, a and b .

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Answer $a =$ and $b =$ (2 marks)

- 9 (b)** Two numbers x and y are each between 10 and 20
The Highest Common Factor (HCF) of x and y is 3

Give one possible pair for the two numbers, x and y .

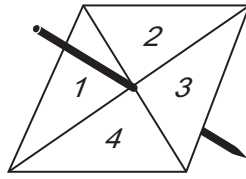
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Answer $x =$ and $y =$ (2 marks)



- 10** A homemade four-sided spinner is known to be biased.



The table shows the probabilities of getting each score.

Score	1	2	3	4
Probability	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{7}{20}$	$\frac{1}{4}$

- 10 (a)** What is the probability of landing on a 1 or a 2?

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Answer (1 mark)

- 10 (b)** The spinner is spun 400 times.

How many times would you expect it to land on a 3?

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Answer (2 marks)



11 (a) Solve $6x - 1 = 2x + 4$

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Answer $x =$ (3 marks)

11 (b) Solve $\frac{2y - 5}{3} = \frac{4y - 1}{2}$

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Answer $y =$ (4 marks)

Turn over for the next question



- 12** A company reduces the prices of its new cars by 8%.
After the reduction a car costs £24 288

What was the price of this car before the reduction?

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Answer £ (3 marks)

- 13 (a)** The wavelength of blue light is 0.000 000 475 metres.
Write 0.000 000 475 in standard form.

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Answer (1 mark)

- 13 (b)** Calculate $2.4 \times 10^9 + 1.7 \times 10^8$
Give your answer in standard form.

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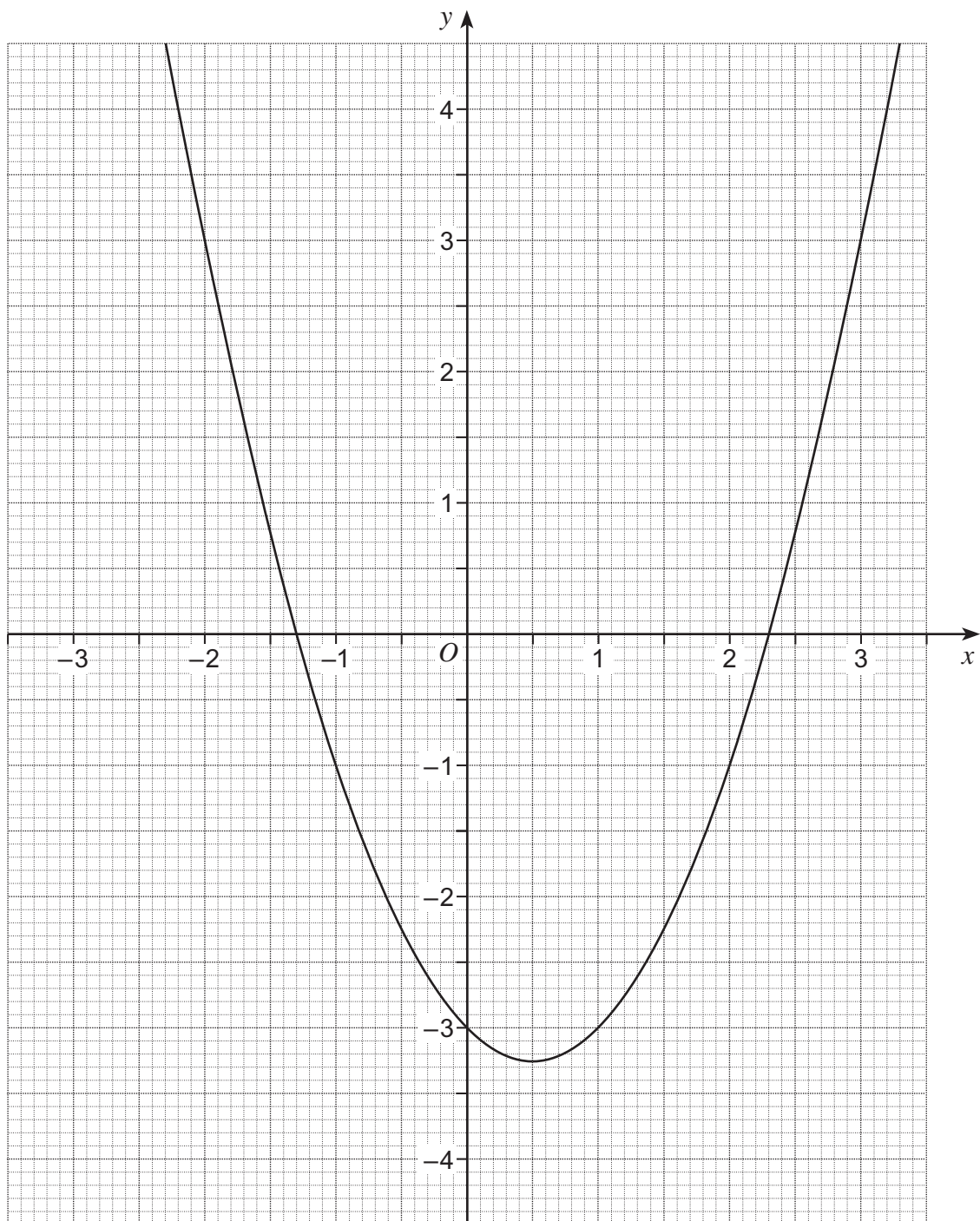
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Answer (2 marks)



- 14** The graph of $y = x^2 - x - 3$ is shown on the grid.



- 14 (a)** Write down the value of y when $x = 1.5$

Answer (1 mark)

- 14 (b)** Write down the values of x when $y = -1$

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Answer (2 marks)



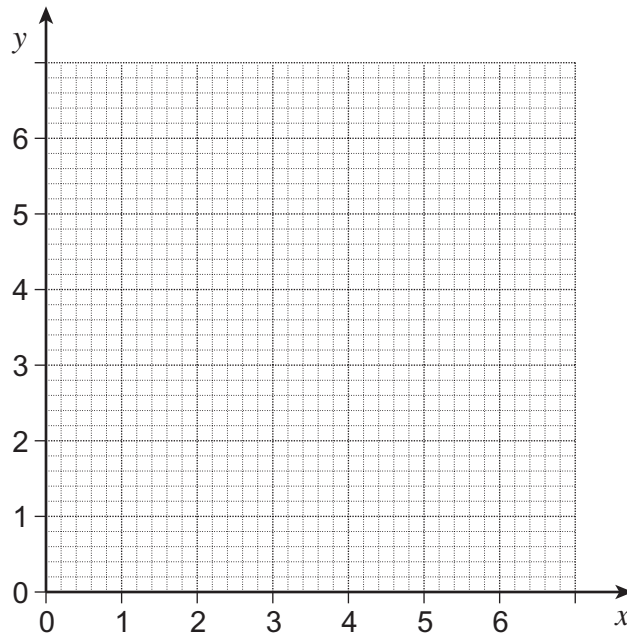
- 15 On the grid, draw lines to find the region satisfied by the three inequalities

$$y \geq 1$$

$$y \leq x + 1$$

$$x + y \leq 5$$

Label the region with the letter R.



(3 marks)

- 16 Solve $2x^2 + 4x - 7 = 0$

Give your answers to 2 decimal places.
You must **not** use trial and improvement.

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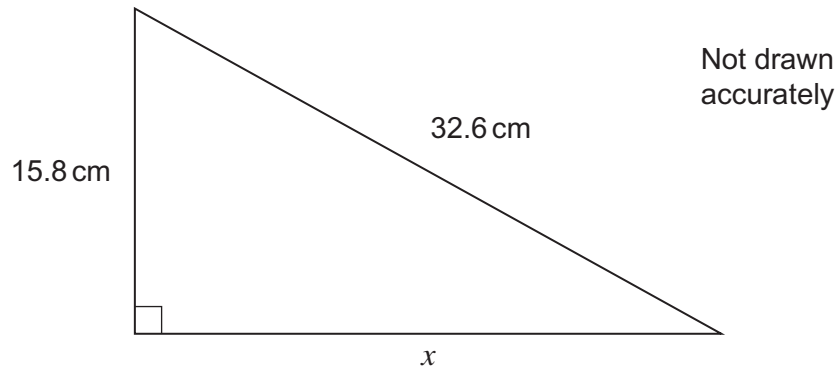
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Answer (3 marks)



- 17 (a)** Work out the length x in this triangle.
Give your answer to an appropriate degree of accuracy.



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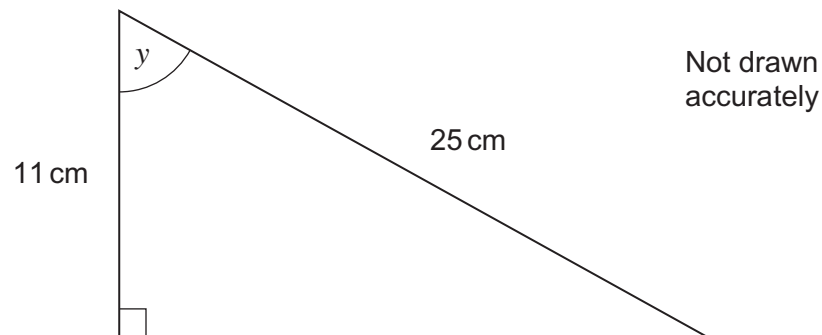
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Answer cm (4 marks)

- 17 (b)** Work out the value of angle y in this triangle.



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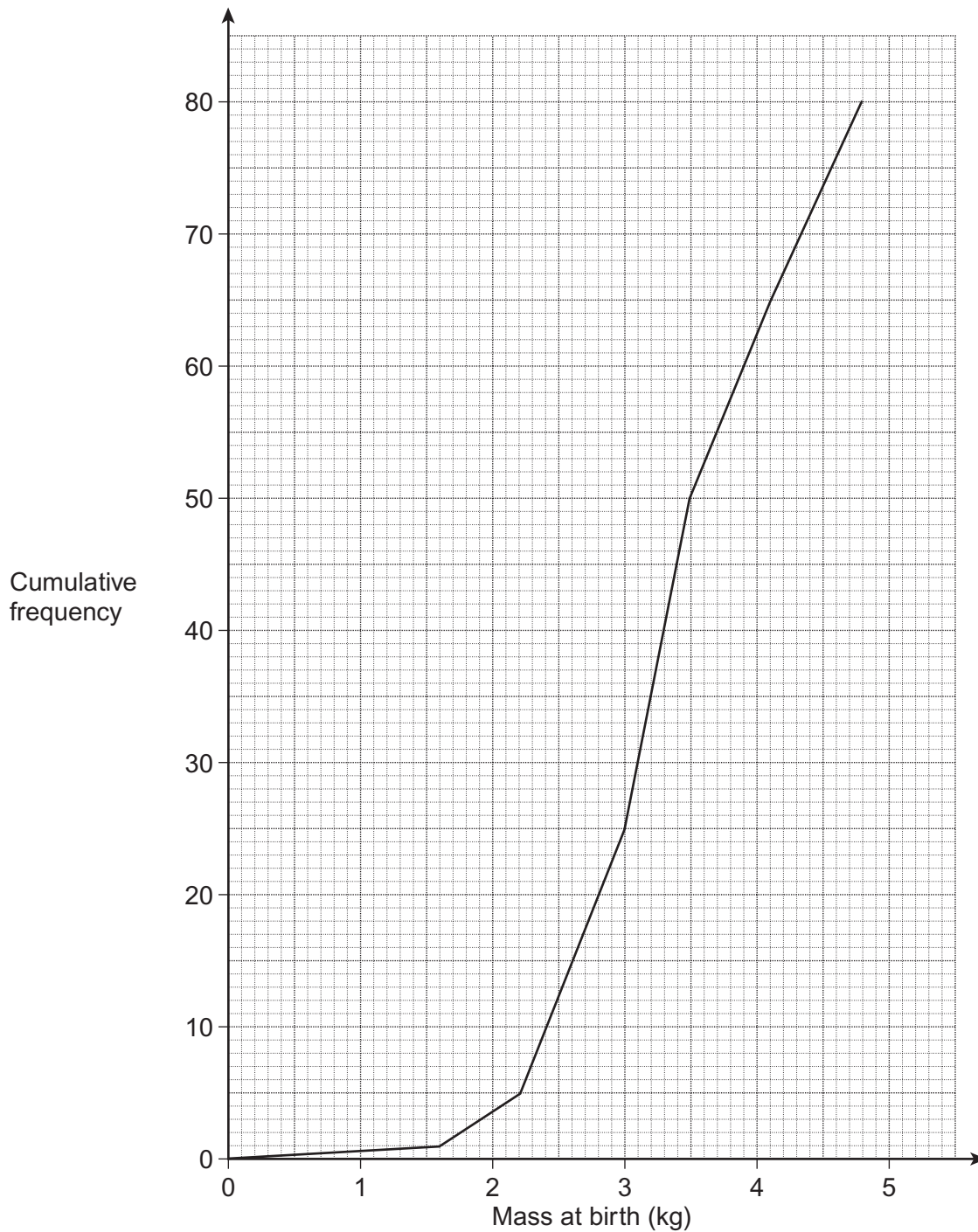
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Answer degrees (3 marks)



- 18** The cumulative frequency diagram shows the mass at birth of 80 babies born in a hospital in Europe.



- 18 (a)** How many babies had a mass at birth of 3.5 kg or less?

Answer (1 mark)

- 18 (b)** What is the median mass at birth?

Answer kg (1 mark)



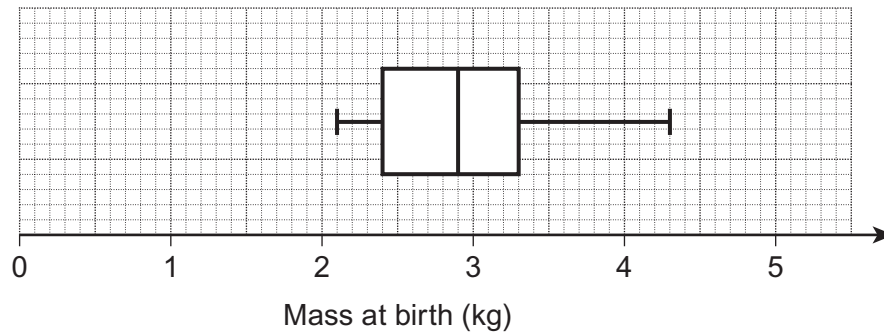
- 18 (c)** What is the interquartile range of the masses at birth?

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Answer kg (2 marks)

- 18 (d)** The box plot shows the masses at birth of 80 babies born in a hospital in Africa.



Use the data to give **two** comparisons between the masses at birth of babies in Europe and in Africa.

Comparison 1

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Comparison 2

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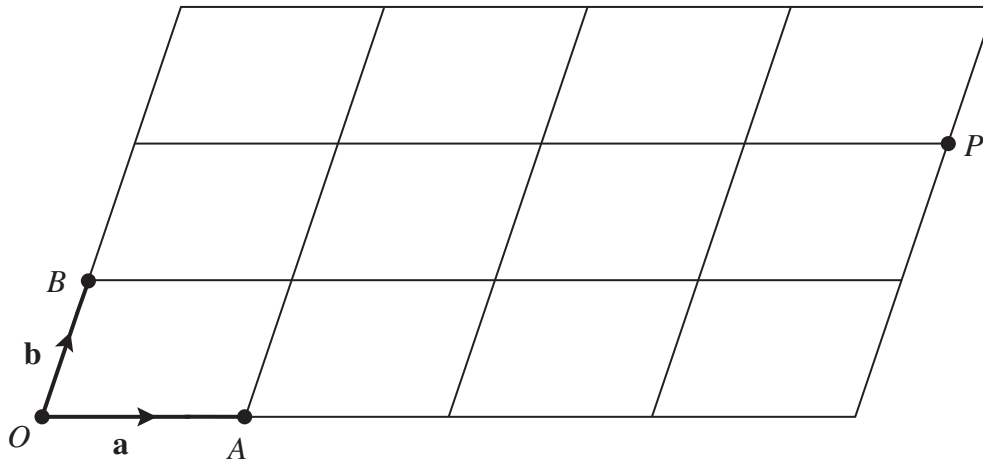
(3 marks)

Turn over for the next question



19

On the parallelogram grid below, $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.
Point P is also shown.



- 19 (a) On the grid, mark the point Q such that $\vec{OQ} = 2\mathbf{a} + \mathbf{b}$. (1 mark)

- 19 (b) Write down, in terms of \mathbf{a} and \mathbf{b} , the vector \vec{OP} .

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Answer (1 mark)

- 19 (c) N is the point such that $\vec{ON} = 15\mathbf{a} - 7\mathbf{b}$.
 M is the point such that $\vec{OM} = 45\mathbf{a} - 21\mathbf{b}$.

- 19 (c) (i) Give a reason why the points O , N and M lie on a straight line.

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(1 mark)

- 19 (c) (ii) Write down the ratio of the lengths $ON : NM$

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Answer (1 mark)



20

Simon is training for a 10-kilometre race.
He runs around the edge of a football pitch.
The length of the pitch is 105 m, measured to the nearest metre.
The width of the pitch is 76 m, measured to the nearest metre.

How many times should Simon run round the pitch to run at least 10 kilometres?
You **must** show your working.

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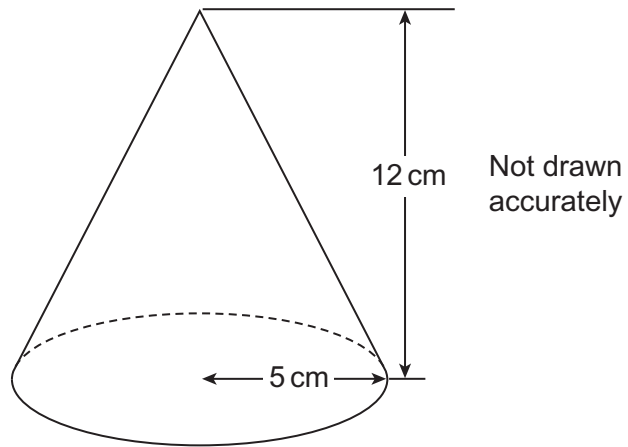
Answer (4 marks)

Turn over for the next question



21

A cone has a base radius of 5 cm and a vertical height of 12 cm.



Calculate the **total** surface area of the cone.

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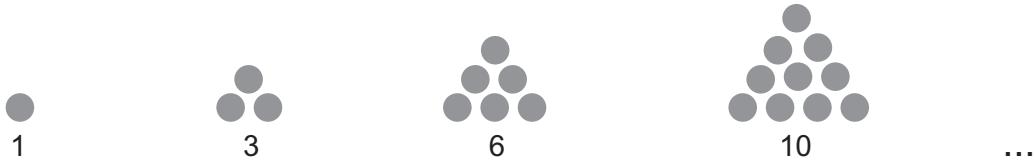
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Answer cm^2 (4 marks)



22 The triangle number sequence starts



22 (a) Write down the next term of the sequence.

Answer (1 mark)

22 (b) The n^{th} triangle number is given by the formula

$$\frac{1}{2} n (n + 1)$$

22 (b) (i) Work out the value of the 100th triangle number.

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Answer (1 mark)

22 (b) (ii) When you add two consecutive triangle numbers you always get a square number.

For example $6 + 10 = 16 = 4^2$

Prove this result algebraically.

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(4 marks)

23 Ernie plays **two** games of chess against a computer.

The computer has three skill levels: low, intermediate and high.

The computer always starts at the **intermediate** skill level.

Ernie knows that he wins 2 out of every 5 games when the computer is set at this level.

If Ernie wins the first game the computer resets to the **high** skill level.

Ernie knows that his chances of winning are halved when the computer is set at this level.

If Ernie does **not** win the first game the computer resets to the **low** skill level.

Ernie knows that his chances of winning are doubled when the computer is set at this level.

23 (a) What is the probability that Ernie wins both games?

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Answer (2 marks)

23 (b) What is the probability that Ernie wins at least one of the two games he plays?

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Answer (3 marks)



24 Solve the simultaneous equations

$$y = x - 3$$

$$x^2 + y^2 = 17$$

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Answer (6 marks)

END OF QUESTIONS



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