Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

J512/03

MATHEMATICS SYLLABUS A

Paper 3
(Higher Tier)

MONDAY 18 MAY 2009: Afternoon
DURATION: 2 hours

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Geometrical instruments
Tracing paper (optional)

WARNING
No calculator can be used for this paper.

READ INSTRUCTIONS OVERLEAF

DC (SM/JG) OV91020 14788/2

INSTRUCTIONS TO CANDIDATES

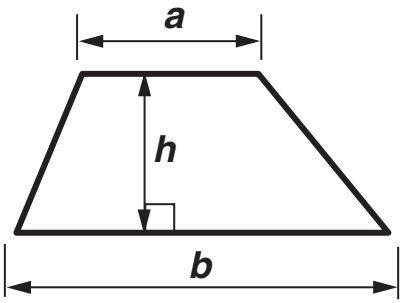
- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Show your working. Marks may be given for a correct method even if the answer is incorrect.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

INFORMATION FOR CANDIDATES

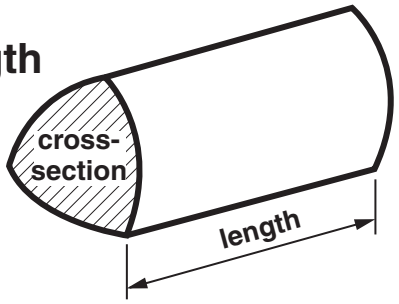
- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 100.**

Formulae Sheet: Higher Tier

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

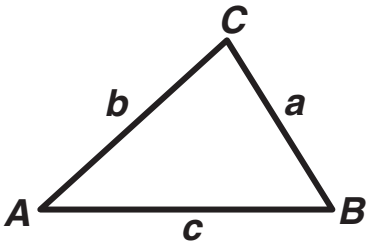


Volume of prism = (area of cross-section) × length



In any triangle ABC

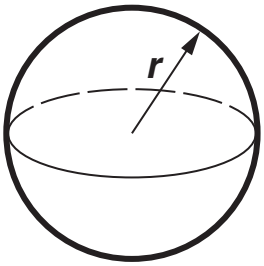
Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$



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

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

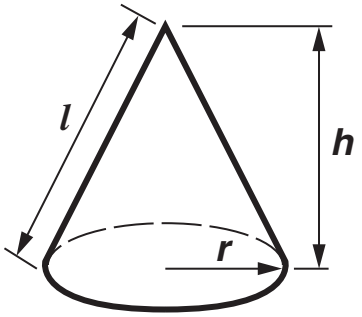
Volume of sphere $= \frac{4}{3}\pi r^3$



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

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

Curved surface area of cone $= \pi rl$



The Quadratic Equation

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

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

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

Complete the table.

_____

_____

_____

	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	**Online price**
Jacket, usually £75	**Jacket £50**
Sale, $\frac{1}{5}$ off	**plus 15% postage and packing**

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

_____

_____

_____

_____

_____

_____

_____

_____

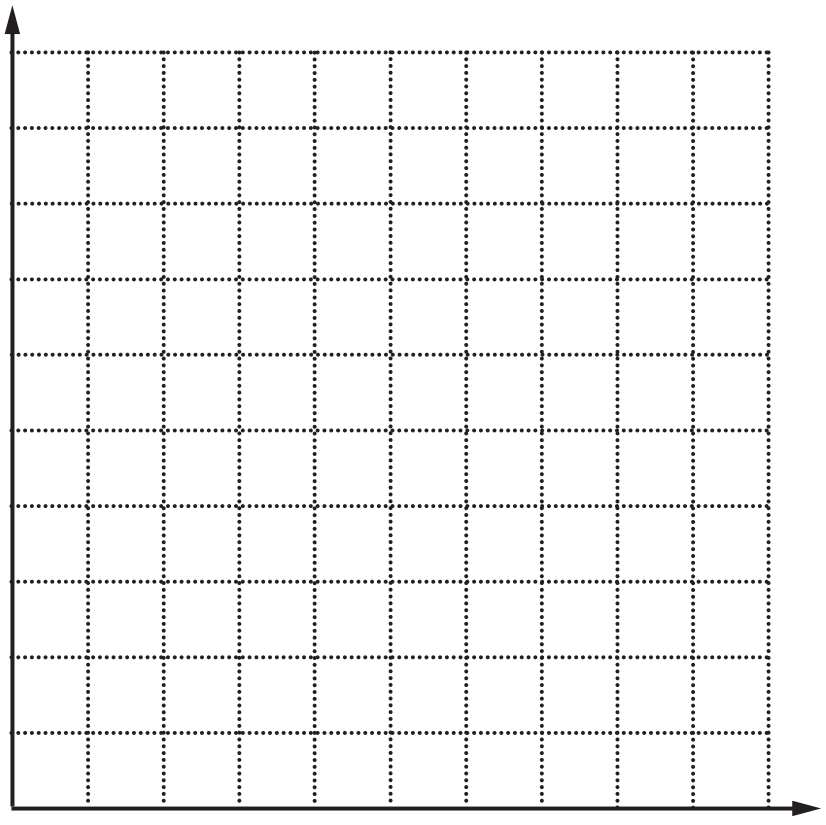
_____ is cheaper by

£ _____ [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.

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

[2]

(b) Solve.

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

(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*?

_____

_____

_____

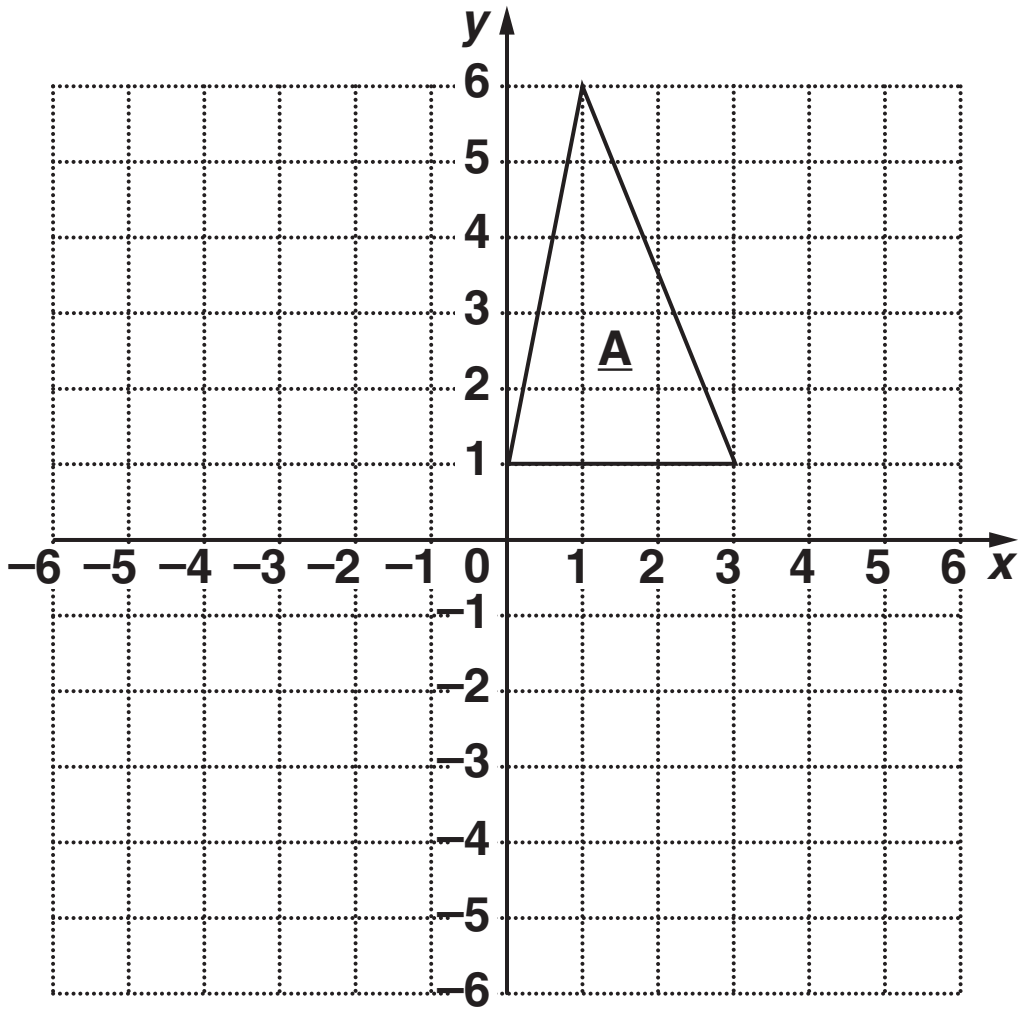
(a) _____ litres [2]

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



(a) Work out the area of triangle A.

_____

_____

_____

(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

$3 < n \leqslant 7$.

_____

_____

(a) _____ [2]

(b) (i) Solve this inequality.

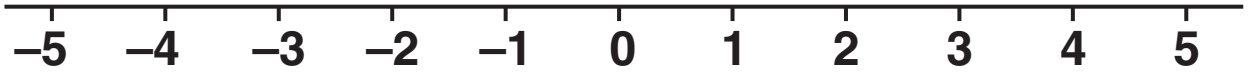
$3x - 2 > 4$

_____

_____

(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.

_____

_____

(a) _____ [2]

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

_____

_____

(b)(i) _____ [2]

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

_____

_____

(ii) _____ [2]

10 Jo wanted to know if a spinner, numbered from 1 to 4, 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?

_____

_____

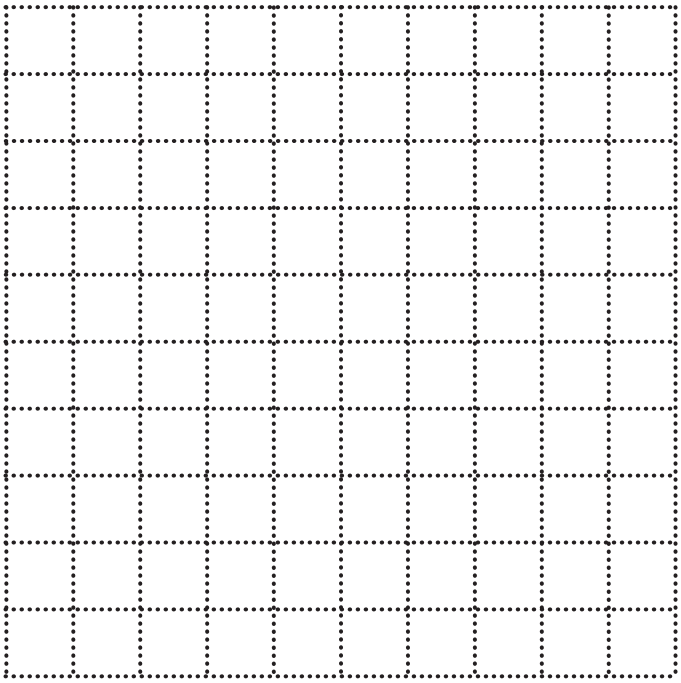
(a) _____ [2]

(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.



(_____ , _____) **[2]**

12 (a) Multiply out.

$5(3x - 4)$

_____

_____

(a) _____ **[2]**

(b) Factorise.

$2a^2 + 8ab$

_____

_____

(b) _____ **[2]**

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

(c)(i) _____ **[1]**

(ii) Simplify.

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

_____

_____

_____

(ii) _____ **[3]**

(iii) Simplify.

$(7^3)^5$

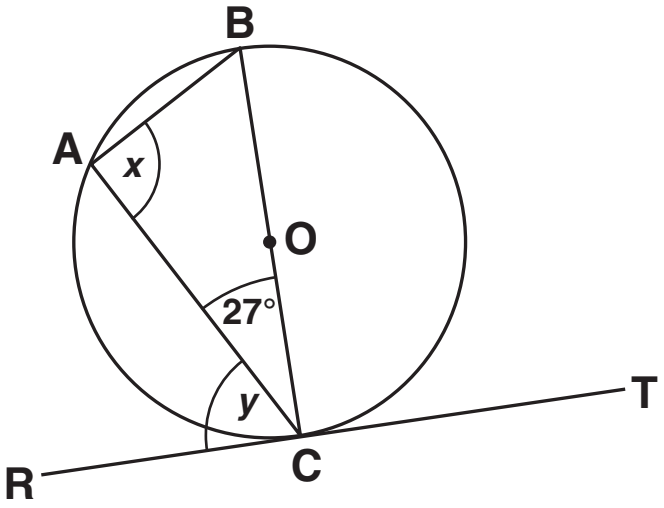
Give your answer as a power of 7.

_____

_____

(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.

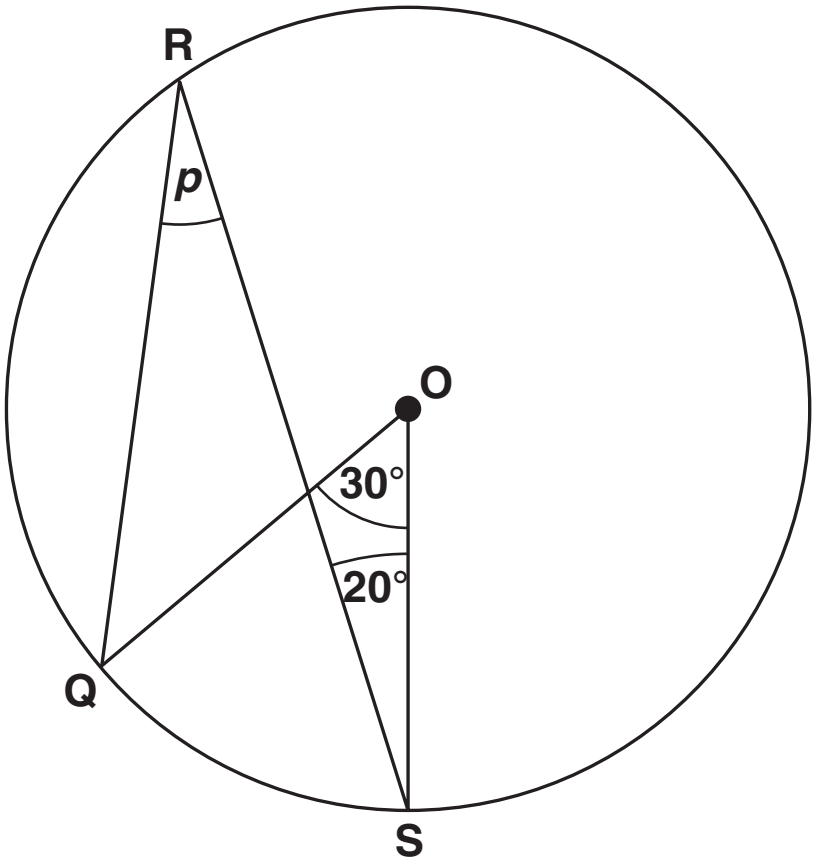
(i) Angle *x* = 90° because _____

_____ **[1]**

(ii) Angle *y* = 63° because _____

_____ **[1]**

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



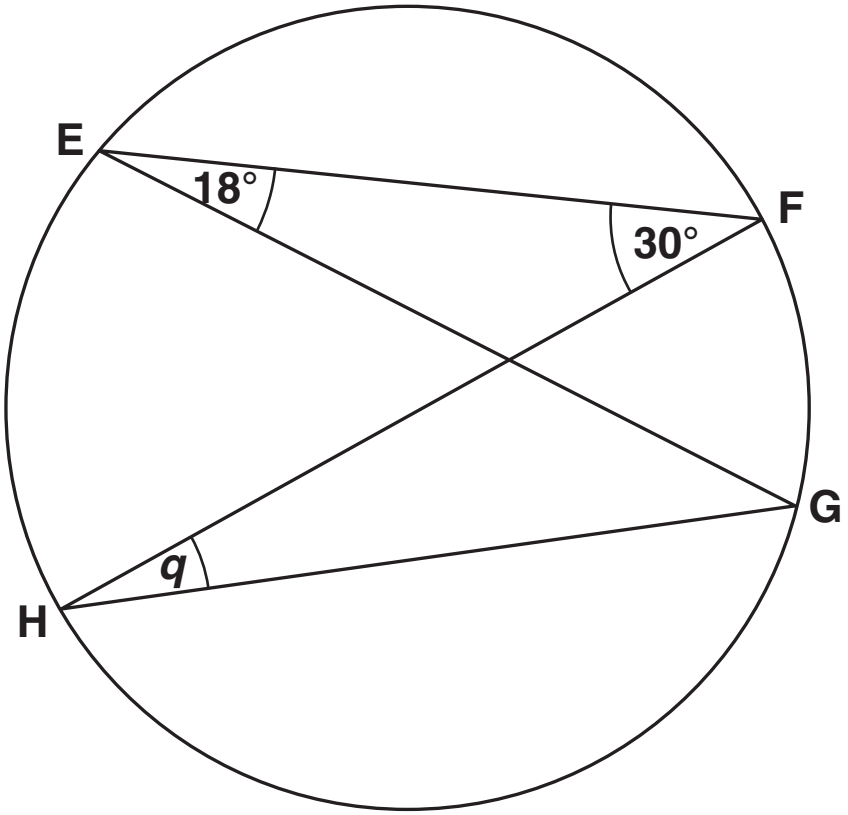
NOT TO SCALE

Work out the size of angle *p*.

_____

(b)(i) _____° [1]

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

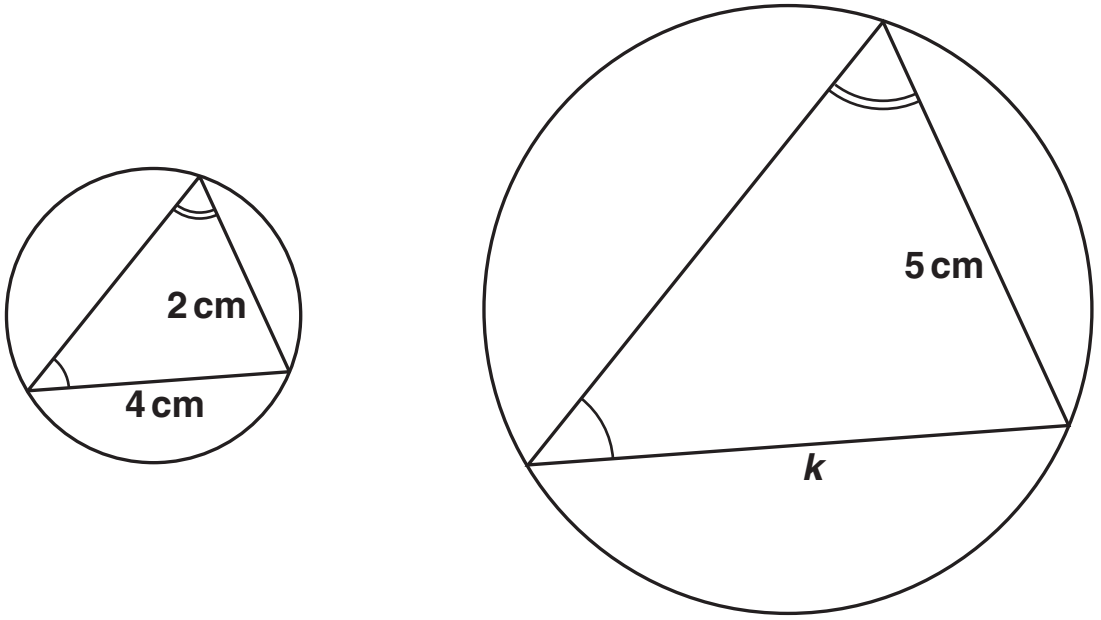


NOT TO SCALE

What is the size of angle *q*?

(ii) _____° [1]

(c) These two triangles are similar.



NOT TO SCALE

Work out the length *k*.

_____

_____

(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]**

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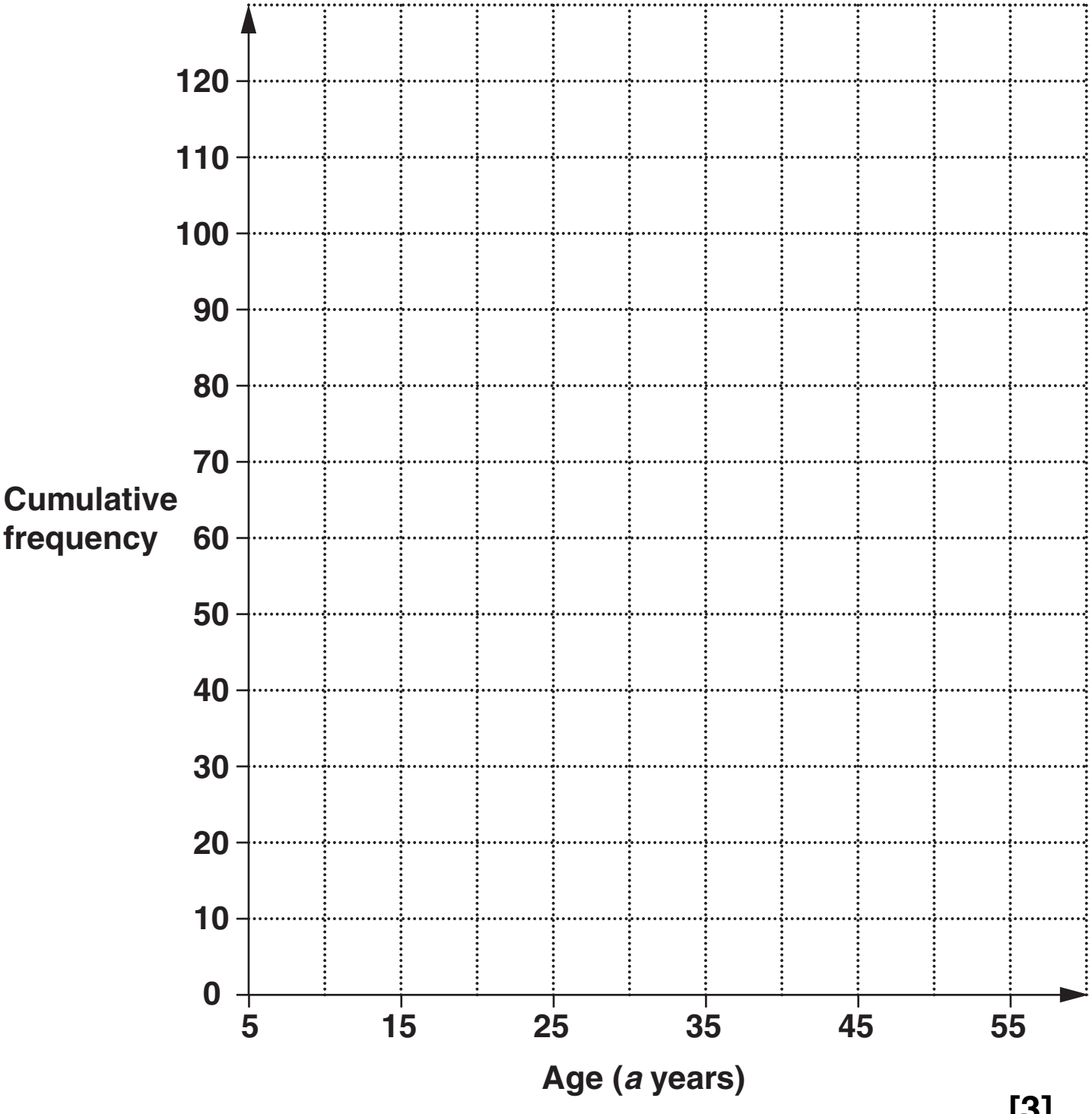
15 This cumulative frequency table shows the distribution of the ages of the members of an athletics club.

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.

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

(a) _____ [3]

(b) Solve.

$3x^2 - 12 = 0$

(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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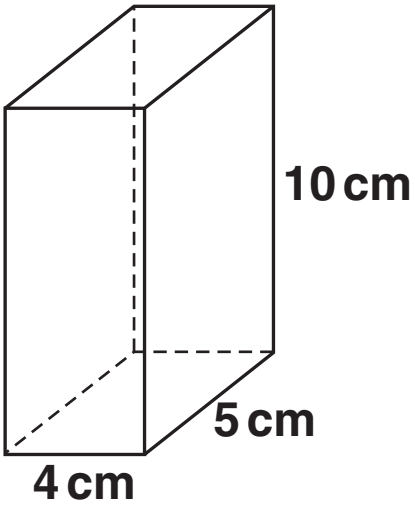
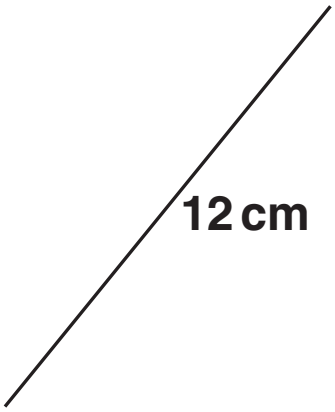
_____ **[3]**

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]**

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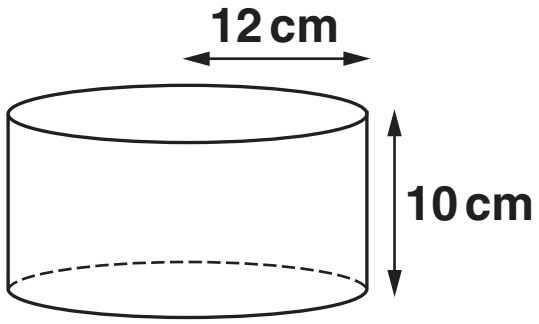
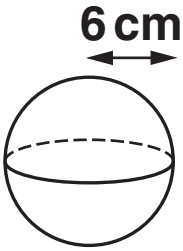
18 **IN THIS QUESTION, DO NOT SUBSTITUTE A NUMERICAL VALUE FOR π.**

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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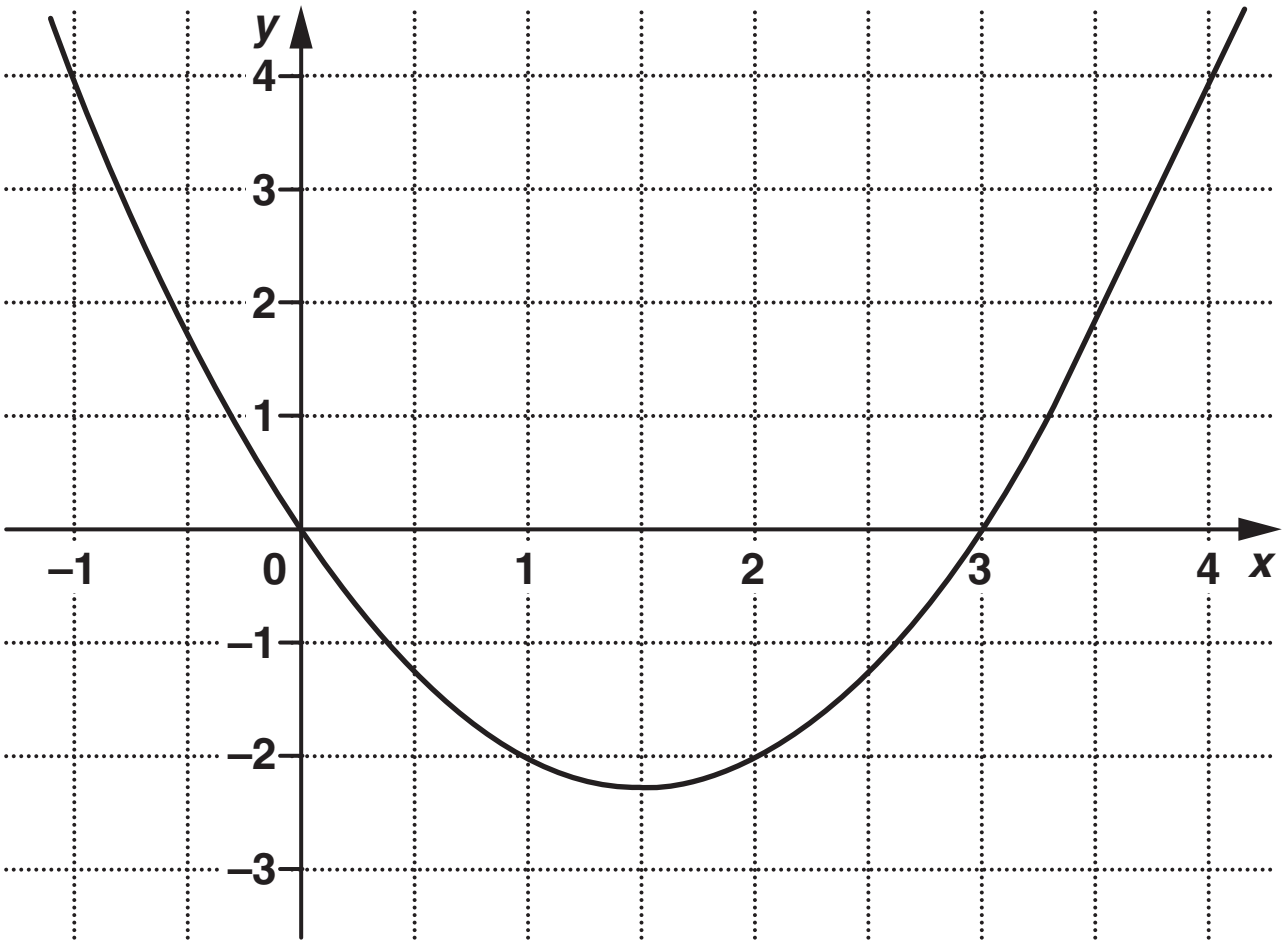
_____

_____

_____

_____ **[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

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

(a) _____ [3]

(b) Find the equation of the line that would need to be drawn on the grid to solve the equation

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

_____

_____

_____

_____

(b) $y =$ _____ **[2]**

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.

_____ **[4]**

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