

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Secondary Education
June 2005



MATHEMATICS (SPECIFICATION A) 3301/2H
Higher Tier
Paper 2 Calculator

H

Wednesday 15 June 2005 9.00 am to 11.00 am

<p>In addition to this paper you will require:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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For Examiner's Use	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
TOTAL	
Examiner's Initials	

Time allowed: 2 hours

Instructions

- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.
- If your calculator does not have a π button, take the value of π to be 3.14 unless otherwise instructed in the question.

Information

- The maximum mark for this paper is 100.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.
- You are expected to use a calculator where appropriate.

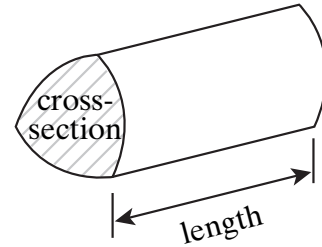
Advice

- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

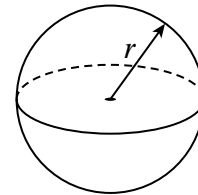
You may need to use the following formulae:

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



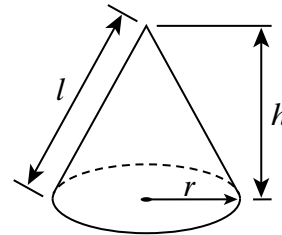
Volume of sphere = $\frac{4}{3} \pi r^3$

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



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

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

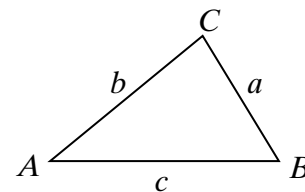


In any triangle ABC

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 (a) Expand and simplify $4(2x - 1) + 3(x + 6)$

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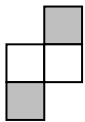
Answer (2 marks)

(b) Expand $x^2(4 - 2x)$

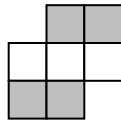
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Answer (2 marks)

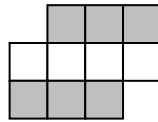
2 Patterns are made from shaded and unshaded squares.



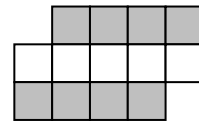
1st pattern



2nd pattern



3rd pattern



4th pattern

(a) How many shaded squares are there in the n th pattern?

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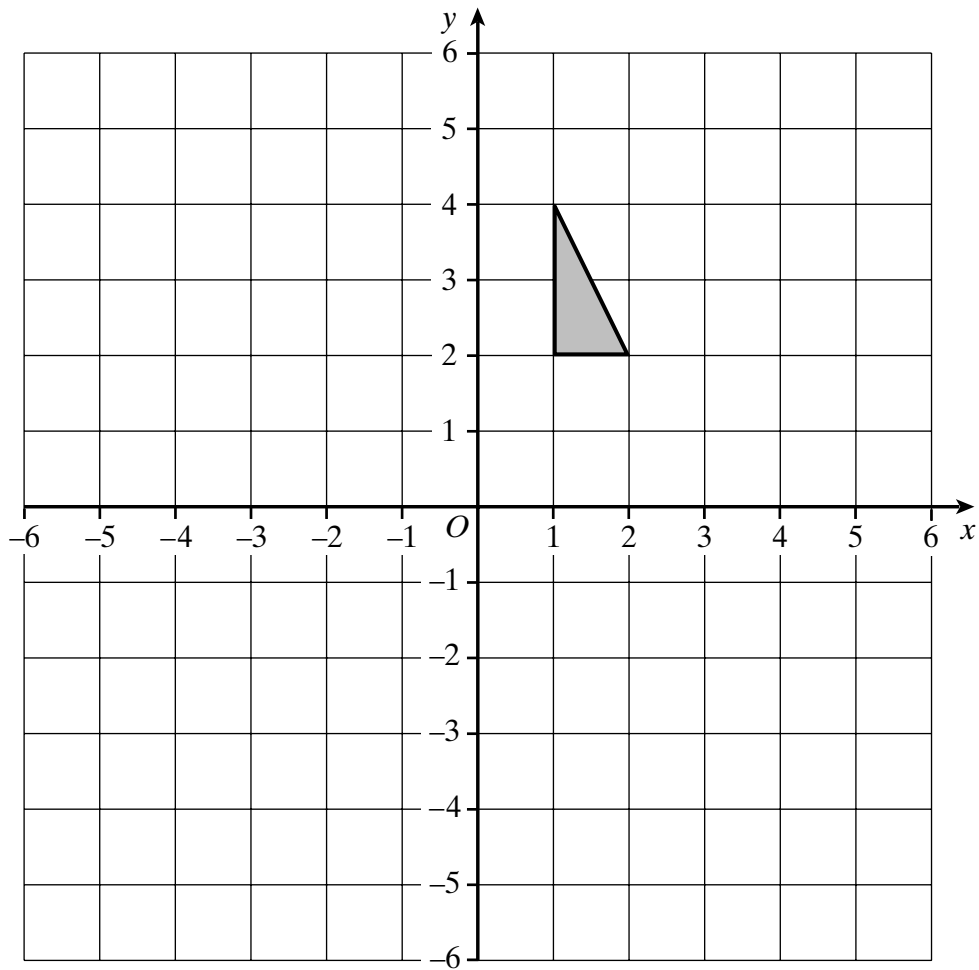
Answer (1 mark)

(b) How many unshaded squares are there in the n th pattern?

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Answer (1 mark)

3



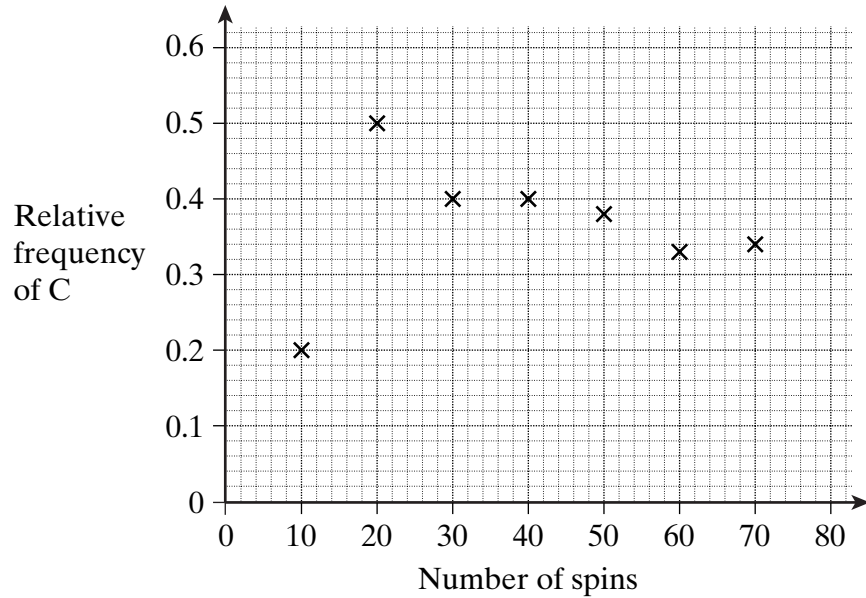
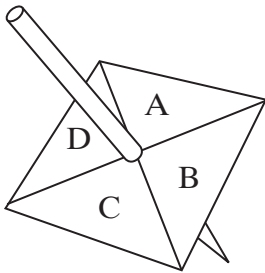
- (a) Reflect the shaded triangle in the line $y = -x$.
Label this new triangle with the letter A .

(2 marks)

- (b) Rotate the original shaded triangle by a quarter-turn anticlockwise about $(0, 2)$.
Label this new triangle with the letter B .

(2 marks)

- 4 Julie has a square-shaped spinner with the letters A, B, C and D on it. She spins the spinner and records the letter on which the spinner lands. She plots the relative frequency of the letter C after every 10 spins.



- (a) How many times did the letter C occur in the first 40 spins?

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Answer (2 marks)

- (b) After 80 spins the letter C occurred 30 times. Plot the relative frequency for 80 spins on the diagram.

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(2 marks)

- (c) Is the spinner biased? Give a reason for your answer.

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(1 mark)

5 A television has a sale price of £180.
This is a saving of 25% on the original price.
What was the original price?

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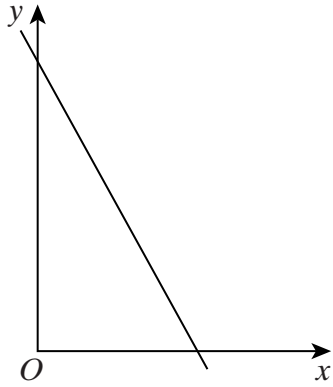
Answer £ (3 marks)

6 Annie invests £3000 for 5 years in a savings account that pays 4% compound interest per year.
How much will she have in the account at the end of 5 years?

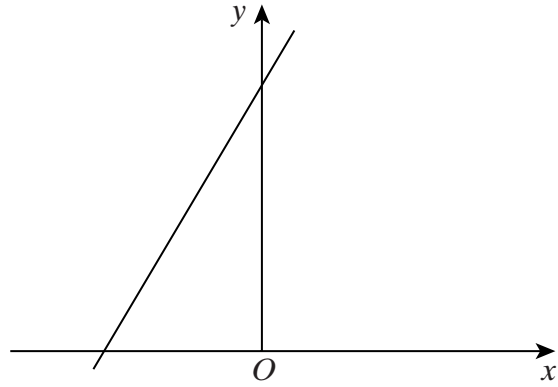
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Answer £ (3 marks)

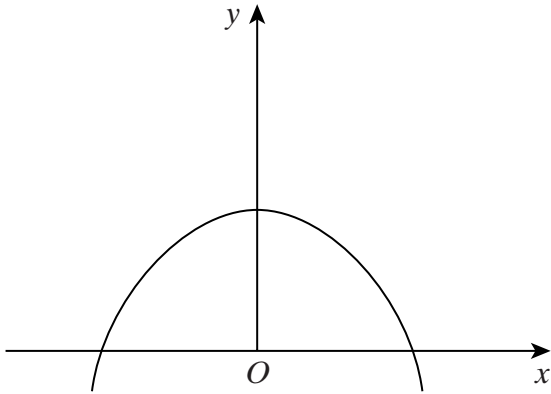
7 (a) Four graphs are sketched.



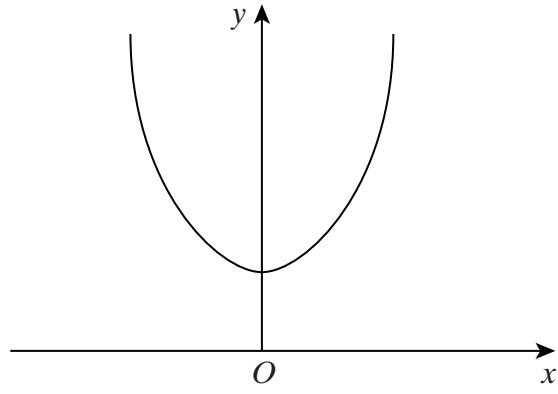
Graph A



Graph B



Graph C



Graph D

Complete the following statements.

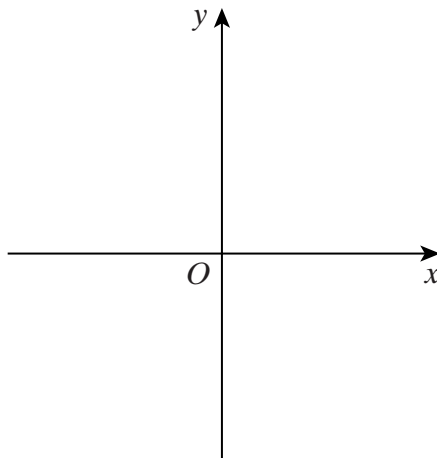
$y = 2x + 4$ matches graph

$y = x^2 + 4$ matches graph

$y + 2x = 4$ matches graph

(3 marks)

(b) Sketch the graph of $y = x^3$ on the axes below.



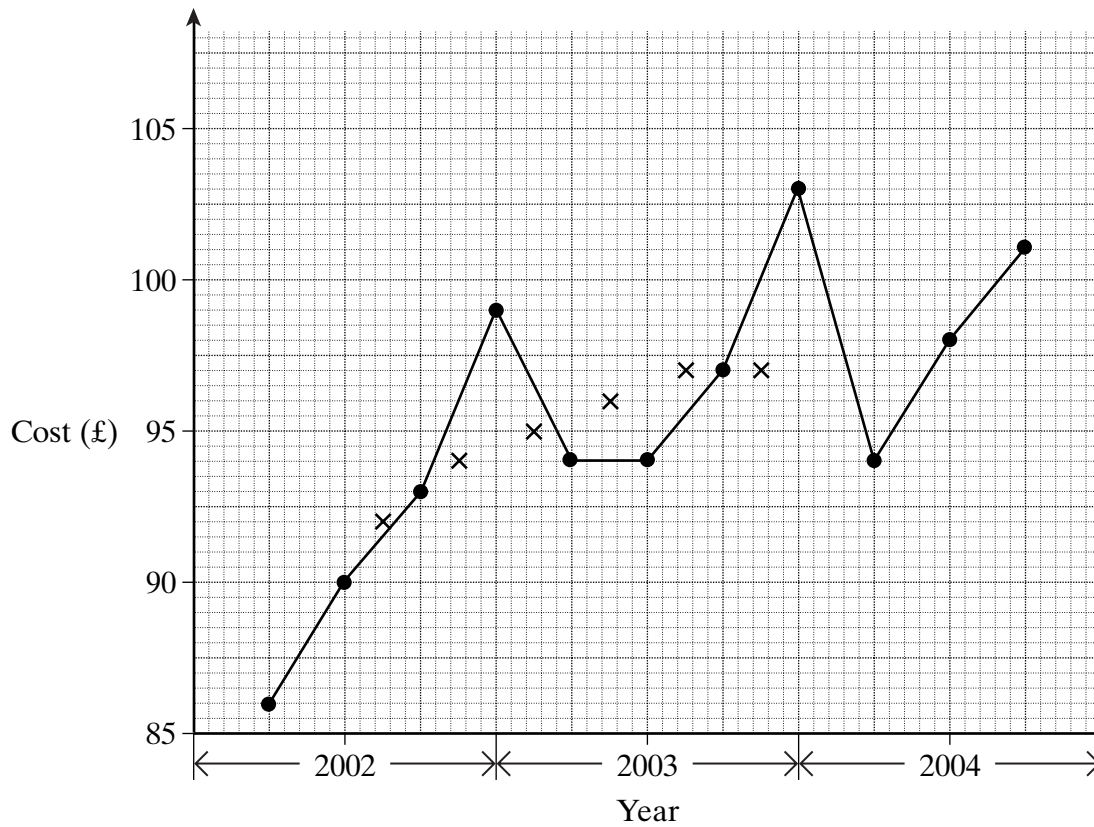
(2 marks)

Turn over ►

8 The table shows the cost of the gas at the end of every three months and some four-point moving averages.

Year	2002				2003				2004			
Quarter	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Cost (£)	86	90	93	99	94	94	97	103	94	98	101	
Four-point moving average		92	94	95	96	97	97	98	99			

The graph shows the actual cost of the gas and some of the moving averages.



Key: ● Actual cost
× Moving average

(a) On the graph plot the last two four-point moving averages.

(2 marks)

(b) Use the trend of the moving averages to predict the cost of the gas at the end of the 4th quarter of 2004.

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Answer £ (3 marks)

9 Astronomers measure distances in the solar system in astronomical units (AU).

One AU is 150 000 000 kilometres.

The distance from the Sun to Pluto is 39.5 AU.

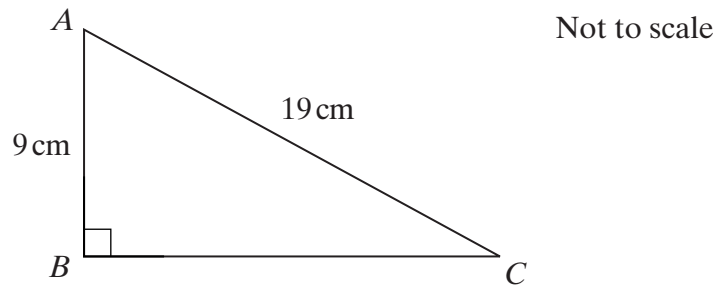
How many kilometres is the Sun from Pluto?

Give your answer in standard form to a sensible degree of accuracy.

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Answer km (3 marks)

- 10 (a) ABC is a right-angled triangle.
 $AC = 19\text{ cm}$ and $AB = 9\text{ cm}$.

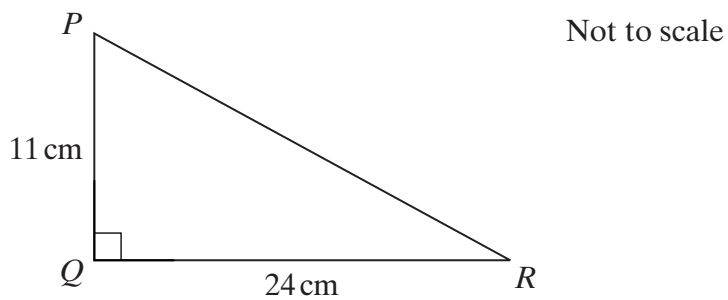


Calculate the length of BC .

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Answer cm (3 marks)

- (b) PQR is a right-angled triangle.
 $PQ = 11\text{ cm}$ and $QR = 24\text{ cm}$.

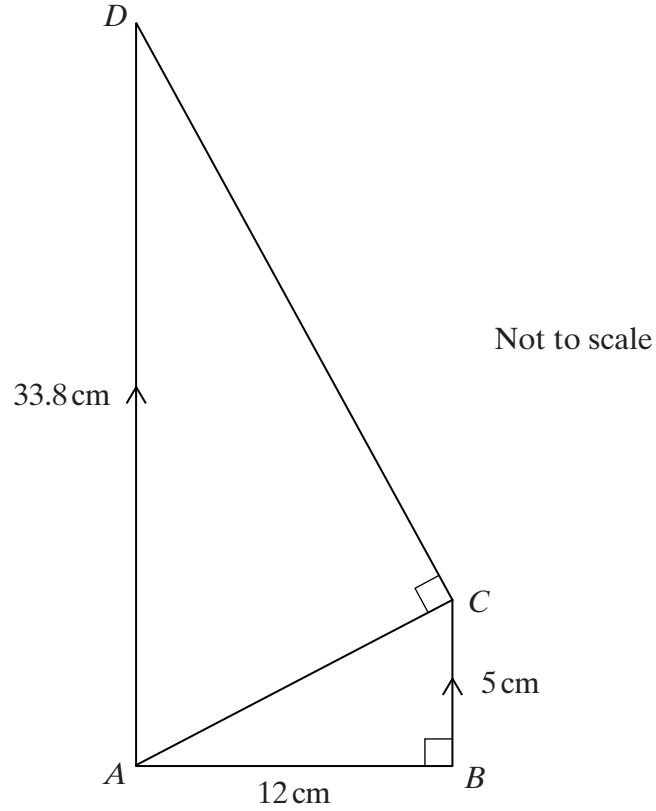


Calculate the size of angle PRQ .

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Answer degrees (3 marks)

- (c) ABC and ACD are right-angled triangles.
 AD is parallel to BC .
 $AB = 12\text{ cm}$, $BC = 5\text{ cm}$ and $AD = 33.8\text{ cm}$.



Calculate the size of angle ADC .

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Answer degrees (4 marks)

11 Solve the equations

(a) $\frac{17-x}{3} = 4.5$

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Answer $x =$ (3 marks)

(b) $2(y-3) = 5-3y$

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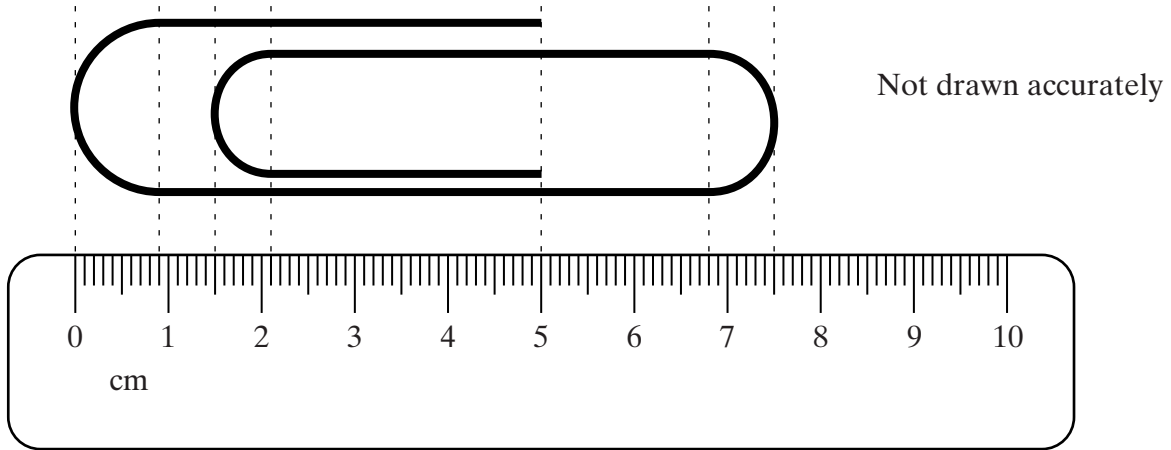
Answer $y =$ (3 marks)

(c) $3(2z-1) + 4(z+3) = 5(2z-1) + 4(3z-1)$

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Answer $z =$ (3 marks)

- 12 A giant paper clip is placed alongside a centimetre ruler.
The curved ends are semicircles.



Calculate the length of wire used to make the clip.

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Answer cm (5 marks)

- 13** y is directly proportional to the square of x .
When $y = 5$, $x = 4$.
Find the value of y when $x = 8$.

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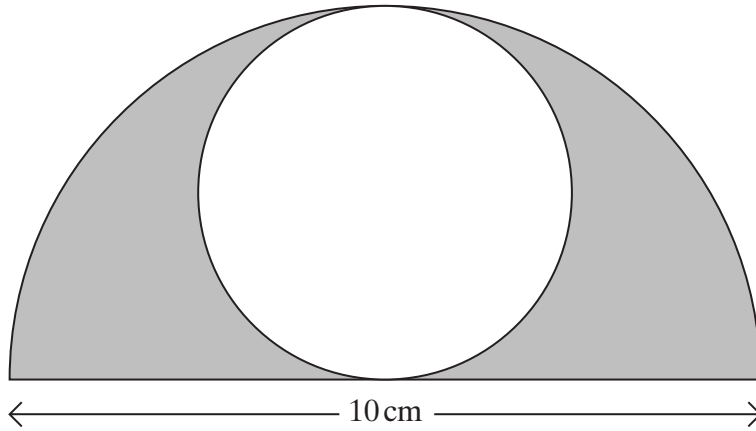
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Answer (3 marks)

14 A circle fits inside a semicircle of diameter 10 cm as shown.



Not drawn accurately

Calculate the shaded area.

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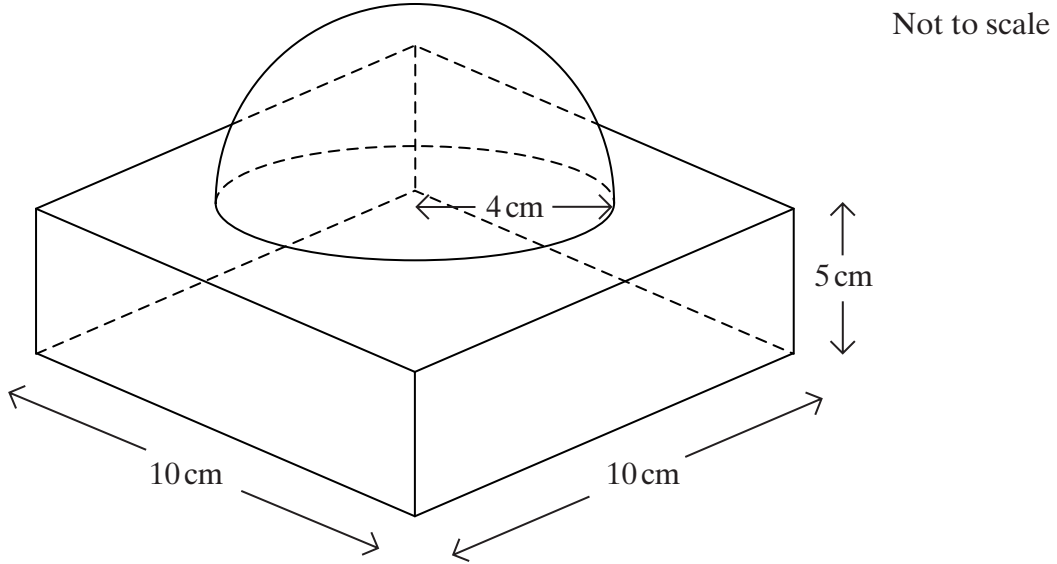
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Answer cm² (3 marks)

Turn over ▶

- 15 A marble paperweight consists of a cuboid and a hemisphere as shown in the diagram. The hemisphere has a radius of 4 cm.



Calculate the volume of the paperweight.

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Answer (4 marks)

- 16 (a) This is a page from Zoe's exercise book.

$$2^3 - 1^3 = 7 \text{ (prime)}$$

$$3^3 - 2^3 = 19 \text{ (prime)}$$

$$4^3 - 3^3 = 37 \text{ (prime)}$$

The difference
between
consecutive cube
numbers
is always a prime
number.

Give a counter example to show that Zoe is wrong.
Justify your answer.

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(2 marks)

- (b) Prove that $(n + 5)^2 - (n + 3)^2 = 4(n + 4)$

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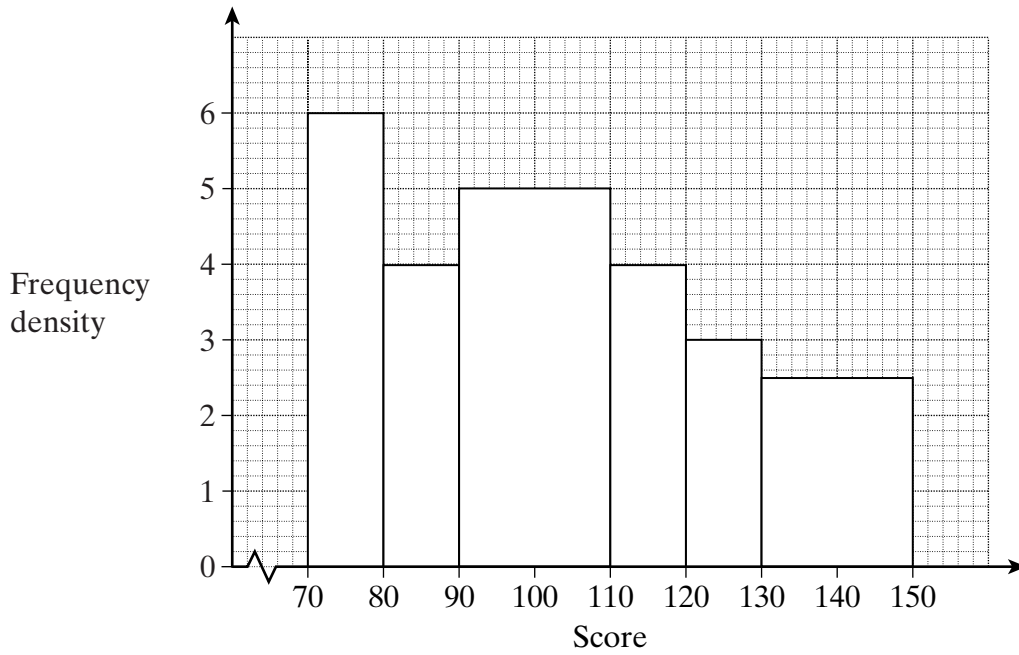
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(3 marks)

Turn over 

17 The histogram shows the test scores of 320 children in a school.



(a) Find the median score.

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Answer (2 marks)

(b) Find the interquartile range of the scores.

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Answer (2 marks)

18 Make x the subject of the formula

$$a(x - b) = a^2 + bx$$

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Answer (4 marks)

19 Solve the equation

$$\frac{4}{2x + 1} - \frac{1}{3x - 1} = 5$$

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Answer (6 marks)

Turn over ►

- 20** A circle has an area of 100 cm^2 , measured to the nearest square centimetre.
What is the lower bound of the radius?

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Answer cm (3 marks)

- 21 (a) Explain why the volume of a cube increases by a factor of 8 when the side length is doubled.

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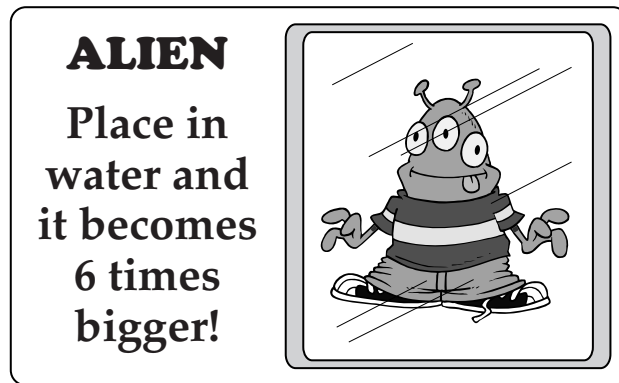
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(2 marks)

- (b) June recently bought a small toy in the local shop.



It was originally 8 cm tall.
After she placed it in water it grew to a similarly shaped alien.
The height was then 14.5 cm.
Is the claim on the pack justified?

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(3 marks)

Turn over ►

22 The grid opposite shows the graph of $y = x^2 + 3x - 2$

(a) By drawing an appropriate straight line on the graph solve the equation

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

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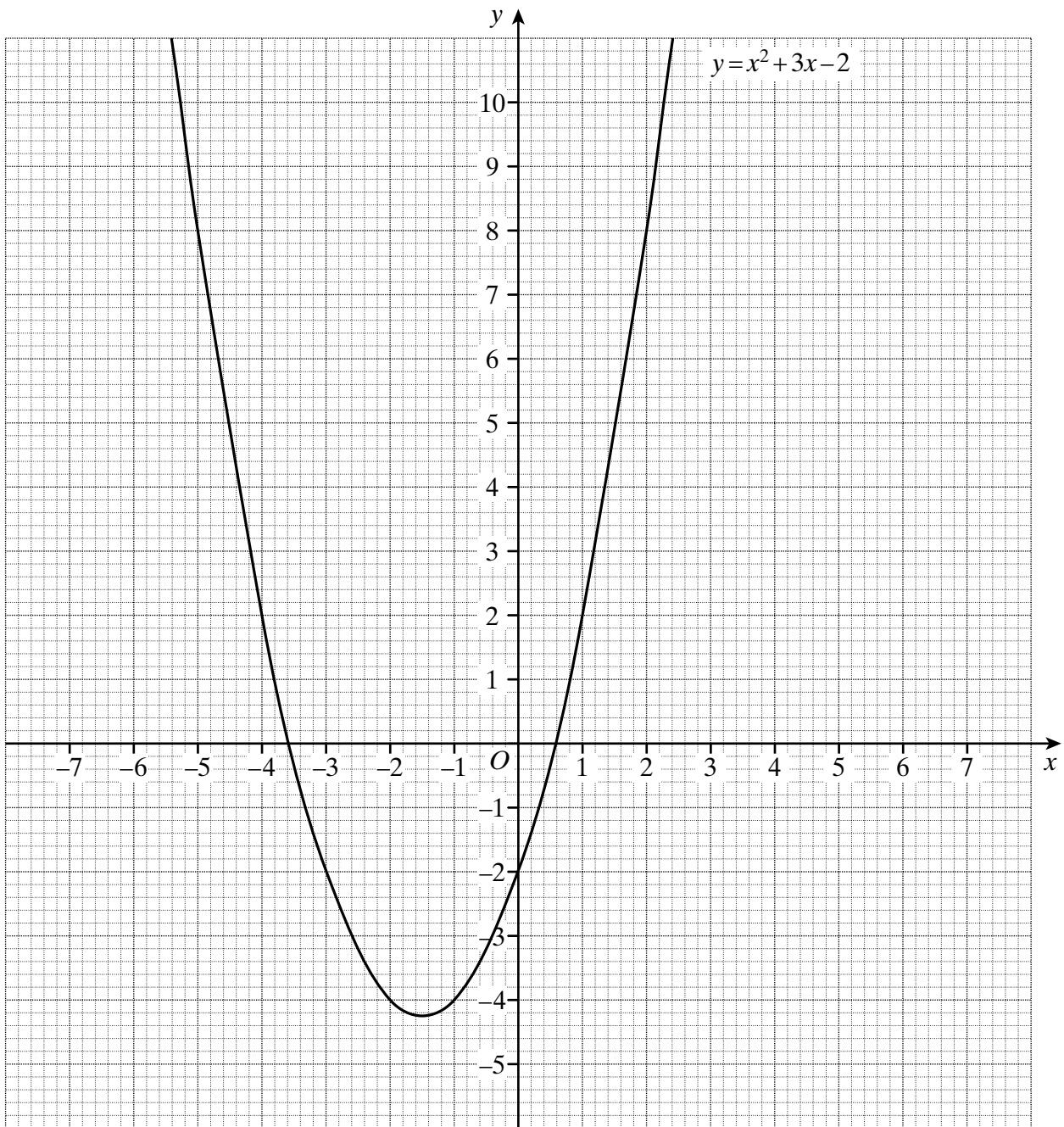
Answer (2 marks)

(b) By drawing an appropriate straight line on the graph solve the equation

$$x^2 + 2x - 1 = 0$$

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Answer (3 marks)



END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE