OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

MATHEMATICS SYLLABUS A

J512/03

Paper 3
(Higher Tier)

OCE/10698

Candidates answer on the question paper

OCR Supplied Materials:
None

Other Materials Required:
- Geometrical instruments
- Tracing paper (optional)

Monday 18 May 2009
Afternoon

Duration: 2 hours

J512/03

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

MODIFIED LANGUAGE

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.

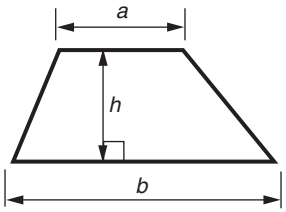
INFORMATION FOR CANDIDATES

- 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.

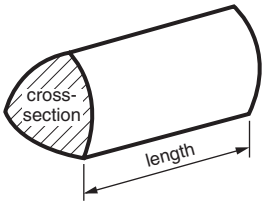
No calculator can be used for this paper

Formulae Sheet: Higher Tier

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



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

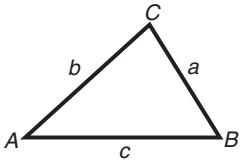


In any triangle *ABC*

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

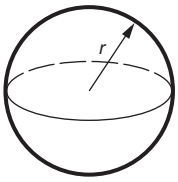
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



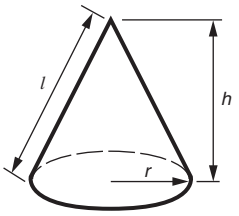
Volume of sphere $= \frac{4}{3}\pi r^3$

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.
The table shows some of the results.

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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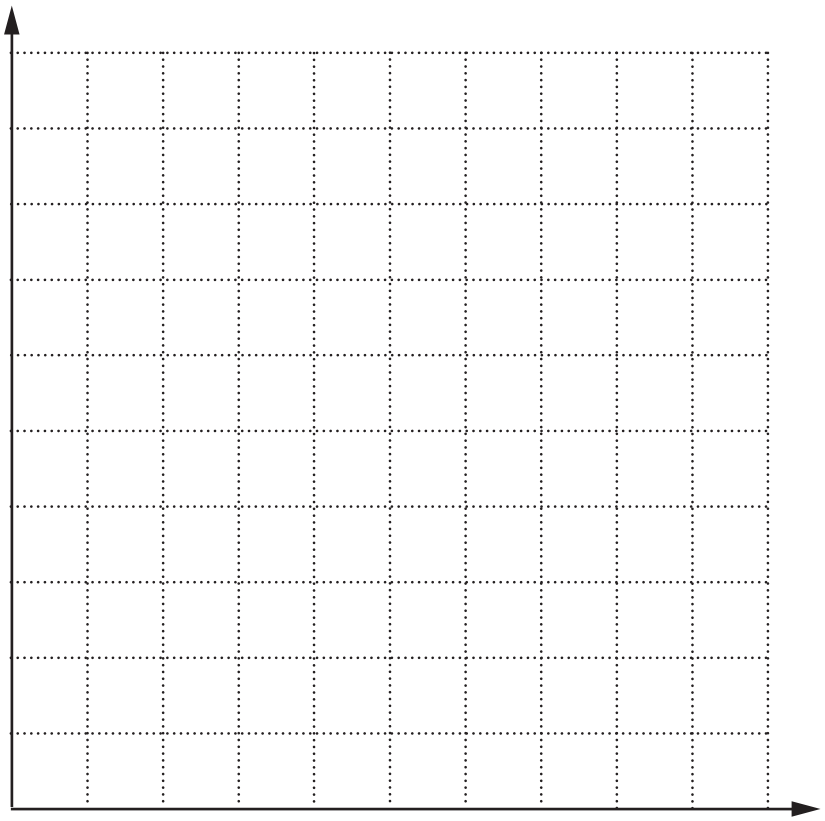
_____ is cheaper by £_____ **[5]**

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?'

☐ A few ☐ A lot

(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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_____

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_____ **[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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.....

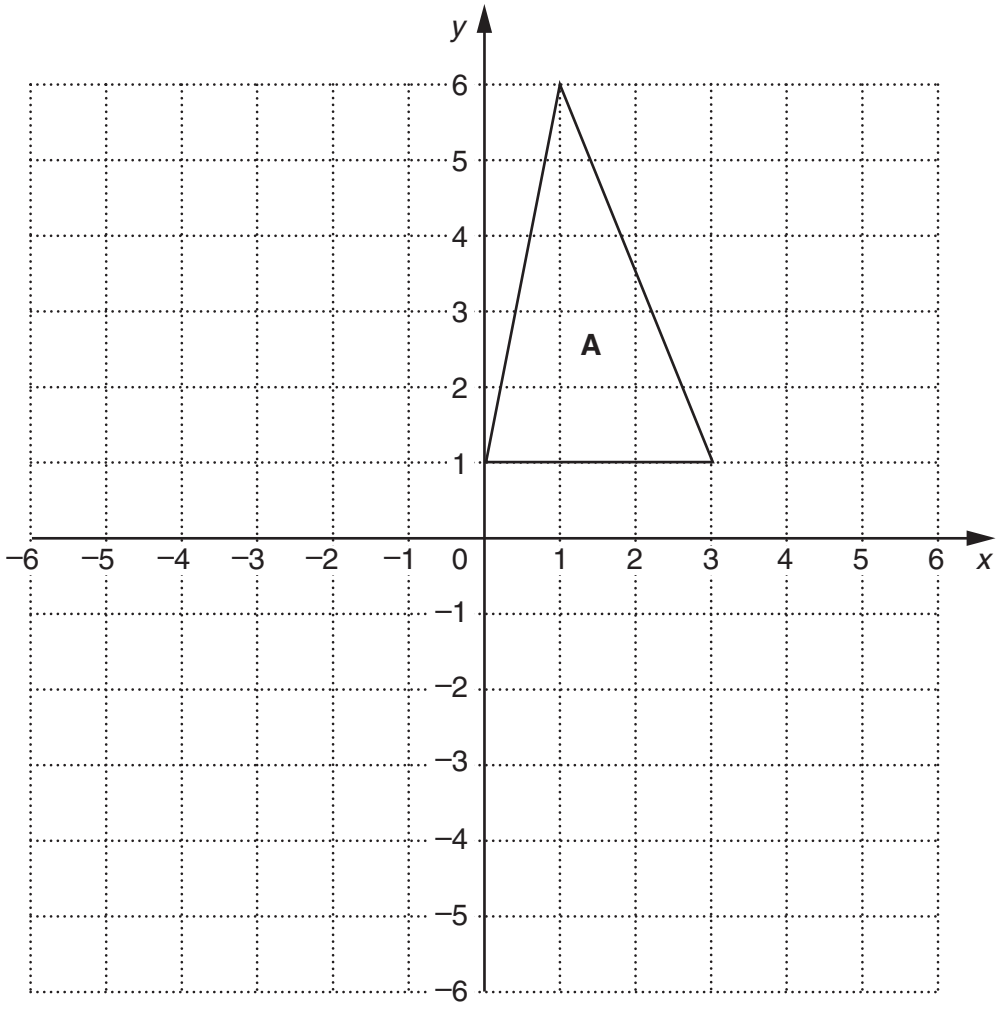
(a) _____ litres **[2]**

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

What is the least possible amount of *Squashy* that could be 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**.

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(a) _____ cm^2 **[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

$$3 < n \leqslant 7.$$

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(a) _____ **[2]**

(b) **(i)** Solve this inequality.

$$3x - 2 > 4$$

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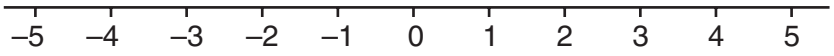
(b)(i) _____ **[2]**

(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 nth term of this sequence.

.....

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(a) _____ **[2]**

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

1 4 9 16

The nth term of this sequence is n^2.

Write down an expression for the nth 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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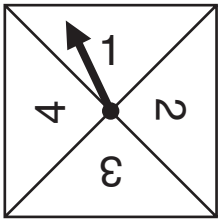
(ii) _____ **[2]**

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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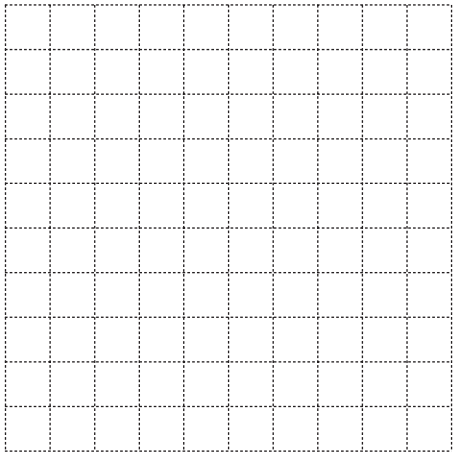
(a) _____ **[2]**

(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.

$2a^2 + 8ab$

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(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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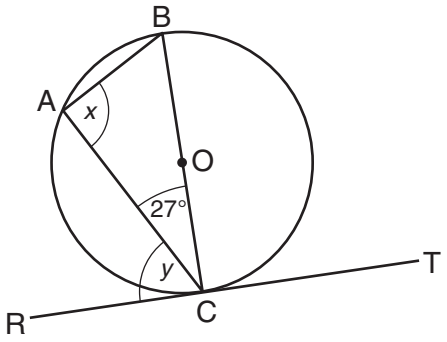
(iii) _____ **[1]**

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.

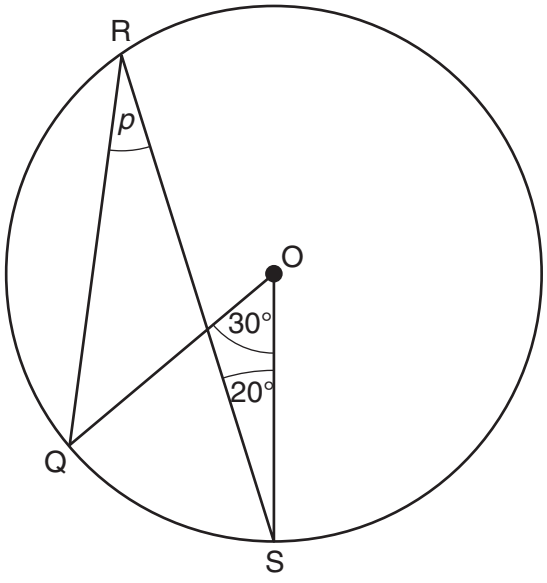
(i) Angle $x = 90°$ because _____

_____ **[1]**

(ii) Angle $y = 63°$ 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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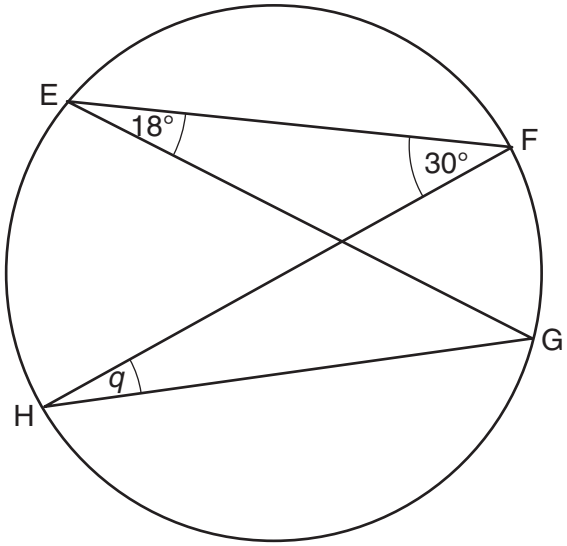
(b)(i) _____ ° **[1]**

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

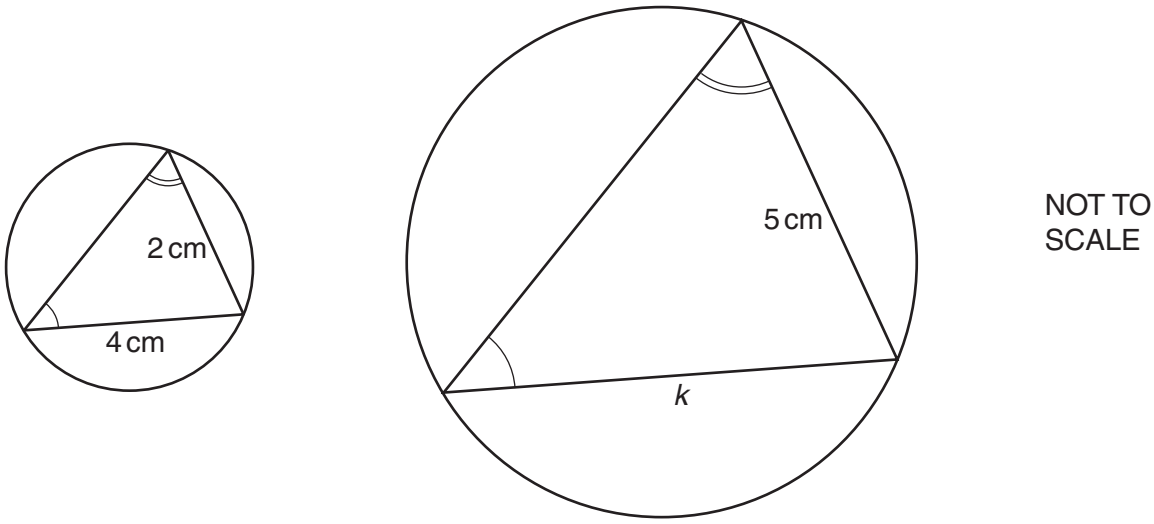


NOT TO SCALE

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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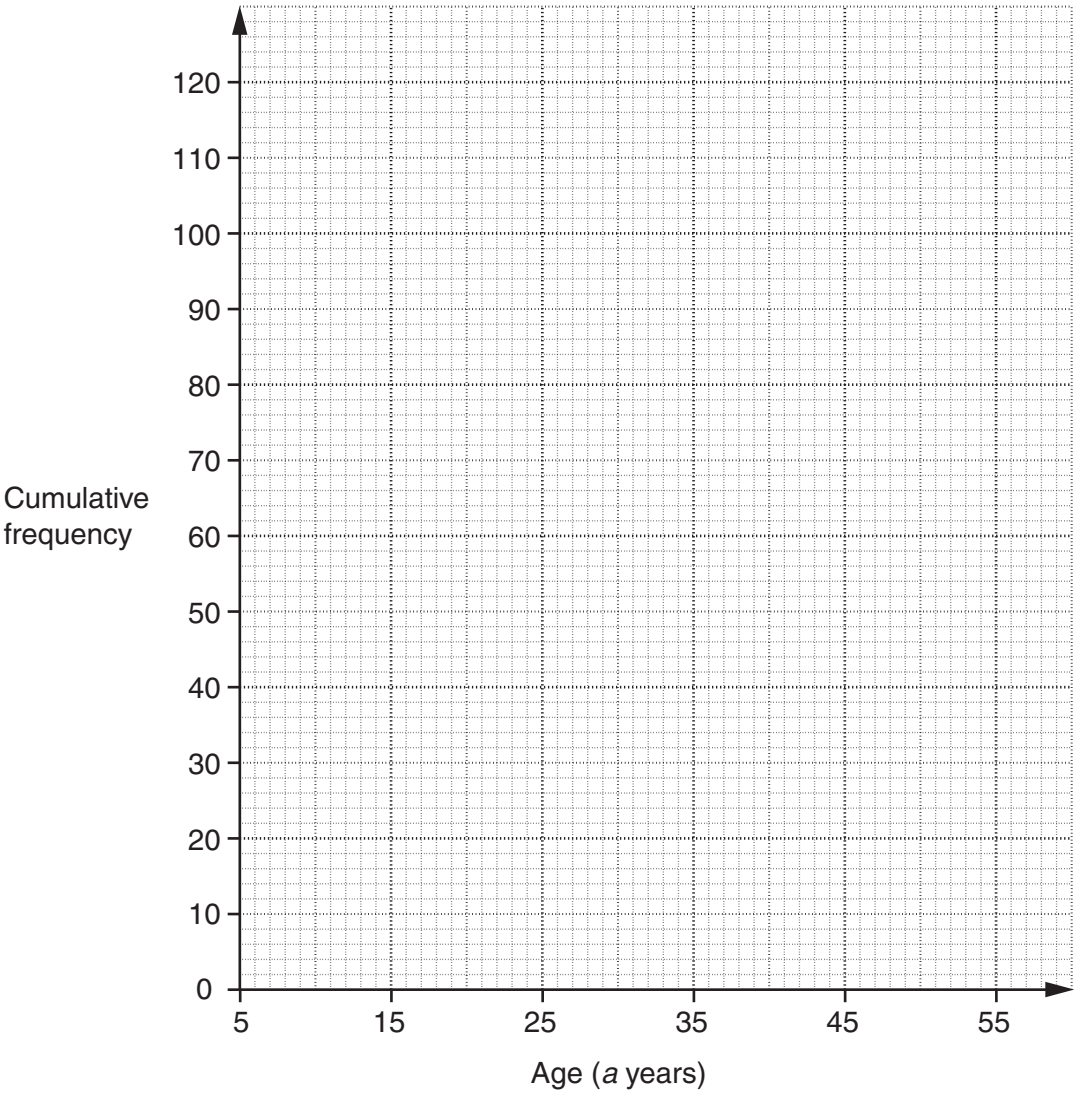
_____ **[3]**

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

Age (a years)	$a \leqslant 5$	$a \leqslant 15$	$a \leqslant 25$	$a \leqslant 35$	$a \leqslant 45$	$a \leqslant 55$
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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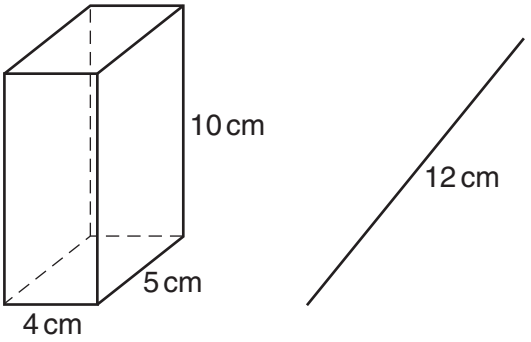
_____ **[3]**

17 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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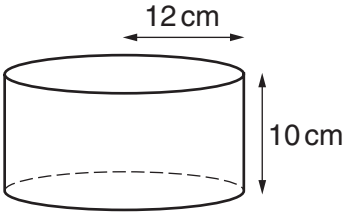
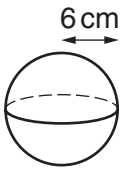
_____ **[4]**

18 In this question, do not substitute a numerical value for π.

A solid metal cylinder has radius 12 cm and height 10 cm.





The cylinder is melted down and all of the metal made into solid spheres of radius 6 cm.

Work out how many of these spheres are made.
Show your working clearly.

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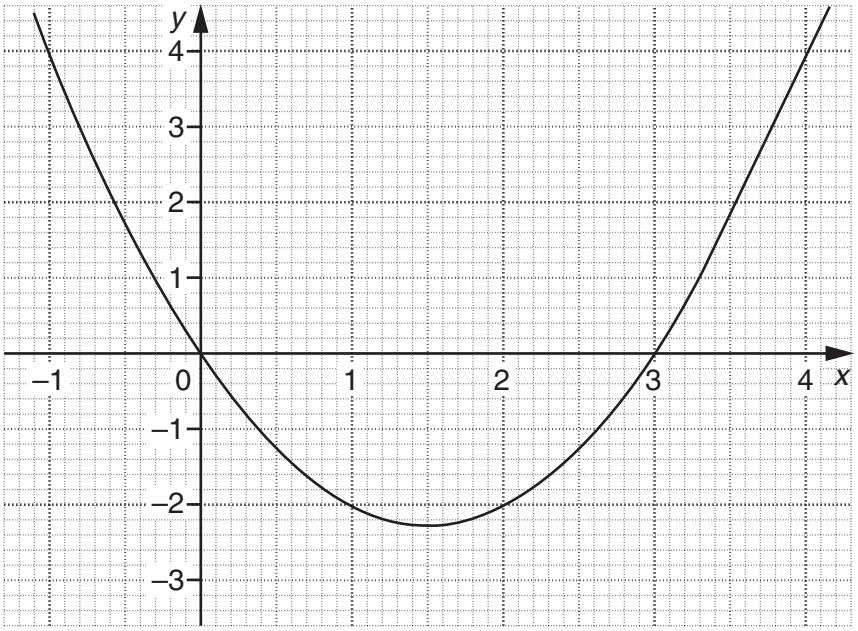
_____ **[6]**

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

20 There are 11 boys and 9 girls in a school maths club.
Two members of the club are chosen at random to represent the school in a competition.

Work out the probability that the two members chosen are of the same sex.

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_____ **[4]**