Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3300U60-1

A23-3300U60-1

WEDNESDAY, 15 NOVEMBER 2023 – MORNING

MATHEMATICS
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this examination.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the questions correctly.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question **3**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**6**	
3.	**6**	
4.	**3**	
5.	**4**	
6.	**3**	
7.	**3**	
8.	**2**	
9.	**5**	
10.	**6**	
11.	**7**	
12.	**3**	
13.	**1**	
14.	**3**	
15.	**3**	
16.	**3**	
17.	**5**	
18.	**8**	
19.	**5**	
Total	**80**	

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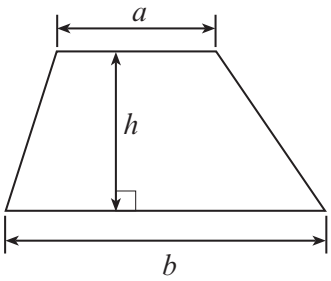
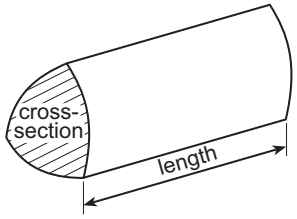
Formula List – Higher Tier

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

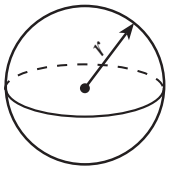


Volume of prism = area of cross-section × length



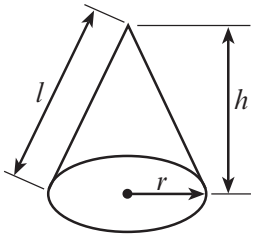
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

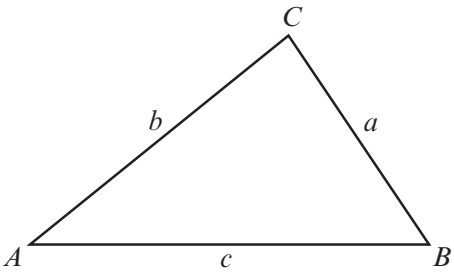


In any triangle ABC

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 $= \frac{1}{2}ab\sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

Examiner only

1. The table below shows some of the values of $y = x^2 + 4x + 5$ for values of x from –4 to 1.

x	–4	–3	–2	–1	0	1
$y = x^2 + 4x + 5$	5	2		2	5	

(a) Complete the table by finding the value of y for $x = -2$ and for $x = 1$. [2]

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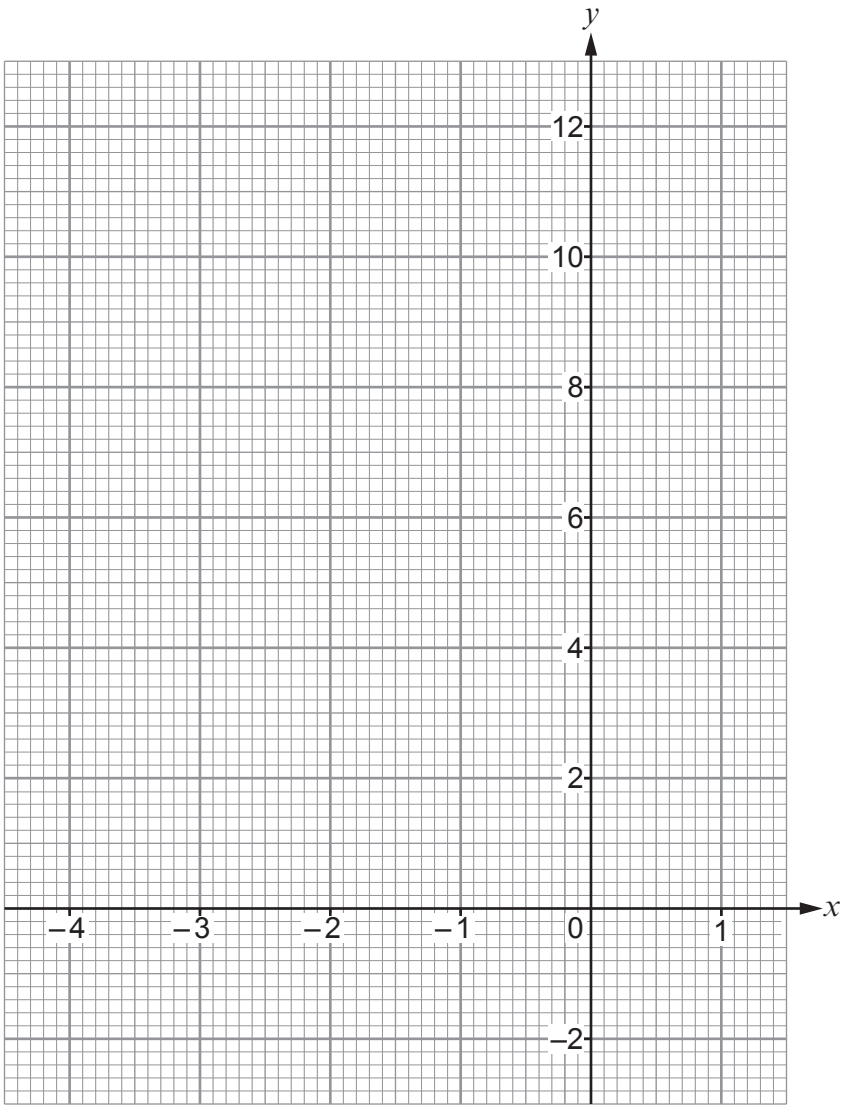
(b) On the graph paper below, draw the graph of $y = x^2 + 4x + 5$ for values of x from –4 to 1. [2]



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2.

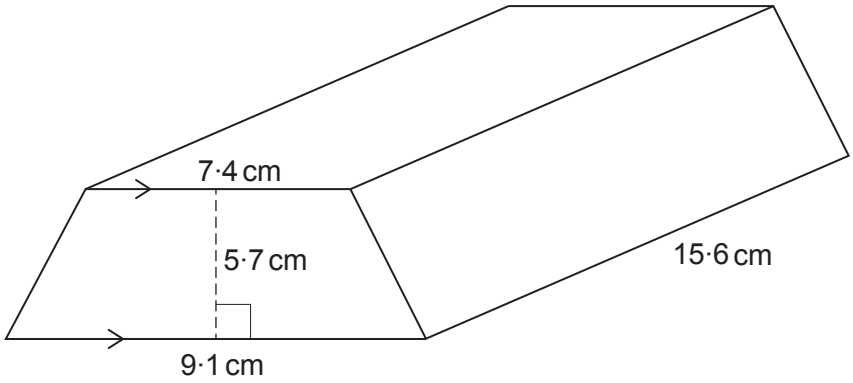


Diagram not drawn to scale

(a) Find the volume of the solid prism shown above. [3]

(b) The solid prism is made of gold.
Gold has a density of 19·3 g/cm^3.

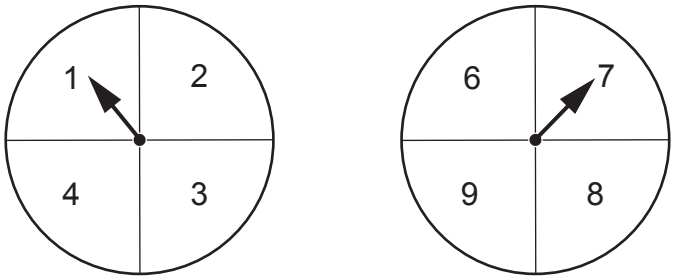
Calculate the mass of the prism.
Give your answer in **kilograms**. [3]

Mass of the prism = ... **kg**

Examiner only

3. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

Vera has two fair spinners.
Each spinner is divided into quarters.
One spinner shows the values 1, 2, 3 and 4.
The other spinner shows the values 6, 7, 8 and 9.



Vera spins the two spinners. She then multiplies the two values together to form a product.
For example, the diagram above forms the product $1 \times 7 = 7$.

Consider the ways in which all the possible products can be formed.
Calculate the probability that the spinners will form a product that is a factor of 36.
You must show all your working to justify your answer. [4 + 2 OCW]

Examiner only

4.

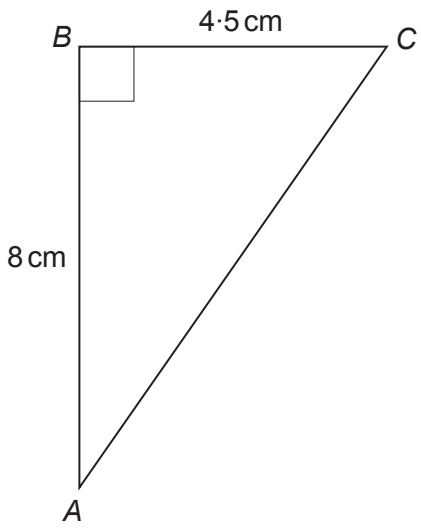


Diagram not drawn to scale

Calculate the length of the side *AC*. [3]

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Examiner only

5. A solution of the equation

$$x^3 + 6x = 80$$

lies between 3 and 4.

Use the method of trial and improvement to find this solution correct to 1 decimal place.
You must show all your working. [4]

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Examiner only

6. The diagram below shows a shape made by joining two congruent rectangles together.
The length of each rectangle is $(5x+3)$ cm.
The width of each rectangle is $(2x-1)$ cm.

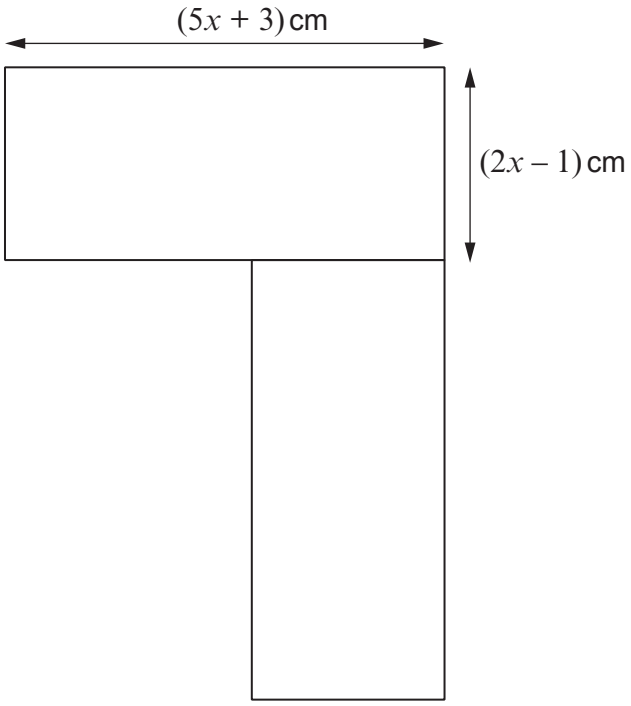

Diagram not drawn to scale

Write an expression for the total area of the shape in the form ax^2+bx+c, where a, b and c are whole numbers. [3]

Examiner only

7.

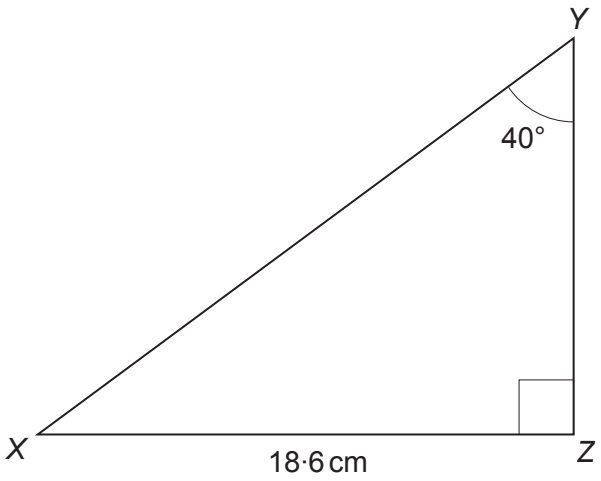

Diagram not drawn to scale

Calculate the length of the side *YZ*. [3]

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8. 7 cubes are stacked on top of each other.
Each of these cubes has edges of length 60 mm, measured correct to the nearest millimetre.

Calculate the greatest possible height of this stack of 7 cubes. [2]

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Examiner only

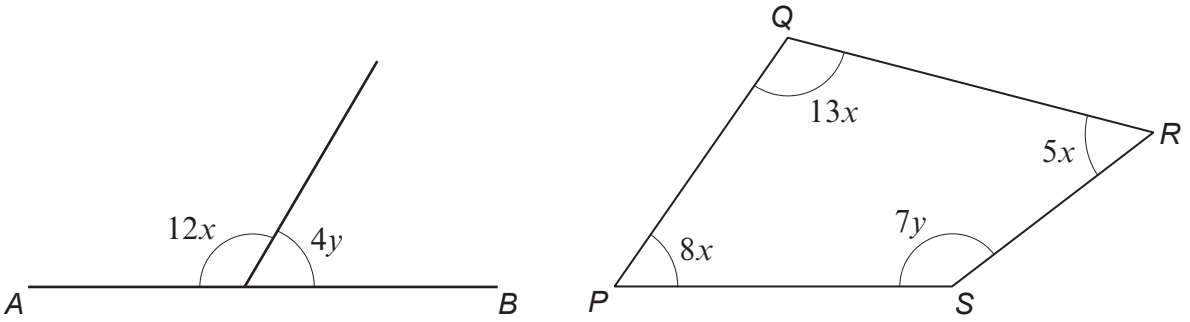
9. The grouped frequency table below shows data for 32 values of t.
One of the frequencies in the table is represented by a.

t	Frequency
$20 \leqslant t < 30$	2
$30 \leqslant t < 40$	8
$40 \leqslant t < 50$	4
$50 \leqslant t < 60$	a
$60 \leqslant t < 70$	3
$70 \leqslant t < 80$	5

Find the estimated mean value of t for the 32 values. [5]

Examiner only

10. *AB* is a straight line.
PQRS is a quadrilateral.
Each angle is given in terms of x or y.



Diagrams not drawn to scale

Use an algebraic method to find the value of x and the value of y. [6]

x = ... and y = ...

Examiner only

11. (a) Factorise $6x^2 + 19x + 10$. [2]

(b) Fully factorise the expression $m^3 - 25m$. [3]

(c) Factorise $(p+7)(p+29)+2(p+7)$. [2]

Examiner only

12. Triangle *ABC* has sides *AB* = 36·1 cm and *AC* = 13·8 cm, as shown below.
$B\hat{A}C = 29°$.

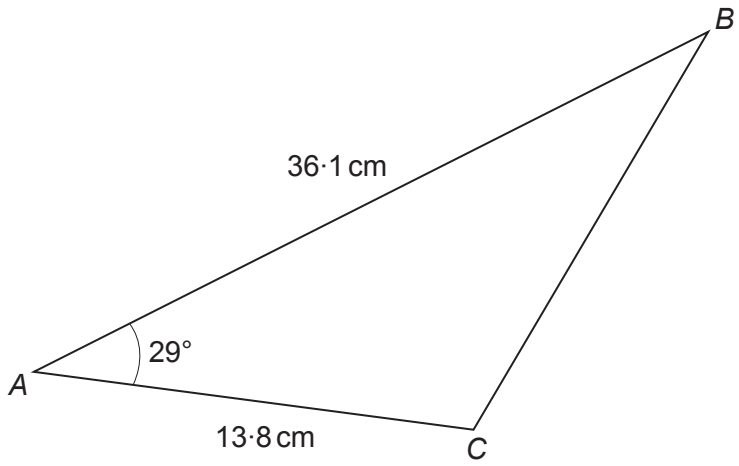


Diagram not drawn to scale

Calculate the length of the side *BC*. [3]

13. Calculate the cube root of 8×10^{216}.
Circle the correct answer. [1]

2×10^{6} 2×10^{72} 2×10^{216} 8×10^{6} 8×10^{72}

Examiner only

14. A solid has a height of 225 cm.
A larger, mathematically **similar** solid has a height of 855 cm.
The surface area of the smaller solid is 5300 cm^2.

Calculate the surface area of the larger solid. [3]

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Examiner only

15. The values b = 23, c = 0·73 and d = 8·3 are each given correct to 2 significant figures.

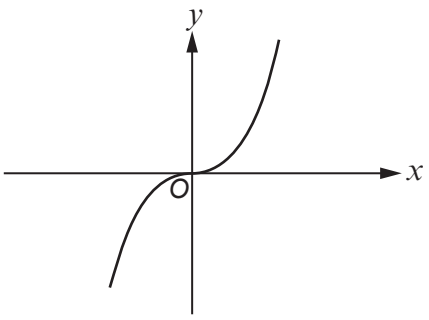
Use the formula

$$a = b - \frac{c}{d}$$

to calculate the greatest possible value of a.
Give your answer correct to 2 decimal places.
You must show all your working. [3]

Examiner only

16. (a) Put a tick next to the graph that represents the equation $y = -x^3$. [1]



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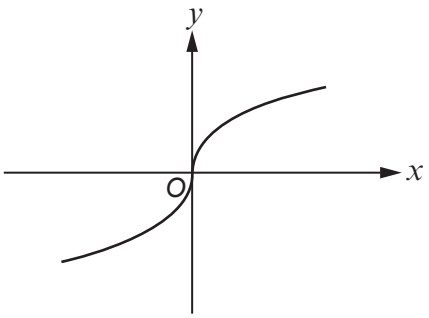

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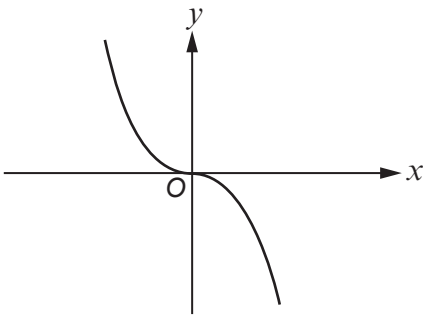

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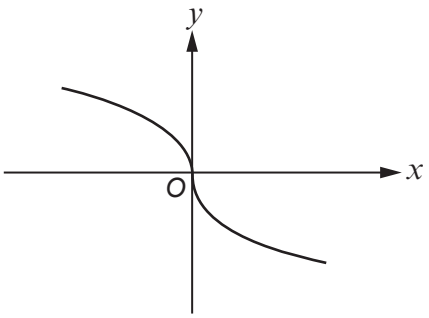

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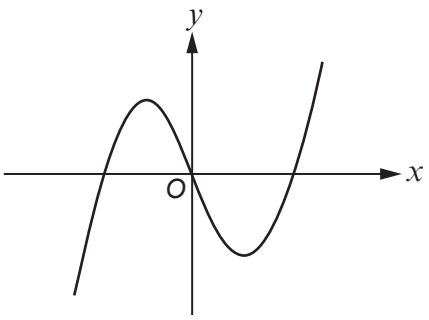

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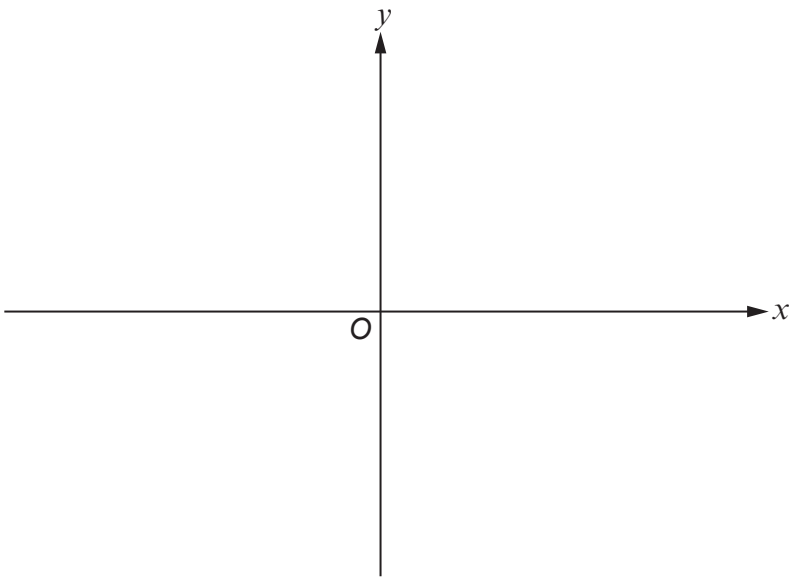
(b) Use the axes below to sketch the graph of $y = -\frac{1}{x}$. [2]



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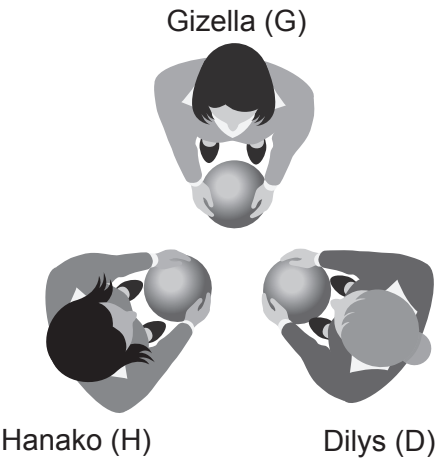
17. Three children, Gizella (G), Dilys (D) and Hanako (H), stand in a triangle, as shown below.



Each child holds a ball.
They must choose to pass their ball to the child on their left or the child on their right.
All 3 children pass their ball at the same time.
The probability that they pass it to their left is shown in the table below.

Name of child	Probability of passing to the left
Gizella	$\frac{1}{5}$
Dilys	$\frac{2}{7}$
Hanako	$\frac{3}{8}$

(a) Calculate the probability that every child passes their ball to the left. [2]

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Examiner only

(b) Calculate the probability that one of the three children does not receive a ball. [3]

Examiner only

18. The diagram below is a sketch of a **regular** 12-sided polygon, with centre *O*.
The polygon has sides of length 5 cm.
AE and *OE* are straight lines.

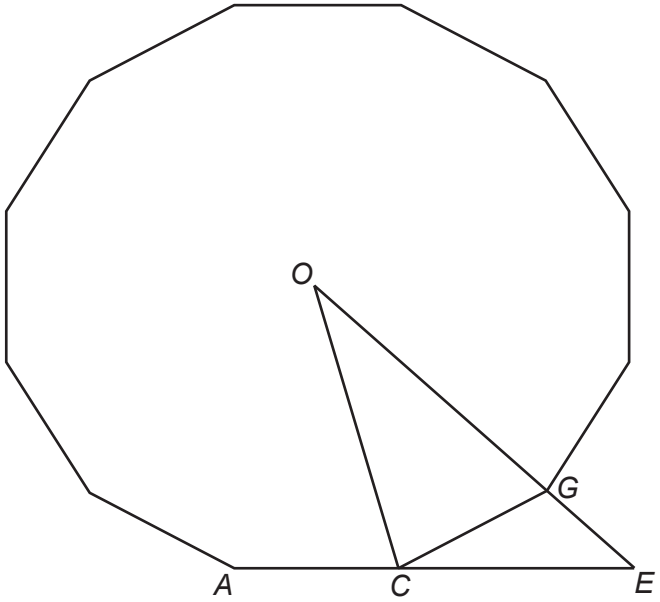

Diagram not drawn to scale

(a) Calculate the length of *CE*.
You must show all your working. [6]

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(b) Hence, calculate the area of triangle *CGE*. [2]

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19. Use the quadratic formula to solve the equation $\frac{x+3}{x}+5=7x$.

Give your answers as decimal numbers.
You **must** show all your working. [5]

END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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