Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Secondary Education
June 2004

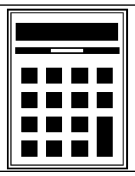
ASSESSMENT and QUALIFICATIONS ALLIANCE

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

H

Tuesday 15 June 2004 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.

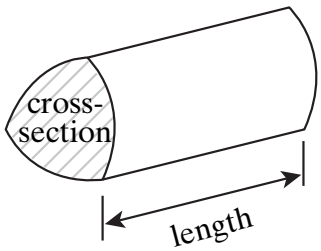
Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	**Mark**
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

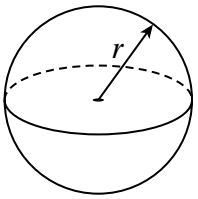
You may need to use the following formulae:

Volume of prism = area of cross-section × length



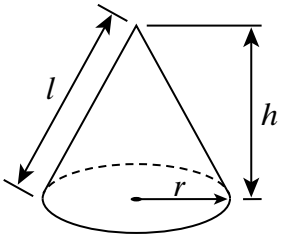
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

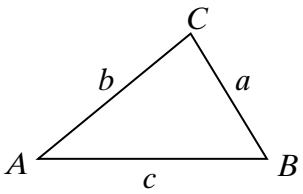


In any triangle ABC

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

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

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 Use your calculator to work out $\sqrt{\dfrac{39\,231}{27.9^2}}$

(a) Write down the full calculator display.

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

(b) Give your answer to 3 significant figures.

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

2 Dario is using trial and improvement to find a solution to the equation

$$x + \frac{1}{x} = 5$$

The table shows his first trial.

x	$x + \frac{1}{x}$	**Comment**
4	4.25	Too low

Continue the table to find a solution to the equation.
Give your answer to 1 decimal place.

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

Turn over ▶

LEAVE MARGIN BLANK

3 (a) An ordinary six-sided dice is biased.
The probabilities of the dice landing on each of the numbers are

Number	1	2	3	4	5	6
Probability	p	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{2}{9}$

Work out the value of p.

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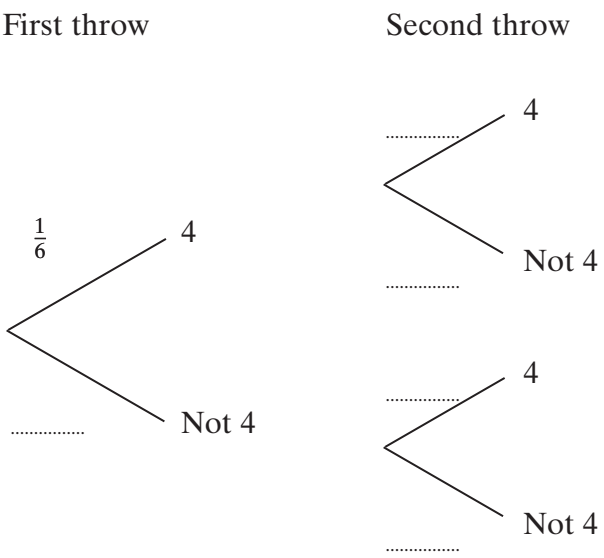
Answer p = ... *(2 marks)*

(b) The dice is thrown twice.

(i) Complete the tree diagram.



(2 marks)

(ii) Calculate the probability that only one 4 is thrown.

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

LEAVE MARGIN BLANK

4 (a) Solve the inequality $2x + 3 \geqslant 1$

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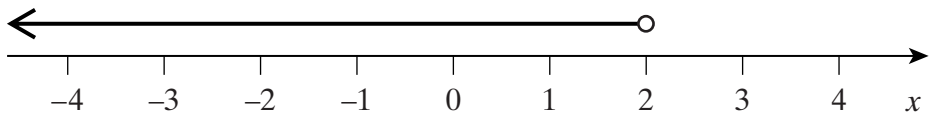
Answer ..... *(2 marks)*

(b) Write down the inequality shown by the following diagram.



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

(c) Write down all the integers that satisfy both inequalities shown in parts (a) and (b).

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

TURN OVER FOR THE NEXT QUESTION

11

LEAVE MARGIN BLANK

5 (a) (i) Multiply out $s(s^2 + 6)$

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

(ii) Multiply out and simplify $4(x - 2) + 3(x + 2)$

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

(iii) Multiply out and simplify $(n + 3)^2$

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

(b) Factorise completely the following expressions

(i) $2a^2 + a$

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

(ii) $8x^3y^2 - 4xy^3$

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

LEAVE MARGIN BLANK

6 (a) The star Alpha Centauri is approximately 40 653 230 000 000 kilometres from earth.
Write this number in standard form to 3 significant figures.

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

(b) Light travels at approximately 298 000 kilometres per second.
There are 86 400 seconds in a day.
How many days will light take to reach the earth from Alpha Centauri?
Give your answer to an appropriate degree of accuracy.

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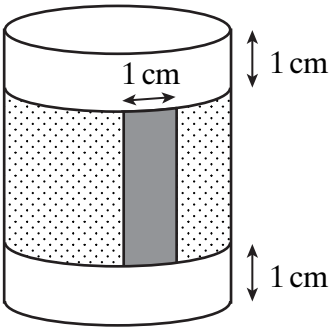
Answer ..... days *(4 marks)*

TURN OVER FOR THE NEXT QUESTION

15

LEAVE MARGIN BLANK

7 A tin of diameter 7 cm and height 12 cm has a label around it.
The label is glued together using a 1 cm overlap.
There is a 1 cm gap between the label and the top and the bottom of the tin.



Not to scale

Find the length and the height of the label.

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Answer Length = ... cm

Height = ... cm *(4 marks)*

8 Make x the subject of the formula

$$3x + 2y = 8y - 3$$

Simplify your answer as much as possible.

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

LEAVE MARGIN BLANK

9 Mr and Mrs Smith are buying a washing machine in a sale.

What was the original price of the washing machine?

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Answer £ ..... *(3 marks)*

10 £4500 is invested at 3.2% compound interest per annum.
How many years will it take for the investment to exceed £5000?

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

13

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11 (a) Solve the equation

$$9(x - 1) = 5(x - 2)$$

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

(b) Solve the equation

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

You **must** show all your working.

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

LEAVE MARGIN BLANK

12 y is inversely proportional to the square of x.
When $y = 3, x = 2$
Find the value of y when $x = 4$

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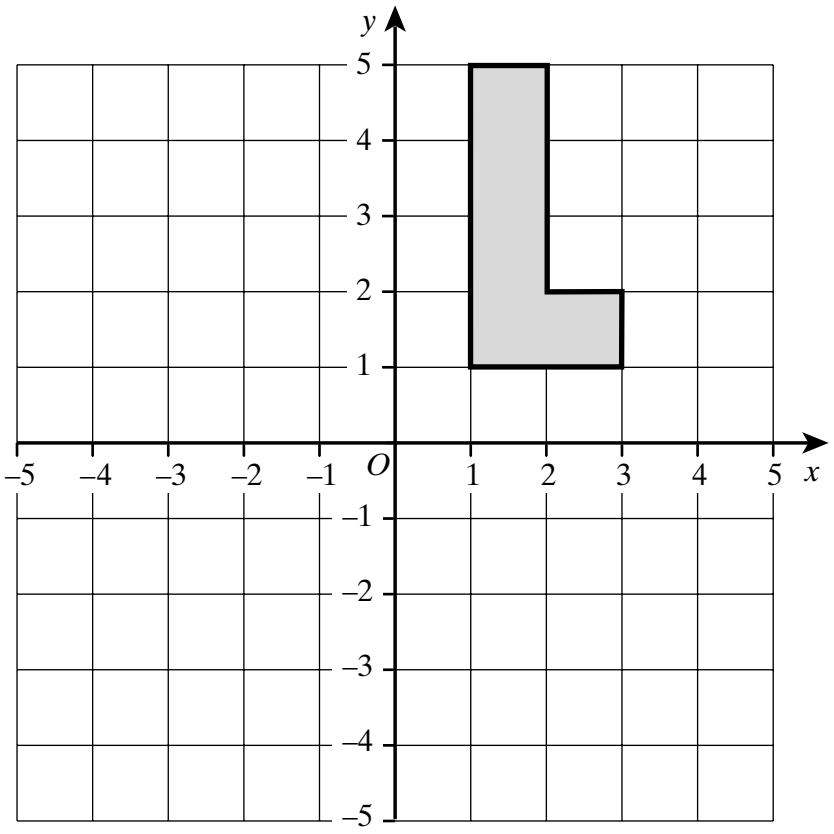
Answer $y =$ ..... *(3 marks)*

13



Enlarge the shaded shape by scale factor $-\frac{1}{2}$ with centre of enlargement $(-1, 0)$.

(2 marks)

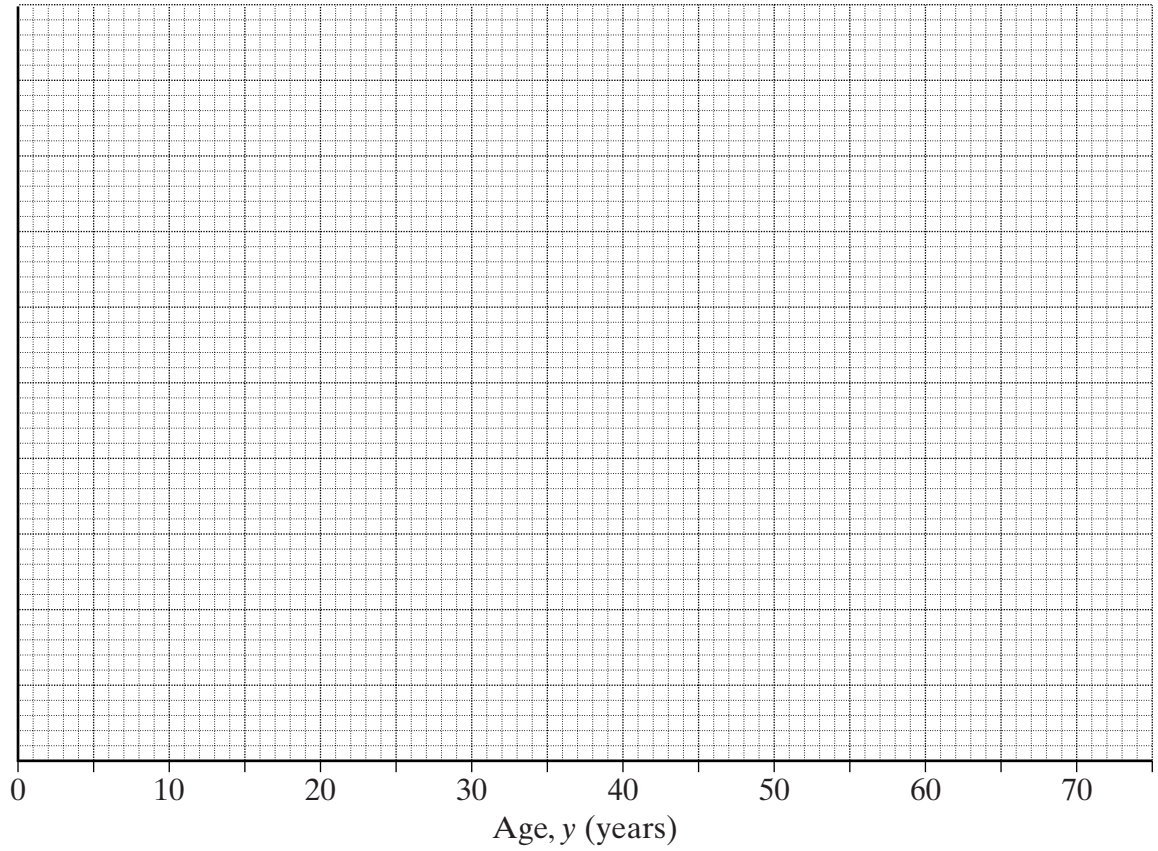
12

LEAVE MARGIN BLANK

14 The table shows the distribution of ages in a health club.

Age, y (years)	**Frequency**
$0 < y \leqslant 15$	75
$15 < y \leqslant 20$	350
$20 < y \leqslant 25$	850
$25 < y \leqslant 40$	750
$40 < y \leqslant 70$	600

(a) (i) Draw a histogram to illustrate this data.



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(3 marks)

(ii) Members over 65 pay a reduced subscription.
Estimate how many members are over 65.

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

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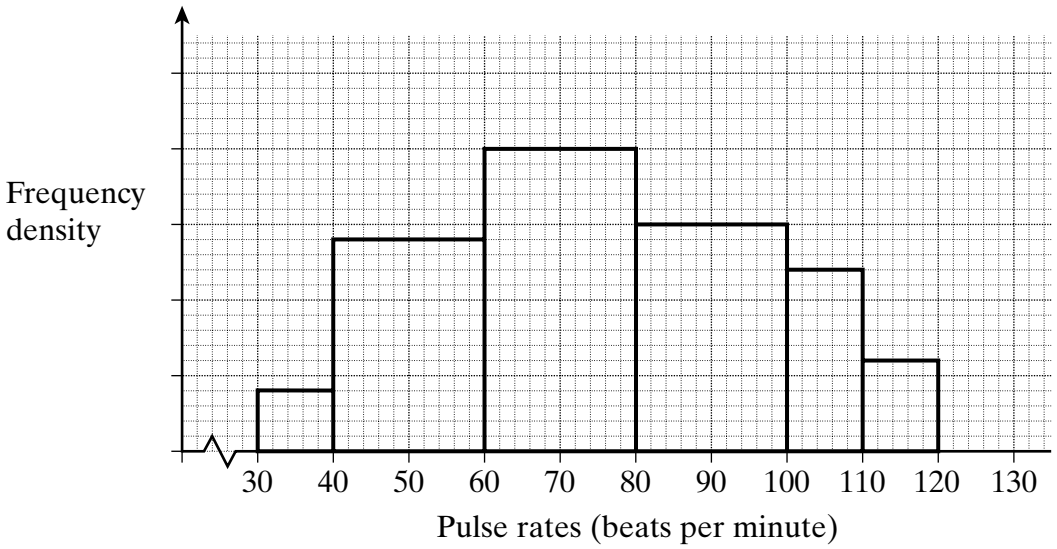
(b) This histogram shows the pulse rates of some of the members of the club.



60 of the members have a pulse rate lower than 50 beats per minute.
How many members have a pulse rate greater than 90 beats per minute?

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

8

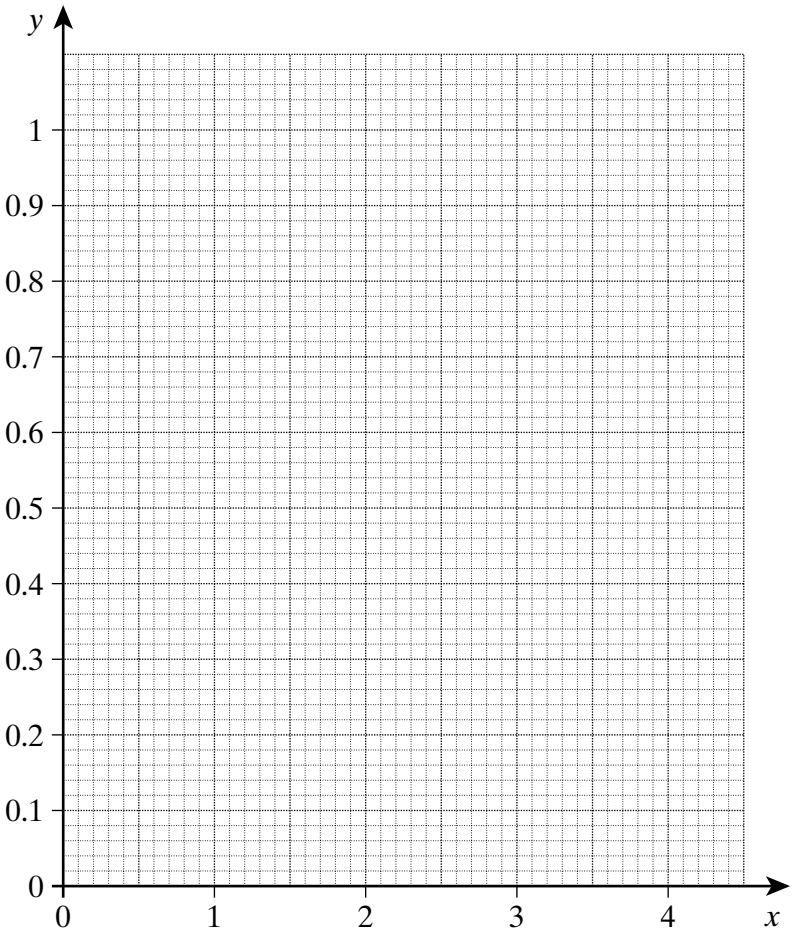
LEAVE MARGIN BLANK

15 (a) Complete the table of values for $y = (0.8)^x$

x	0	1	2	3	4
y	1	0.8	0.64		0.41

(1 mark)

(b) On the grid below, draw the graph of $y = (0.8)^x$ for values of x from 0 to 4.



(2 marks)

(c) Use your graph to solve the equation $(0.8)^x = 0.76$

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

LEAVE MARGIN BLANK

16 Rationalise the denominator of $\dfrac{2+\sqrt{3}}{\sqrt{3}}$

Simplify your answer fully.

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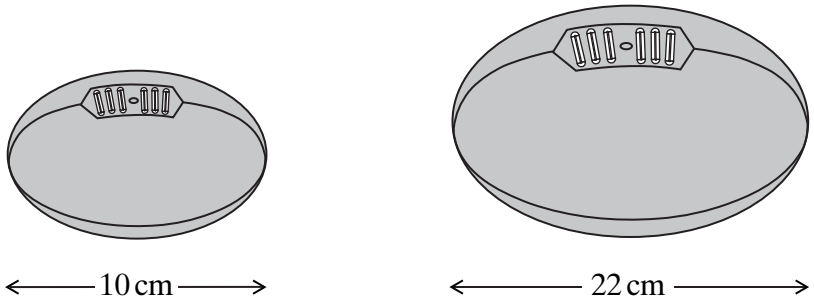
Answer ..... *(3 marks)*

17 A child's rugby ball is 10 cm long and has a volume of 200 cm^3.
It is similar in shape to a full-size rugby ball.
A full-size rugby ball is 22 cm long.



Not to scale

Find the volume of the full-size ball.

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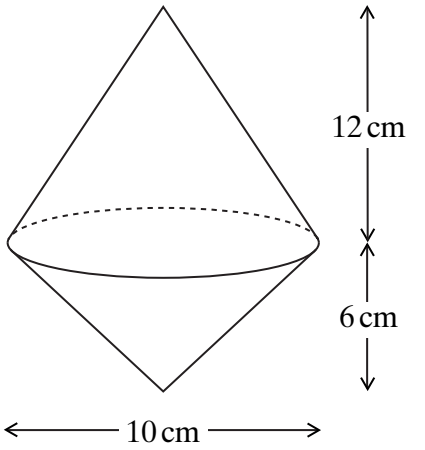
Answer ..... cm^3 *(2 marks)*

9

Turn over ▶

LEAVE MARGIN BLANK

18 The diagram shows a float made from two cones with dimensions as shown.



Not to scale

Calculate the total surface area of the float.

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Answer ..... cm^2 *(5 marks)*

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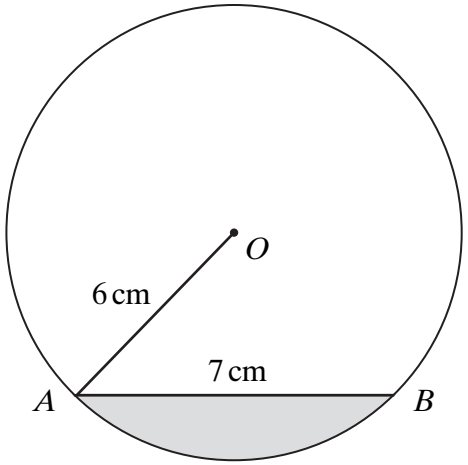
19 AB is a chord of a circle, centre O, radius 6 cm.
$AB = 7$ cm



Not drawn accurately

Calculate the area of the shaded segment.

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Answer ..... cm^2 *(6 marks)*

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Turn over ▶

LEAVE MARGIN BLANK

20 Solve the simultaneous equations

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

You **must** show your working.
Do **not** use trial and improvement.

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Answer ..... *(5 marks)*

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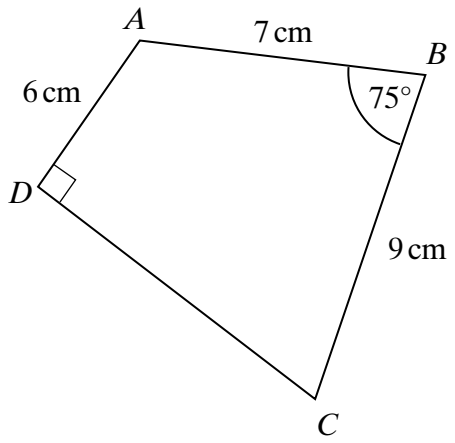
21 $ABCD$ is a quadrilateral.
$AB = 7$ cm, $AD = 6$ cm and $BC = 9$ cm.
Angle $ABC = 75°$ and angle $ADC = 90°$



Not drawn accurately

Calculate the perimeter of $ABCD$.

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

10

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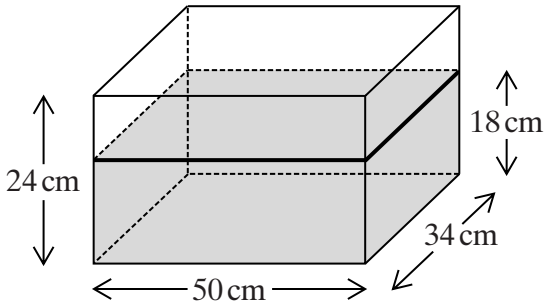
22 A water tank is 50 cm long, 34 cm wide and 24 cm high.
It contains water to a depth of 18 cm.



Not to scale

Four identical spheres are placed in the tank and are fully submerged.
The water level rises by 4.5 cm.

Calculate the radius of the spheres.

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

END OF QUESTIONS

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