Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Secondary Education
November 2005

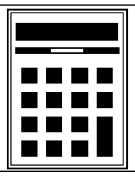
ASSESSMENT and QUALIFICATIONS ALLIANCE

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

H

Friday 11 November 2005 9.00 am to 11.00 am

In addition to this paper you will require:
- a calculator
- mathematical instruments.



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.

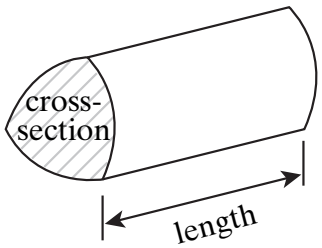
Advice
- In all calculations, show clearly how you work out your answer.

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	
24	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

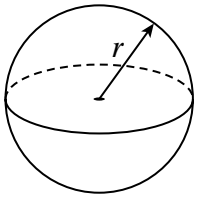
You may need to use the following formulae:

Volume of prism = area of cross-section × length



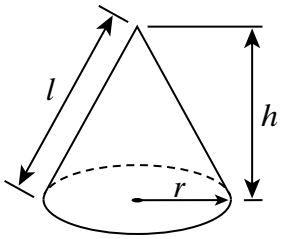
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

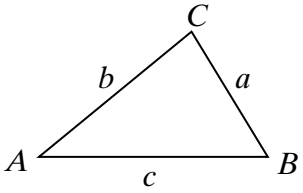
Curved surface area of cone = $\pi r l$



In any triangle ABC

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

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



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

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

LEAVE MARGIN BLANK

Answer **all** questions in the spaces provided.

1 Jane earns £11 400 per year.
After her pay rise she earns £12 198 per year.

What was her percentage pay rise?

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Answer ..... % *(3 marks)*

2 Use trial and improvement to find a solution to the equation

$$x^3 - x = 21$$

Give your answer to one decimal place.
You **must** show your working.

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Answer x = ... *(4 marks)*

3 Caleb says that the cube root of any number is always smaller than the number.
Give an example to show that Caleb is wrong.

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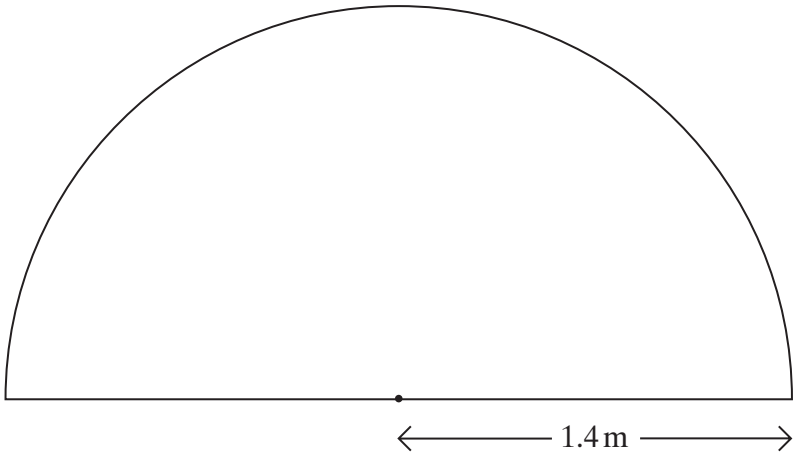
(2 marks)

9

Turn over ▶

4 Jasmin has a pond in her garden.
The surface of the pond is a semicircle of radius 1.4 m.



Not to scale

(a) Calculate the area of a semicircle of radius 1.4 m.
You **must** show your working.
State the units of your answer.

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Answer ..... *(3 marks)*

(b) The pond is 50 cm deep.
The sides of the pond are vertical.

Calculate the volume of the pond.
Give your answer in cubic metres.

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Answer ..... m^3 *(2 marks)*

5 The ordered stem and leaf diagram shows the number of cameras sold each day, over a period of 20 days.

Key | 1 | 2 represents 12 cameras

0	4	8	9					
1	1	2	2	2	6	7	9	9
2	0	3	5	8	8	8		
3	1	2	5					

The next day 28 cameras are sold.
Does the median increase, decrease or stay the same?
You **must** show your working.

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(3 marks)

6 A can of drink weighs 342g to the nearest gram.

(a) What are the minimum and maximum weights of the can?

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Answer Minimum weight ..... g

Maximum weight ..... g *(2 marks)*

(b) The cans are sold in packs of 12
What are the minimum and maximum weights of a pack of cans?

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Answer Minimum weight ..... g

Maximum weight ..... g *(2 marks)*

12

7 Solve the equations.

(a) $5y + 11 = 3(y + 7)$

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Answer $y =$ ..... *(3 marks)*

(b) $\frac{x + 1}{3} + \frac{x + 2}{5} = 1$

You **must** show your working.

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Answer $x =$ ..... *(4 marks)*

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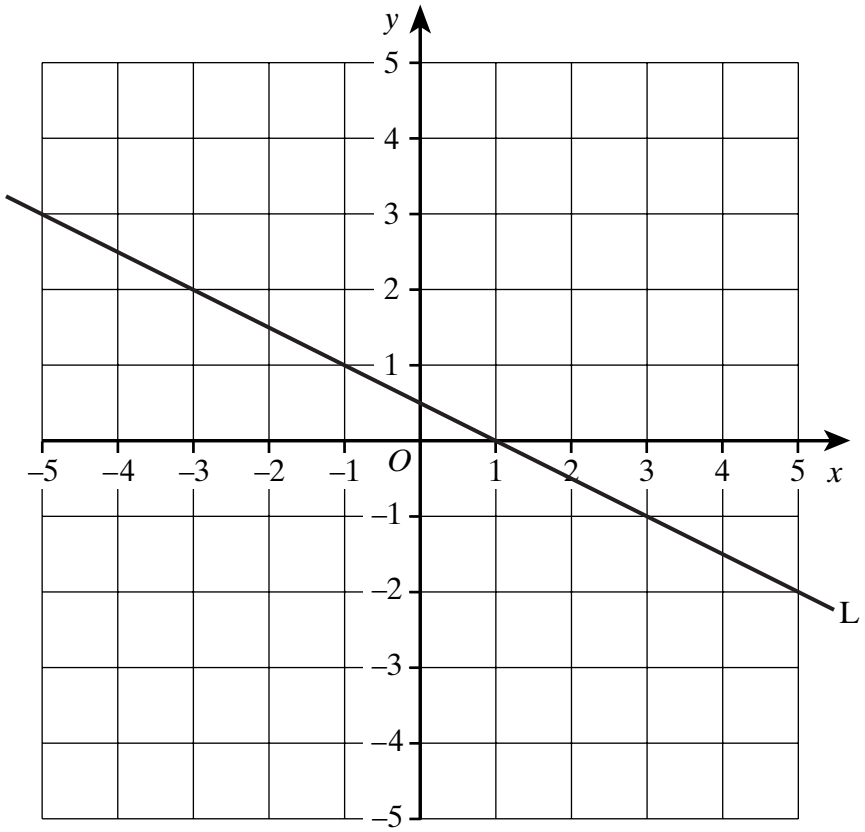

Find the equation of the line L.

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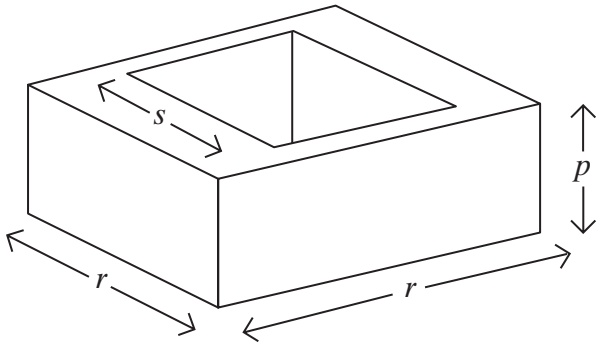
Answer ..... *(3 marks)*

10

9 A cuboid has a square hole cut through it.
The dimensions are shown on the diagram.



Not drawn accurately

The following formulae represent various lengths, areas or volumes of the solid.
For each formula state whether it represents a length (L), an area (A) or a volume (V).

$4pr$ represents .....

$8(p + r + s)$ represents .....

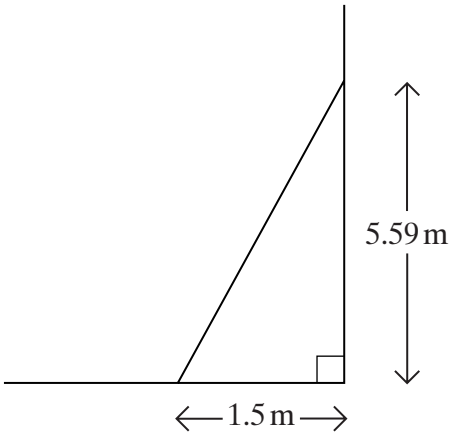
$p(r^2 - s^2)$ represents .....

$(r - s)(r + s)$ represents .....

(3 marks)

10 For a ladder to be safe it must be inclined at between 70° and 80° to the ground.

The diagram shows a ladder resting against a wall.



Not to scale

Is it safe?
You **must** show your working.

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(3 marks)

TURN OVER FOR THE NEXT QUESTION

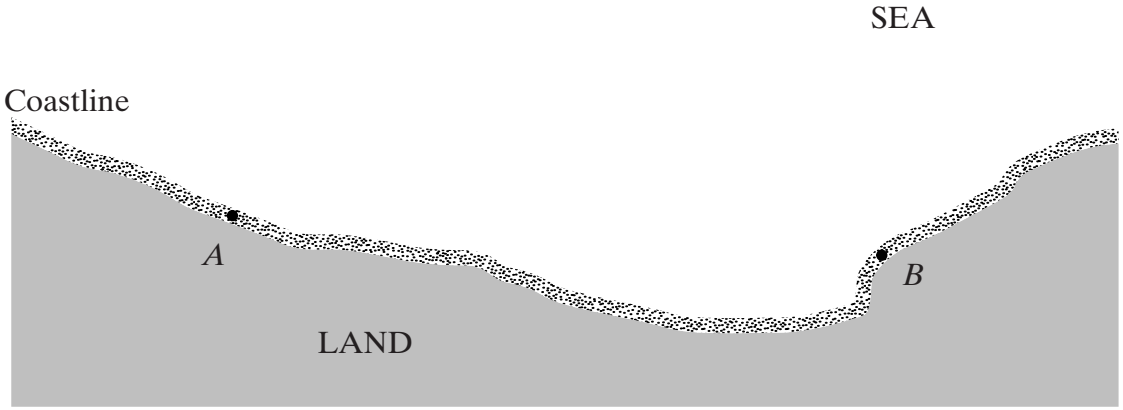
6

11 (a) Using a ruler and compasses only, construct an angle of 60°.
Show all your construction lines and arcs.

(2 marks)

(b) Two lifeboat stations *A* and *B* receive a distress call from a boat.
The boat is within 6 kilometres of station *A*.
The boat is within 8 kilometres of station *B*.
Shade the possible area in which the boat could be.

Scale: 1 cm represents 1 km



(2 marks)

12 The table shows the number of students at a tutorial college each term since Autumn 2002. The table also shows the 3-point moving averages for this data except for Spring 2003 and Summer 2005.

	Autumn 2002	Spring 2003	Summer 2003	Autumn 2003	Spring 2004	Summer 2004	Autumn 2004	Spring 2005	Summer 2005	Autumn 2005
Number of students	48	30	81	54	39	93	69	57	114	
3-point moving average			55	58	62	67	73	80		

(a) Calculate the 3-point moving average for Spring 2003.
You **must** show your working.

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Answer ..... *(2 marks)*

(b) (i) By continuing the number sequence for the moving averages, predict the 3-point moving average for Summer 2005.

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Answer ..... *(1 mark)*

(ii) Show how the college predicted that the number of students in Autumn 2005 would be 93.

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(1 mark)

8

13 Sam sees this sign in a shop window.

How much was the phone before the price reduction?

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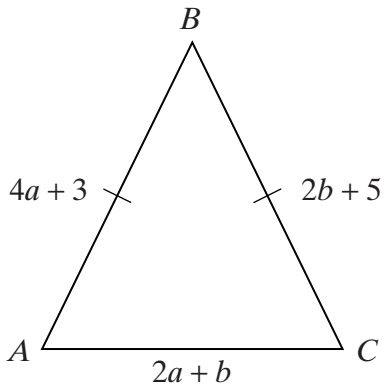
Answer £ ..... *(3 marks)*

14 ABC is an isosceles triangle.
The lengths, in cm, of the sides are

$AB = 4a + 3$, $BC = 2b + 5$ and $AC = 2a + b$



Not to scale

(a) $AB = BC$

Show that $2a - b = 1$

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(2 marks)

(b) The perimeter of the triangle is 32 cm.

Find the values of a and b.

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Answer $a =$ ..... cm, $b =$ ..... cm *(4 marks)*

9

15 Julie has a bag containing x blue marbles and y red marbles.
The ratio of blue marbles to red marbles is 2 : 3
She adds z blue marbles.
The ratio of blue marbles to red marbles is now 2 : 1

What is the ratio between x and z?

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Answer ..... *(3 marks)*

16 Write $0.4\dot{2}\dot{1}$ as a fraction in its simplest form.

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Answer ..... *(3 marks)*

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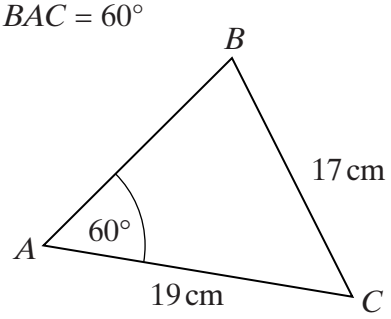
17 (a) ABC is a triangle.
$AC = 19$ cm, $BC = 17$ cm and angle $BAC = 60°$



Not to scale

Calculate the size of angle ABC.

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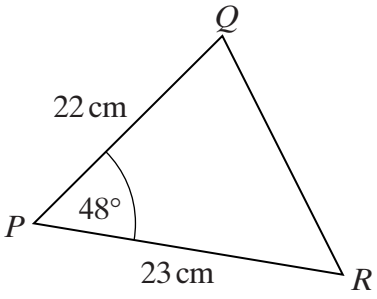
Answer ..... degrees *(3 marks)*

(b) PQR is a triangle.
$PR = 23$ cm, $PQ = 22$ cm and angle $QPR = 48°$



Not to scale

Calculate the length of QR.
Give your answer to an appropriate degree of accuracy.

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Answer ..... cm *(4 marks)*

13

Turn over ▶

18 There are 250 workers in a factory.
The table shows the number of each type of worker in the factory.

Managers	Craftsmen	Labourers	Administrators
25	130	54	41

(a) A stratified sample of size 40 is required.
Calculate the number of each type of worker that should be chosen.

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Answer Managers .....

Craftsmen .....

Labourers .....

Administrators .....

(3 marks)

(b) Describe a method to obtain a stratified sample of size 40 from the workers in the factory.

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(2 marks)

19 The triangle number sequence is

1, 3, 6, 10, 15, 21, …

The nth term of this sequence is given by

$$\frac{1}{2}\,n(n+1)$$

(a) Write down an algebraic expression for the $(n-1)$th term of the sequence.

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Answer ..... *(1 mark)*

(b) Prove that the sum of any two consecutive triangle numbers is a square number.

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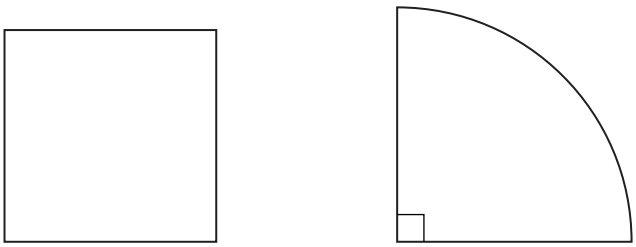
(3 marks)

9

20 A square of side x and a quarter-circle of radius r have the same area.



Not to scale

Express r in terms of x.
Simplify your answer.

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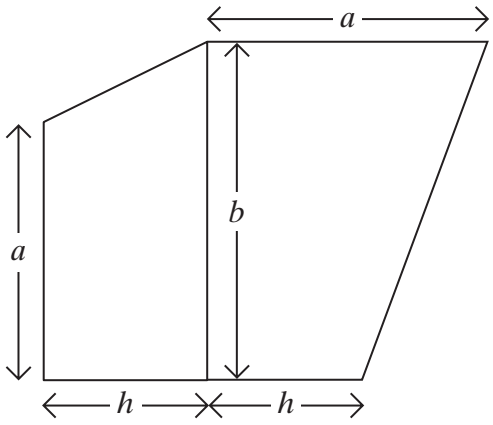
Answer r = ... *(3 marks)*

21 A shape is made from two trapezia.



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The area of this shape is given by

$$A = \frac{h}{2}(a + b) + \frac{b}{2}(a + h)$$

Rearrange the formula to make a the subject.

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Answer a = ... *(4 marks)*

7

22 The grid on the opposite page shows graphs of a curve

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

and 3 straight lines

$$y = x + 1$$
$$y = -x - 2$$
and $$y = -x + 2$$

You **must** use the graphs to answer the following questions.

(a) Write down a pair of simultaneous linear equations that have a solution

$x = -1\frac{1}{2}$, $y = -\frac{1}{2}$

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Answer ..... *(1 mark)*

(b) Write down and simplify a quadratic equation whose solutions are approximately – 3.3 or 0.3
You **must** show clearly how you obtain your answer.

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Answer ..... *(2 marks)*

(c) Write down the approximate solutions to the equation $x^2 + x - 4 = 0$
You **must** show clearly how you obtain your answer.

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Answer ..... *(2 marks)*

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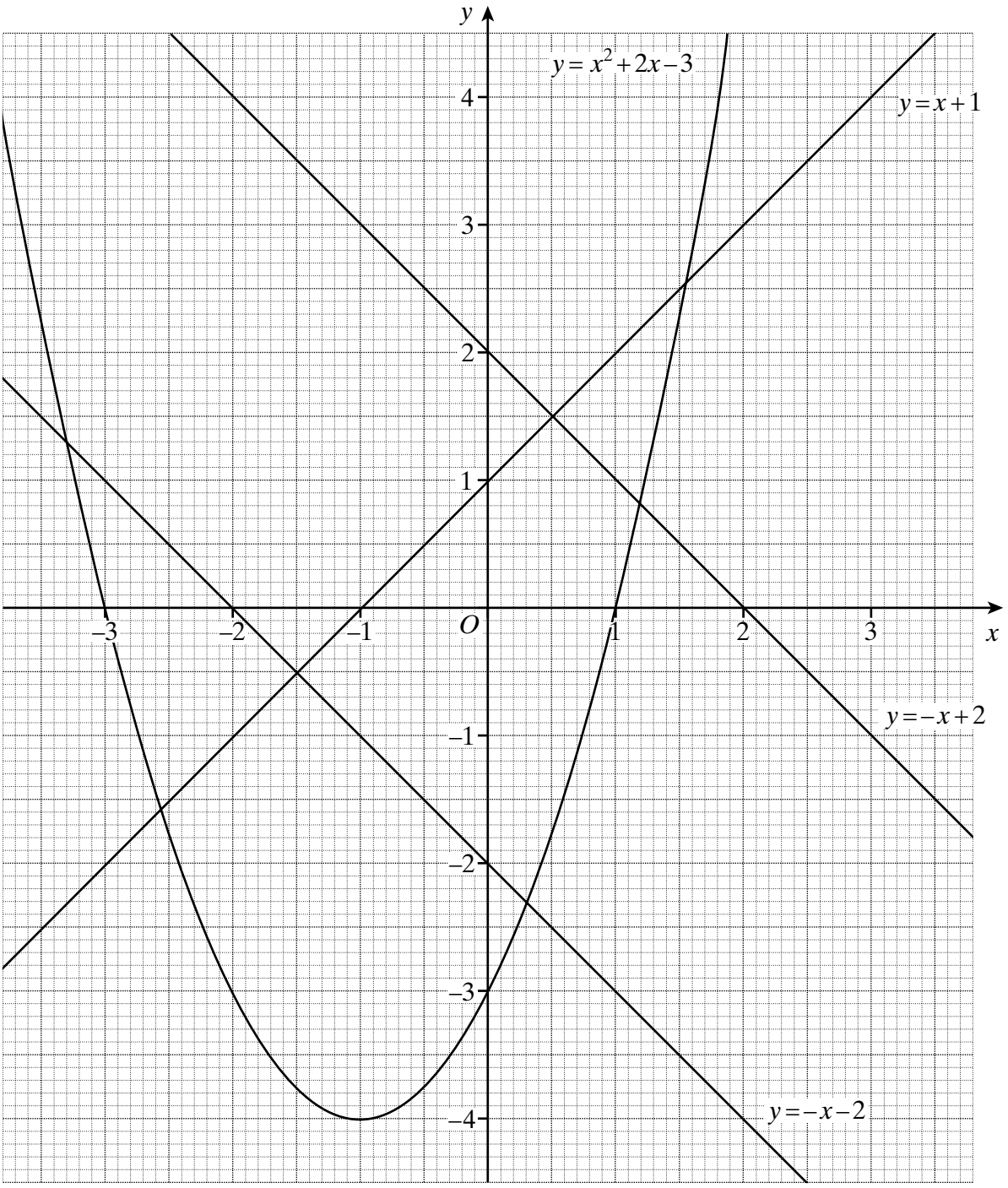
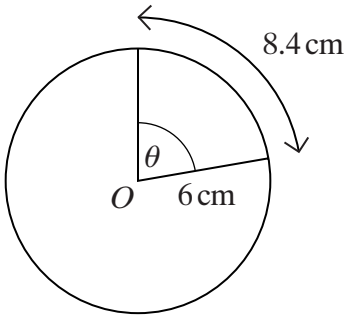


5

23 (a) A circle has a radius of 6 cm.
A sector has an arc length of 8.4 cm.
The angle at the centre of the sector is θ.



Not drawn accurately

Calculate the value of θ.

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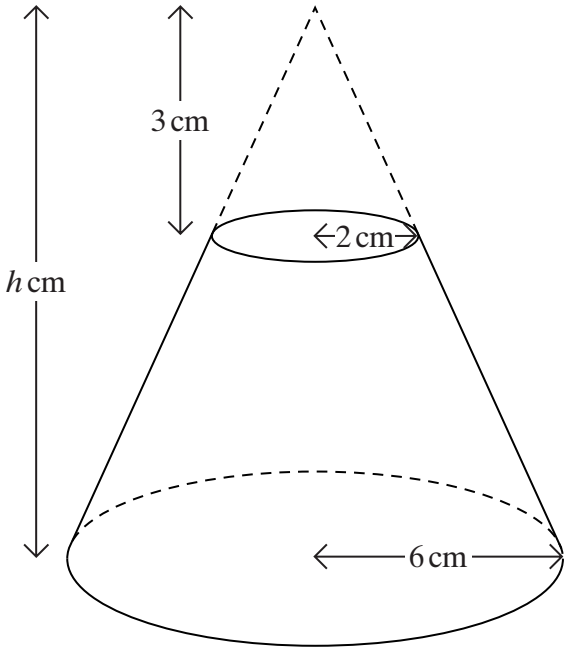
Answer ..... degrees *(3 marks)*

(b) A cone has base radius 6 cm and height h cm.
A smaller cone of base radius 2 cm and height 3 cm is cut from the top.
The remaining frustum has dimensions as shown.



Not drawn accurately

Calculate the volume of the frustum.

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Answer ..... cm^3 *(5 marks)*

8

LEAVE MARGIN BLANK

24 Jane and Mitzi have both done the same number of practice papers for their mathematics examination.
They both have the same total mark, T.
They do one more practice paper.
Jane scores 89 and her average score increases to 68.
Mitzi scores 57 and her average score decreases to 64.

Find the final number of practice papers taken by each student.
You **must** show your working.

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Answer ..... *(4 marks)*

END OF QUESTIONS

4