

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
MATHEMATICS SYLLABUS A**

**J512/03**

Paper 3  
(Higher Tier)

**Monday 18 May 2009  
Afternoon**

**Duration: 2 hours**

Candidates answer on the question paper

**OCR Supplied Materials:**

None

**Other Materials Required:**

- Geometrical instruments
- Tracing paper (optional)



Candidate Forename		Candidate Surname	
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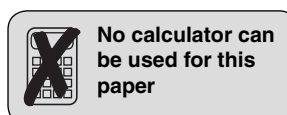
Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Show your working. Marks may be given for a correct method even if the answer is incorrect.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

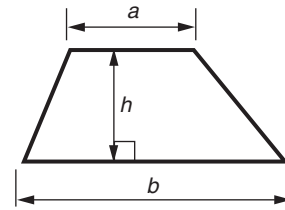
**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **100**.
- This document consists of **20** pages. Any blank pages are indicated.

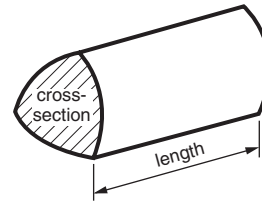


## Formulae Sheet: Higher Tier

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



**Volume of prism** = (area of cross-section) x length

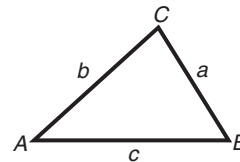


**In any triangle ABC**

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

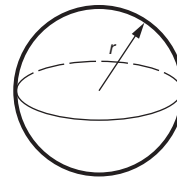
**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

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



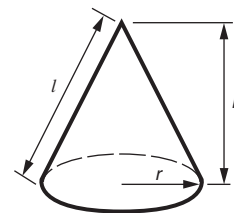
**Volume of sphere**  $= \frac{4}{3} \pi r^3$

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



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

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



**The Quadratic Equation**

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

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

**PLEASE DO NOT WRITE ON THIS PAGE**

- 1 Mr Smith did a survey of how students travelled to school. He displayed his results in a table.

Complete the table.

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	Bus	Walk	Car	Total
Boys	21		13	57
Girls		8		
Total	40			100

[3]

- 2 A jacket can be bought in a shop or online.

Shop price

Jacket, usually £75

Sale,  $\frac{1}{5}$  off

Online price

Jacket £50

plus 15% postage and packing

Which method of buying the jacket is cheaper, and by how much?  
Show all your working clearly.

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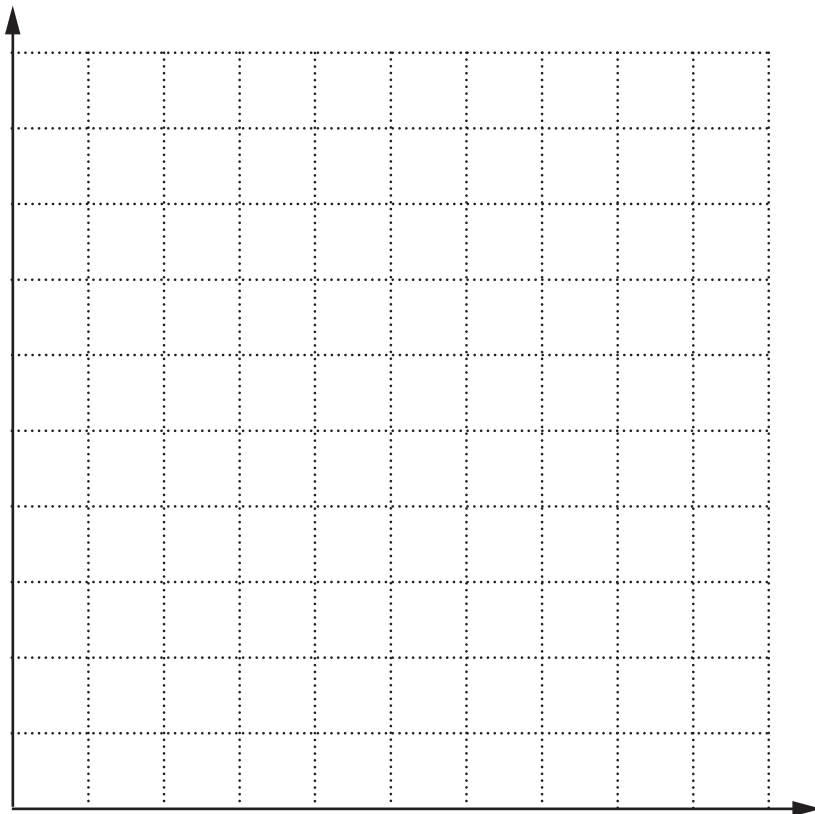
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\_\_\_\_\_ is cheaper by £\_\_\_\_\_ [5]

- 3 (a) The table shows the distribution of waiting times (in minutes) that customers spent at the checkout of a supermarket.

Waiting time (minutes)	Frequency
0 up to 2	8
2 up to 4	19
4 up to 6	11
6 up to 8	6
8 up to 10	3

- (i) Draw a grouped frequency diagram to show this information. Show your scales and label your axes clearly.



[3]

(ii) Write down the modal class for these waiting times.

(a)(ii) \_\_\_\_\_ minutes [1]

(iii) One of these customers is chosen at random.

What is the probability that this customer waited 6 minutes or more?

.....  
.....

(iii) \_\_\_\_\_ [2]

(b) At the supermarket, Jack is doing a survey about eating sweets. This is his questionnaire.

*'How many chocolate bars do you eat?'*

<input type="checkbox"/>	A few	<input type="checkbox"/>	A lot
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(Please tick one box.)

Write down two things that are wrong with Jack's questionnaire.

1 \_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_ [2]

- 4 (a) Show that  $x = 2$  is the solution of this equation.

$$9x - 1 = 4x + 9$$

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**(b)** \_\_\_\_\_ **[2]**

- (b) Solve.

$$\frac{x}{2} - 3 = 5$$

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**(b)** \_\_\_\_\_ **[2]**

- 5 (a) In a carton of *Squashy*, orange juice and water are mixed in the ratio 3 : 7.

How many litres of orange juice are needed to make 60 litres of *Squashy*?

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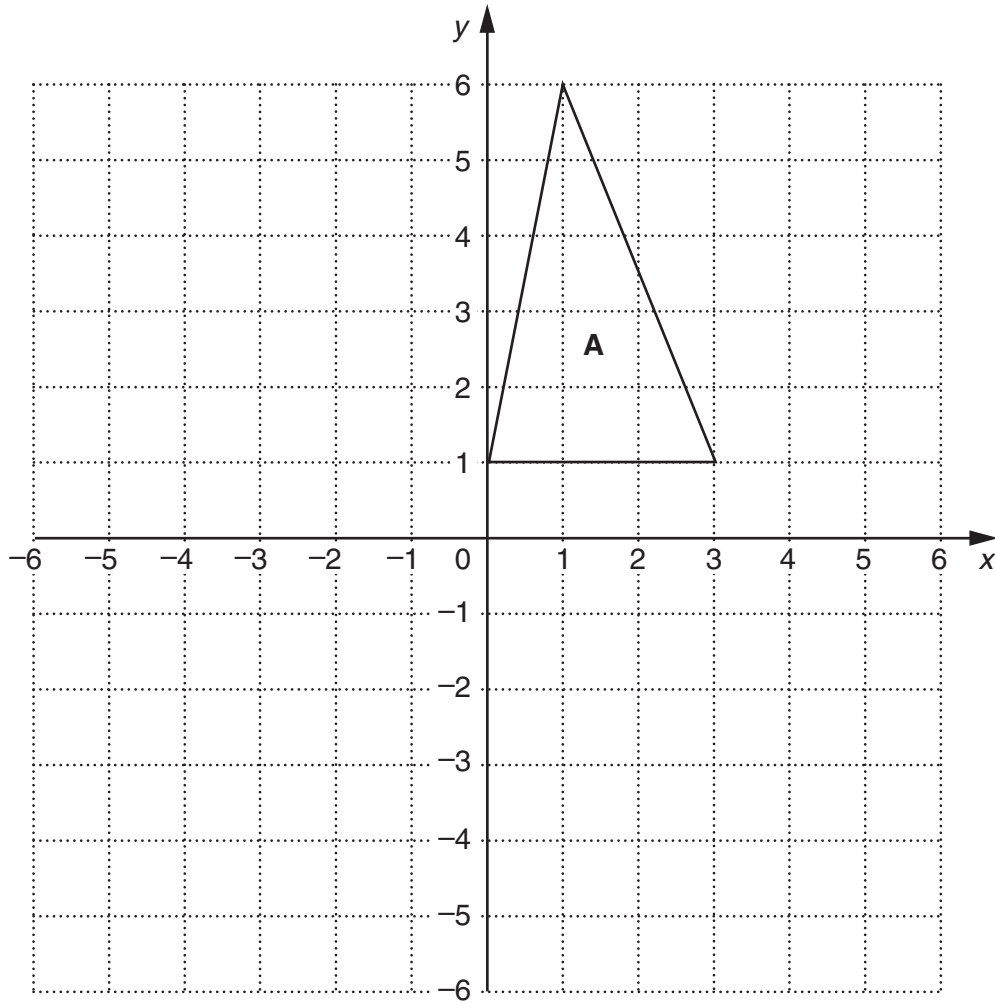
**(a)** \_\_\_\_\_ litres **[2]**

- (b) One carton contains 150 ml of *Squashy*, correct to the nearest millilitre.

What is the least possible amount of *Squashy* that could be contained in the carton?

**(b)** \_\_\_\_\_ ml **[1]**

6



- (a) Triangle **A** is drawn on a 1 cm square grid.

Work out the area of triangle **A**.

.....

.....

.....

(a) \_\_\_\_\_ cm<sup>2</sup> [2]

- (b) Reflect triangle **A** in the line  $x = 3$ .  
Label the image **P**.

[2]

- (c) Rotate triangle **A** 90° clockwise about (0,0).  
Label the image **Q**.

[3]

- 7 (a) List the integer values,  $n$ , which satisfy

$$3 < n \leq 7.$$

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(a) \_\_\_\_\_ [2]

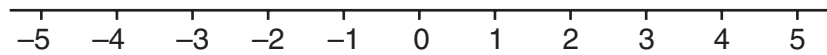
- (b) (i) Solve this inequality.

$$3x - 2 > 4$$

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(b)(i) \_\_\_\_\_ [2]

- (ii) Show your solution to part (i) on the number line below.



[1]



8 (a) Here are the first four terms of a sequence.

25    20    15    10

Find an expression for the  $n$ th term of this sequence.

.....  
 .....

(a) \_\_\_\_\_ [2]

(b) Here are the first four terms of another sequence.

1    4    9    16

The  $n$ th term of this sequence is  $n^2$ .

Write down an expression for the  $n$ th term of the following sequence.

3    6    11    18    .....

.....

(b) \_\_\_\_\_ [1]

9 As a product of prime factors,

$$24 = 2 \times 2 \times 2 \times 3.$$

(a) Write 40 as a product of prime factors.

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(a) \_\_\_\_\_ [2]

(b) (i) Work out the highest common factor (HCF) of 24 and 40.

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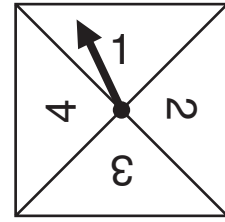
(b)(i) \_\_\_\_\_ [2]

(ii) Work out the least common multiple (LCM) of 24 and 40.

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(ii) \_\_\_\_\_ [2]

- 10 Jo wanted to know if this spinner was fair. She spun it a number of times.



The table shows her results.

Number	1	2	3	4
Frequency	115	129	132	124

- (a) What is the relative frequency of obtaining a 2?

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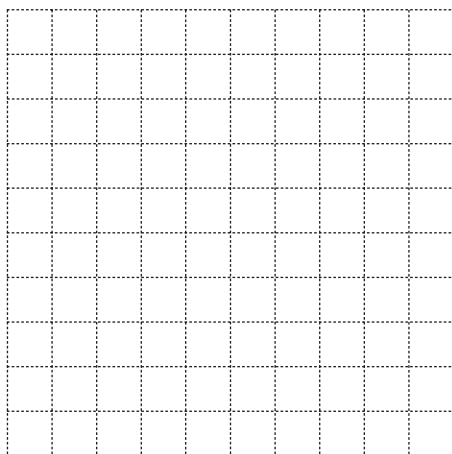
(a) \_\_\_\_\_ [2]

- (b) Do the results suggest that the spinner is fair? Give a reason for your answer.

\_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_ [1]

- 11 Work out the coordinates of the midpoint of the line joining the points (3,5) and (-1,7). You may use the grid to help you.



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( \_\_\_\_\_ , \_\_\_\_\_ ) [2]

12 (a) Multiply out.

$$5(3x - 4)$$

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 .....

(a) \_\_\_\_\_ [2]

(b) Factorise.

$$2a^2 + 8ab$$

.....  
 .....

(b) \_\_\_\_\_ [2]

(c) (i) Write down the value of  $3^0$ .

(c)(i) \_\_\_\_\_ [1]

(ii) Simplify.

$$\frac{8x^6y^5}{2x^4y}$$

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(ii) \_\_\_\_\_ [3]

(iii) Simplify.

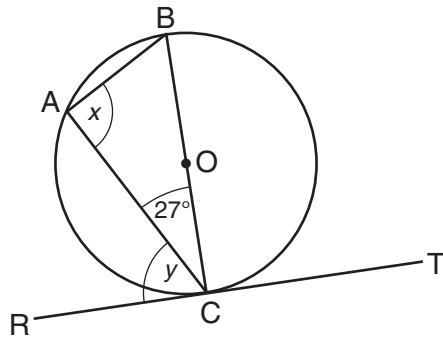
$$(7^3)^5$$

Give your answer as a power of 7.

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(iii) \_\_\_\_\_ [1]

- 13 (a) A, B and C are points on the circle, centre O.  
 RCT is a tangent to the circle.  
 BOC is a straight line.



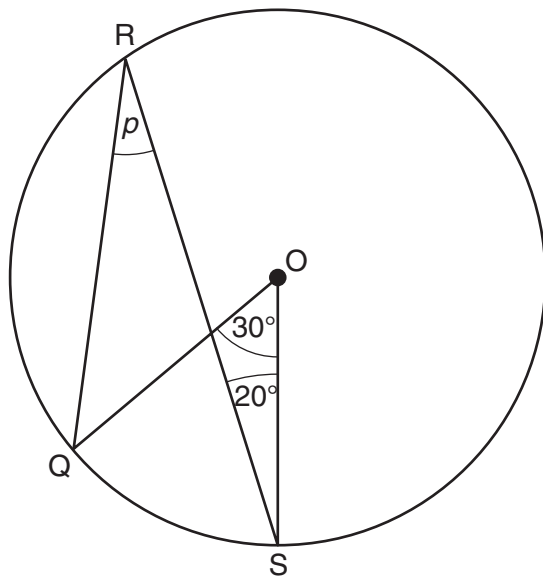
NOT TO SCALE

Complete each of these statements by giving a geometrical reason.

(i) Angle  $x = 90^\circ$  because \_\_\_\_\_  
 \_\_\_\_\_ [1]

(ii) Angle  $y = 63^\circ$  because \_\_\_\_\_  
 \_\_\_\_\_ [1]

- (b) (i) Q, R and S are points on a circle, centre O.



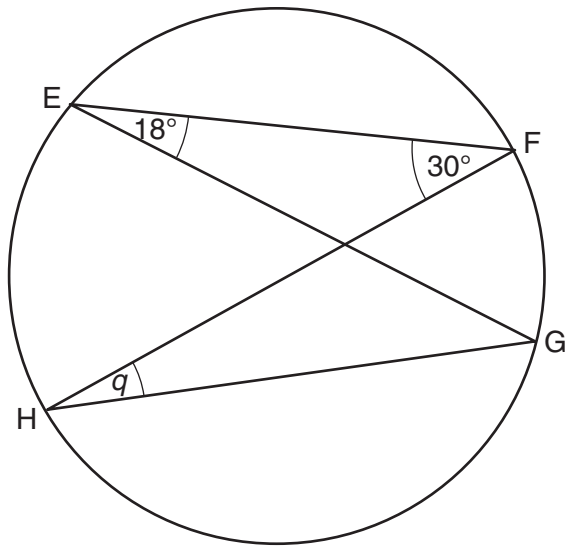
NOT TO SCALE

Work out the size of angle  $p$ .

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(b)(i) \_\_\_\_\_ ° [1]

(ii) E, F, G and H are points on a circle.

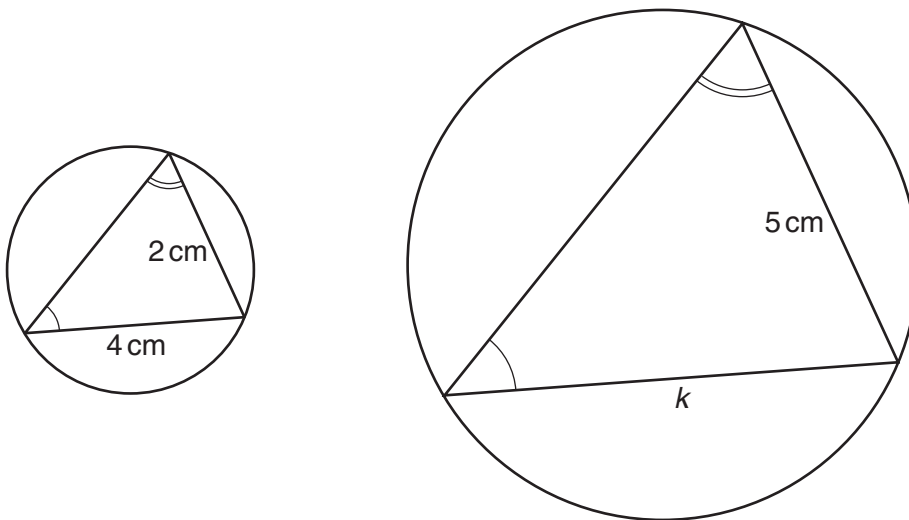


NOT TO SCALE

What is the size of angle  $q$ ?

(ii) \_\_\_\_\_ ° [1]

(c) These two triangles are similar.



NOT TO SCALE

Work out the length  $k$ .

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(c) \_\_\_\_\_ cm [2]

14 Work out.

$$2\frac{1}{2} \times 1\frac{2}{3}$$

Give your answer as a mixed number.

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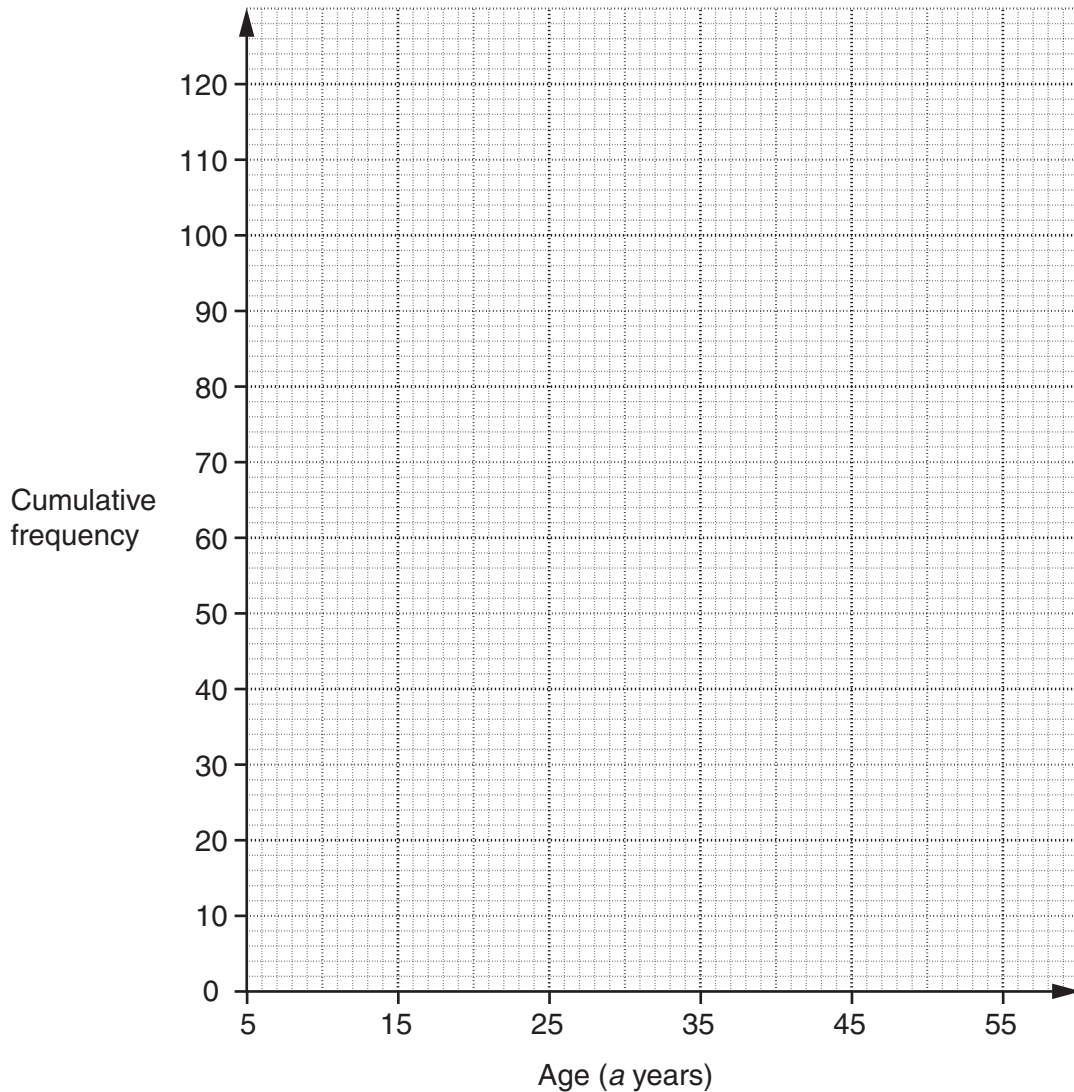
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\_\_\_\_\_ [3]

- 15 This cumulative frequency table shows the distribution of the ages of the members of an athletics club.

Age ( $a$ years)	$a \leq 5$	$a \leq 15$	$a \leq 25$	$a \leq 35$	$a \leq 45$	$a \leq 55$
Cumulative frequency	0	36	99	112	117	120

- (a) On the grid below, draw a cumulative frequency diagram for these ages.



[3]

- (b) Use the cumulative frequency diagram to estimate the median age of the members.

(b) \_\_\_\_\_ years [1]

- (c) Geoff says “Not many of the members are over 40.”

Explain why Geoff is correct.

\_\_\_\_\_  
 \_\_\_\_\_ [1]

16 (a) Factorise and solve.

$$x^2 - 2x - 15 = 0$$

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(a) \_\_\_\_\_ [3]

(b) Solve.

$$3x^2 - 12 = 0$$

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(b) \_\_\_\_\_ [3]

(c) Show that the equation  $(2x - 1)^2 = 9 - 6x^2$  can be simplified to

$$5x^2 - 2x - 4 = 0.$$

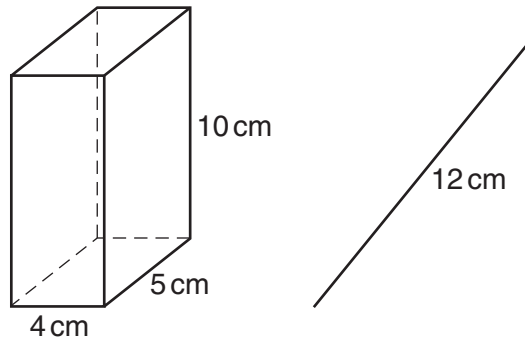
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[3]



17

17 An empty box is a cuboid with internal measurements 4 cm by 5 cm by 10 cm.



Is it possible to fit a thin, straight rod that is 12 cm long entirely inside the box?  
Use calculations to show how you decide.

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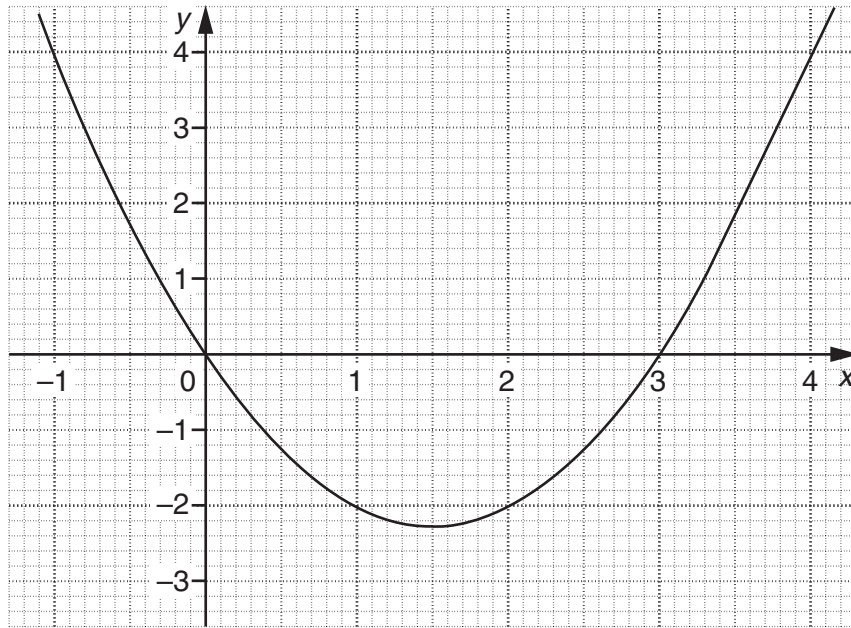
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[4]



19 The diagram shows the graph of  $y = x^2 - 3x$ .



(a) By drawing a suitable straight line on this diagram, solve the equation

$$x^2 - 3x = x - 1.$$

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(a) \_\_\_\_\_ [3]

(b) Find the equation of the line that would need to be drawn on the grid to solve the equation  $x^2 - 5x + 2 = 0$ .

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(b)  $y =$  \_\_\_\_\_ [2]

**TURN OVER FOR QUESTION 20**

