Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

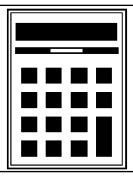
General Certificate of Secondary Education
November 2007

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

H

Friday 9 November 2007 9.00 am to 11.00 am

For this paper you must have:
- 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.
- Answer the questions in the spaces provided.
- Use a calculator where appropriate.
- Do all rough work in this book.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper. They must be tagged securely to this answer book.

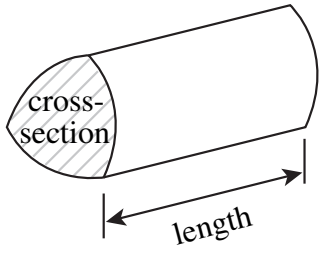
Advice
- In all calculations, show clearly how you work out your answer.

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	
TOTAL	
Examiner's Initials	

Formulae Sheet: Higher Tier

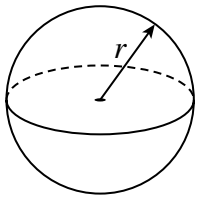
You may need to use the following formulae:

Volume of prism = area of cross-section × length



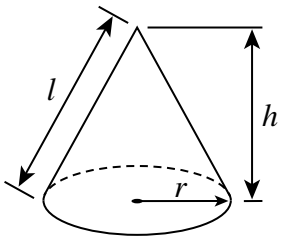
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

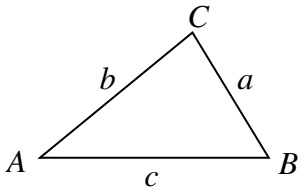


In any triangle ABC

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 (a) Calculate the reciprocal of 0.8

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

(b) Calculate $\sqrt{8.17^3 + 4.39^2}$

(i) Give **all** the figures on your calculator display.

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

(ii) Give your answer to an appropriate degree of accuracy.

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

2 Solve the equations

(a) $4(2x - 7) = 12 + 3x$

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

(b) $\frac{y}{7} - 9 = 2$

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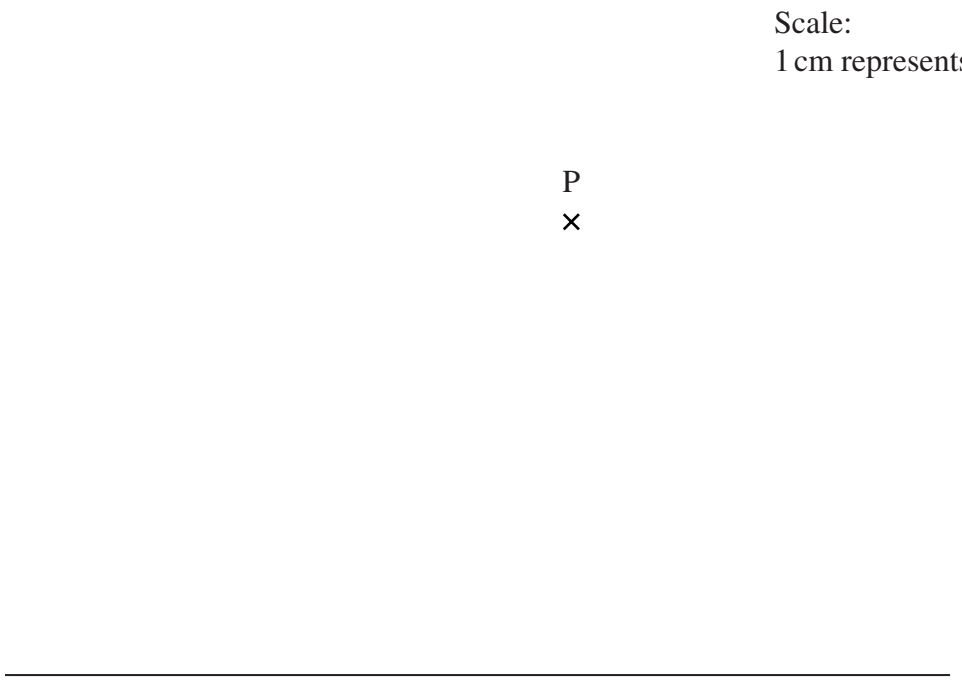
Answer $y =$ ..... *(2 marks)*

8

3 The diagram shows a scale drawing of a straight road.
A walker is at point P.



(a) Use a ruler and compasses to construct the perpendicular from the point P to the road.
You **must** show all your construction lines and arcs.

(3 marks)

(b) Find the shortest real distance from the walker to the road.

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

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

$$x^3 + 2x = 60$$

Give your answer to 1 decimal place.
You **must** show your working.

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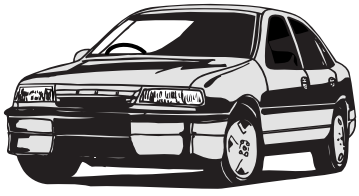
Answer x = ... *(4 marks)*

5 A car is in a sale.



Sale

15% off normal price

Sale price £12 512

What is the normal price of the car?

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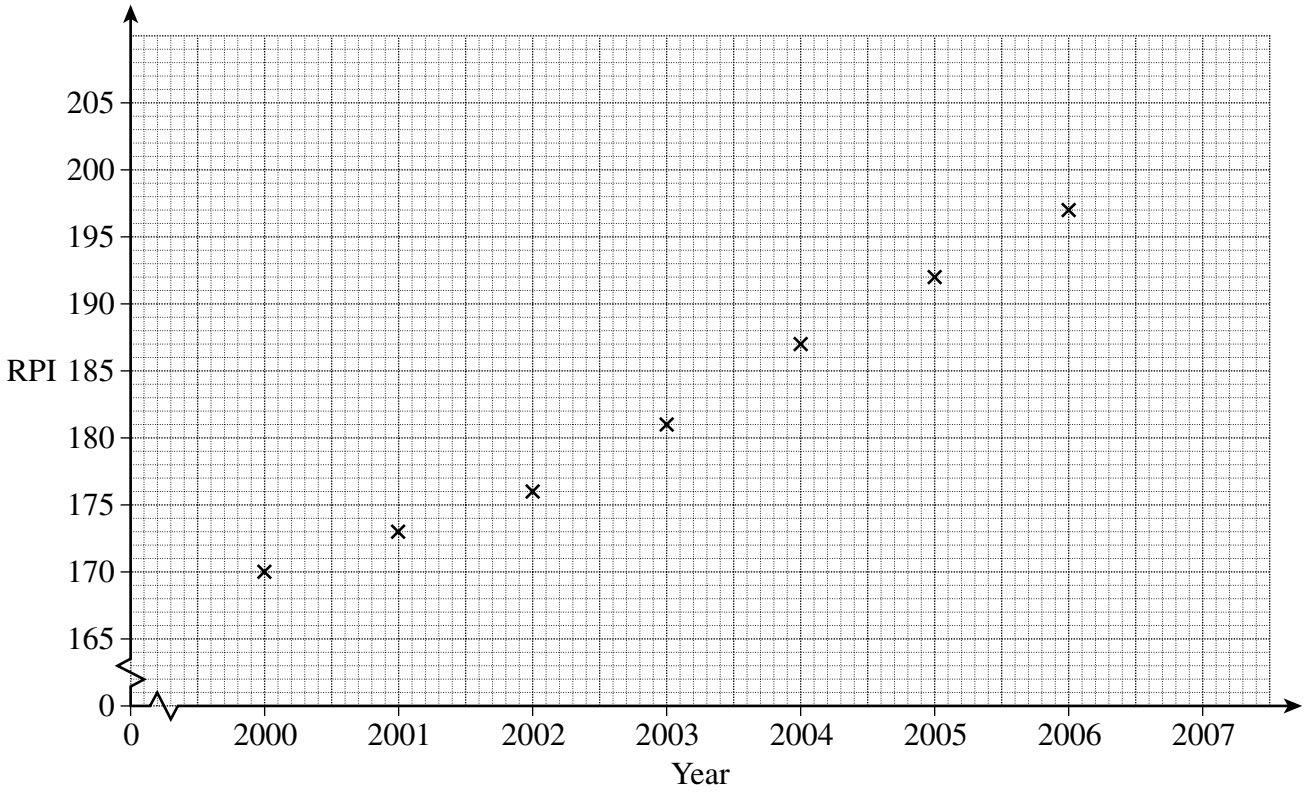
Answer £ ..... *(3 marks)*

Turn over ►

12

6 The values of the Retail Price Index (RPI) for various years are shown in the table and on the graph.

Year	2000	2001	2002	2003	2004	2005	2006
RPI	170	173	176	181	187	192	197



(a) Use the graph to estimate the RPI for 2007.

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

(b) The RPI for 1987 was 100

State the percentage increase in the RPI from 1987 to 2005.

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

(c) Calculate the percentage increase in the RPI from 2000 to 2006.

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

7 (a) Expand and simplify $(x + 2)(x - 4)$

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

(b) Expand and simplify

$$2(m + 5) - 3(2m - 1)$$

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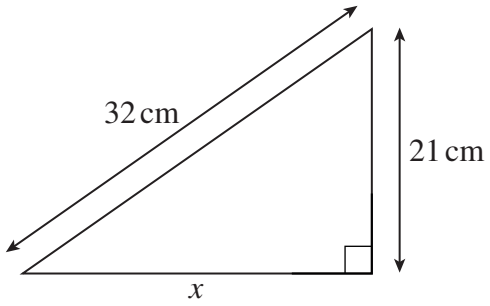
Answer ..... *(2 marks)*

Turn over for the next question

8 (a)



Not drawn accurately

Calculate the length x.

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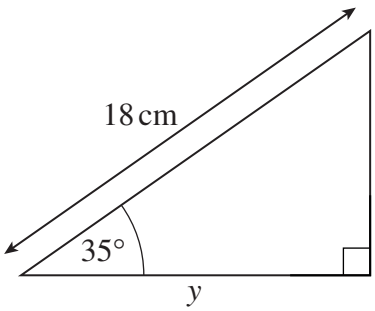
Answer ..... cm *(3 marks)*

(b)



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Calculate the length y.

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

9 Bob has a circular lawn with a radius of 2.2 m.
He has a 1 kg box of lawn feed.
The label says 'Use 75 g diluted in 4 litres of water per square metre of lawn'.

Does Bob have enough lawn feed for his lawn?
You **must** show your working.

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(4 marks)

10 Here are the equations of four lines

Line A $y = 3x - 2$

Line B $y = 2 - 3x$

Line C $y = \frac{1}{3}x + 2$

Line D $y = 3x$

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(a) Which two lines are parallel?

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

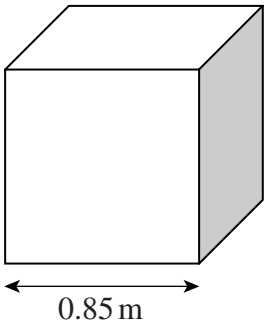
(b) Which two lines intersect on the y-axis?

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

(c) Which two lines are perpendicular?

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

11 A bag filled with sand is a cube 0.85 m along each side.



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The bag holds 1 tonne of sand.

Find the density of the sand.
Give your answer in kilograms per cubic metre.

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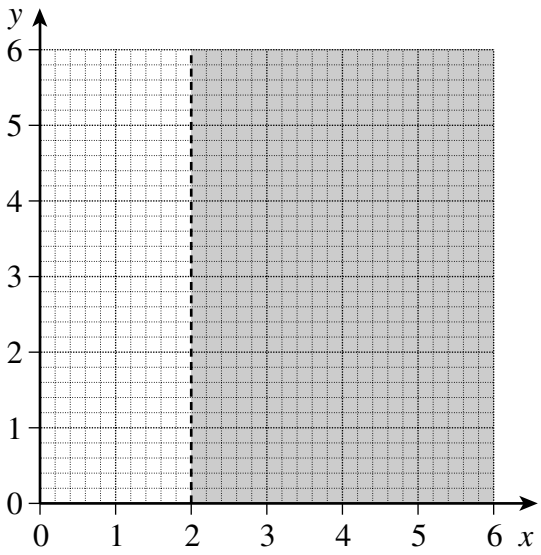
Answer ..... kg/m^3 *(3 marks)*

12 (a)

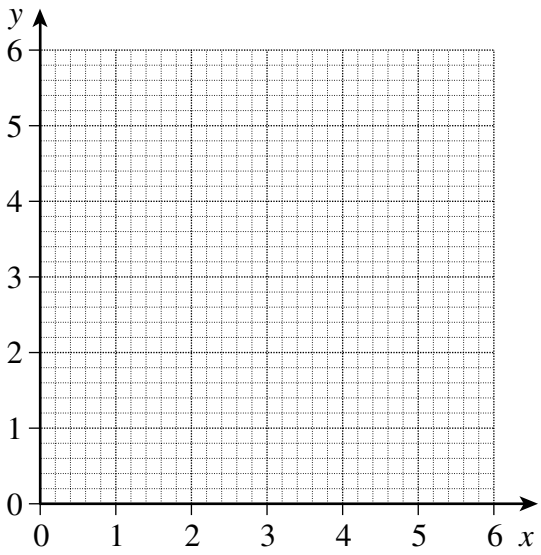


Which inequality is shown shaded on the grid?
Circle the correct answer.

$y > 2$ $\quad$ $y \geqslant 2$

$x > 2$ $\quad$ $x \geqslant 2$ *(1 mark)*

(b)



On the grid draw lines to find the region satisfied by the three inequalities

$$y > 2$$
$$y < x + 1$$
$$x + y < 5$$

Label the region with the letter R.

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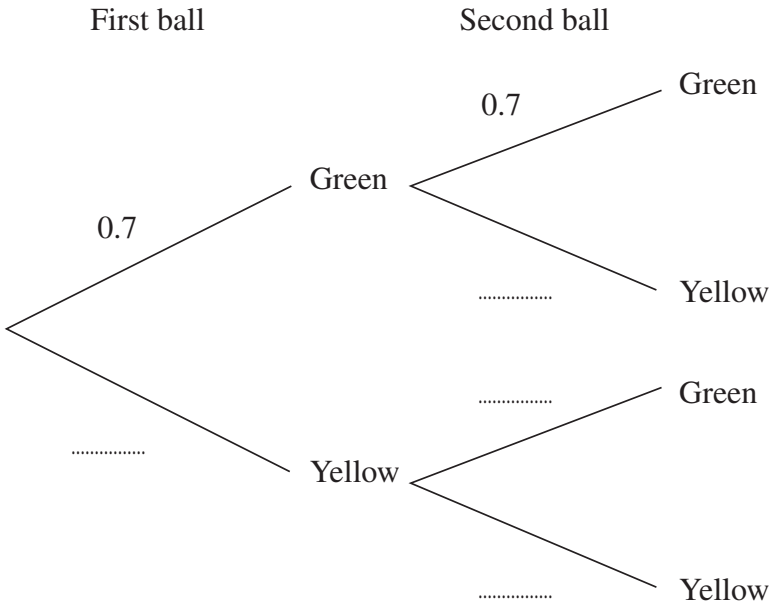
(3 marks)

Turn over ▶

7

13 A bag contains 7 green and 3 yellow balls.
A ball is taken from the bag at random and replaced.
Another ball is then taken from the bag at random.

(a) Complete the tree diagram.



(1 mark)

(b) What is the probability that both balls are different colours?

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

14 The mass of one atom of Hydrogen is 1.67×10^{-24} grams.
The mass of one atom of Oxygen is 2.66×10^{-23} grams.

(a) One molecule of water has two atoms of hydrogen and one atom of oxygen.
The total mass of one molecule of water is given by

$$2 \times 1.67 \times 10^{-24} + 2.66 \times 10^{-23}$$

Work out the total mass.
Give your answer in standard form.

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

(b) Calculate the number of molecules in one gram of water.
Give your answer in standard form.

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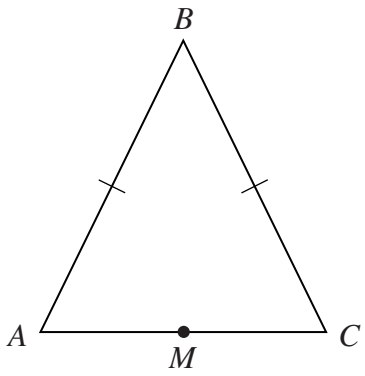
Answer ..... *(2 marks)*

Turn over for the next question

15 *ABC* is an isosceles triangle.
M is the midpoint of *AC*.



Prove that triangles *ABM* and *CBM* are congruent.

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(4 marks)

16 (a) Factorise fully $8a^2 - 50$

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

(b) Simplify fully $\dfrac{12x^2 - 36x + 15}{12x^2 - 3}$

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

Turn over for the next question

17 (a) The table shows the heights of 40 students.

Height, h (cm)	**Number of students**	**Midpoint**	
$140 < h \leqslant 144$	6	142	
$144 < h \leqslant 148$	10		
$148 < h \leqslant 152$	7		
$152 < h \leqslant 156$	9		
$156 < h \leqslant 160$	6		
$160 < h \leqslant 164$	2		

Calculate an estimate of the mean height of the students.

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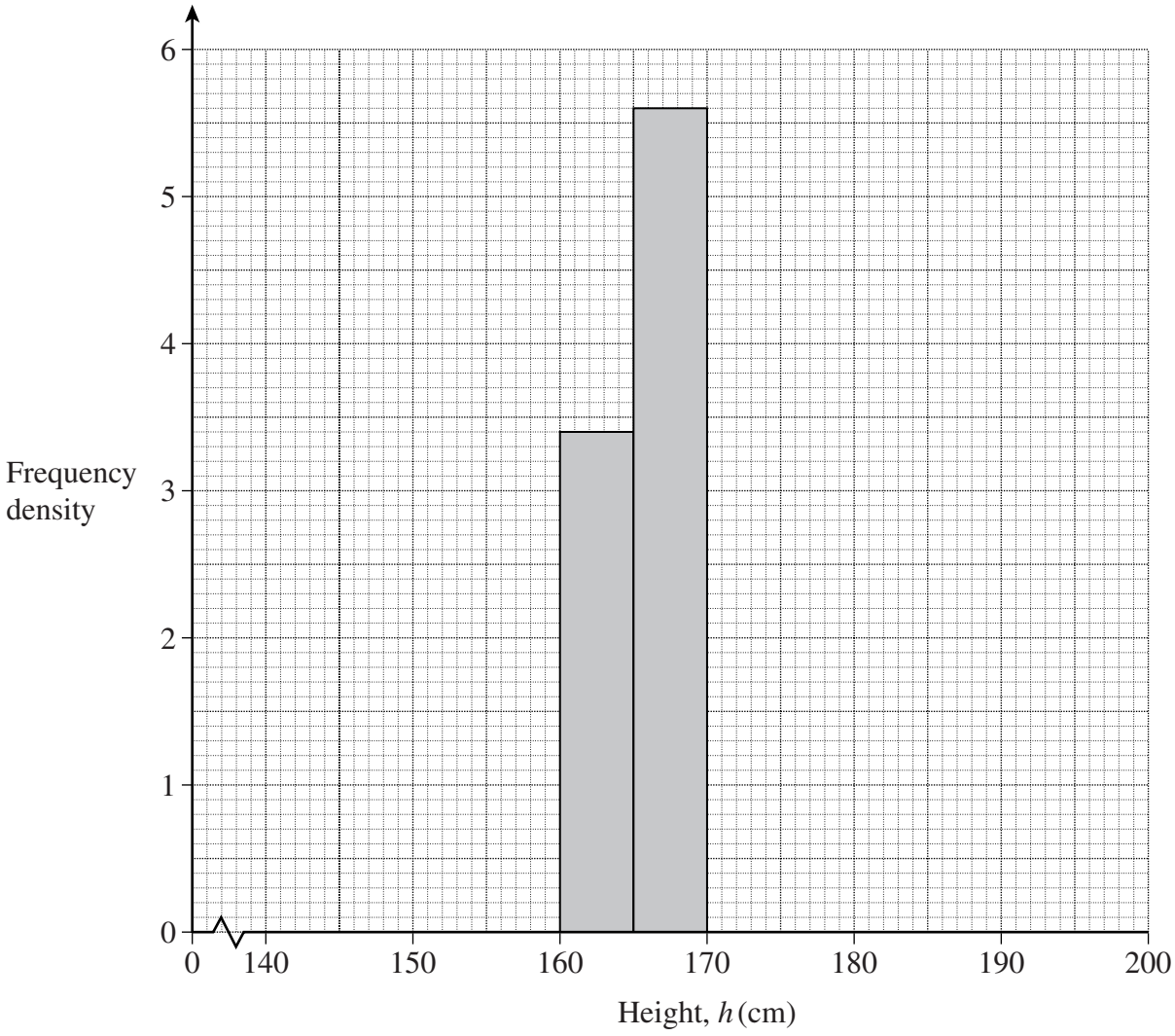
Answer ..... cm *(3 marks)*

(b) The table and histogram below show the same data for the heights of 100 adults.

Height, h (cm)	$140 < h \leqslant 160$	$160 < h \leqslant 165$	$165 < h \leqslant 170$	$170 < h \leqslant 185$	$185 < h \leqslant 200$
Number of adults	25			18	12



Complete the table and the histogram.

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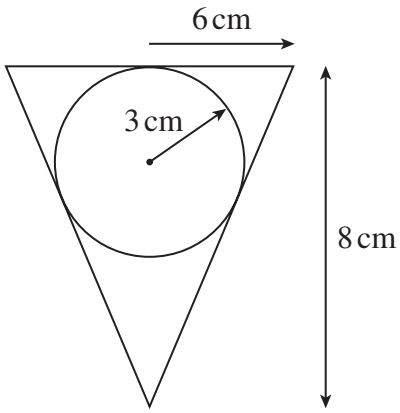
(4 marks)

Turn over ▶

7

18 A solid sphere of radius 3 cm just fits inside a hollow cone of radius 6 cm and height 8 cm. A (vertical) cross-sectional view is shown.



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Calculate the fraction of the volume of the cone taken up by the sphere.
You **must** show your working.

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

19 (a) Show that the x-coordinates of the solutions of the simultaneous equations

$$2x + y = 3 \text{ and } x^2 + y^2 = 5$$

satisfy the equation $5x^2 - 12x + 4 = 0$

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(3 marks)

(b) Solve the equation $5x^2 - 12x + 4 = 0$

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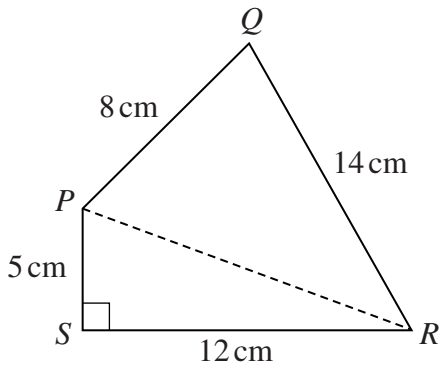
Answer ..... *(3 marks)*

Turn over for the next question

20 The quadrilateral *PQRS* has dimensions as shown.
Angle *PSR* = 90°



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Calculate the area of triangle *PQR*.

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

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21 Marvin is travelling by air.
Marvin has some scales that weigh items up to 3 kg.
The scales are accurate to the nearest 50 g.
Marvin weighs his case and luggage in four separate lots.
The values shown on his scales are

2 kg 400 g, 2 kg 800 g, 2 kg 750 g and 1 kg 850 g.

At the airport his case and luggage are weighed as one item.
The scales at the airport are accurate to the nearest 100 g.

The allowance is 10 kg.

Can Marvin be sure his case and luggage does not exceed the allowance?
You **must** show your working.

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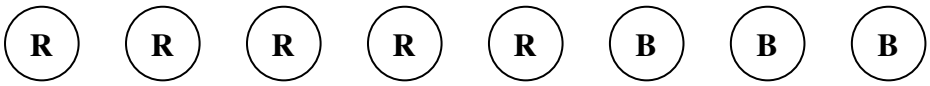
(4 marks)

Turn over for the next question

22 A bag contains 5 red and 3 blue balls.



Two balls are taken out and **not** replaced.

What is the probability that **at least one** of them is red?

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

23 y is directly proportional to the cube of x.
y is inversely proportional to z.
When $y = 2$, $x = 2$ and $z = 16$
Find the value of z when $x = 4$
Show your working.

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

END OF QUESTIONS

8

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