General Certificate of Secondary Education
June 2009

AQA

MATHEMATICS (SPECIFICATION A)   **4306/2H**
Higher Tier
Paper 2 Calculator

H

Monday 1 June 2009   9.00 am to 11.00 am

For this paper you must have:
- a calculator
- mathematical instruments.

Time allowed: 2 hours

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book.

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. These must be tagged securely to this answer booklet.

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

Formulae Sheet: Higher Tier

Area of trapezium $= \frac{1}{2}(a+b)h$
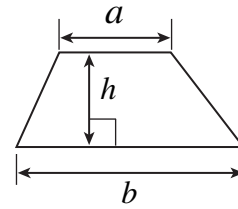
Volume of prism $=$ area of cross-section $\times$ length
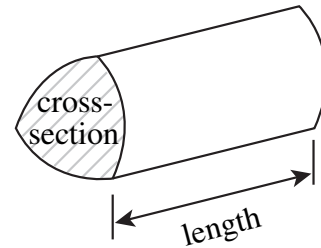
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$
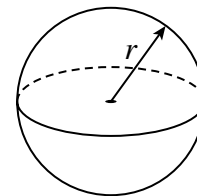
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$
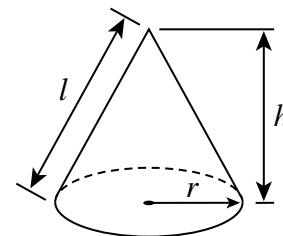
In any triangle *ABC*

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

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

Cosine rule $\quad a^2 = b^2 + c^2 - 2bc \cos A$
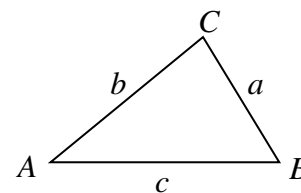
The Quadratic Equation
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1   A householder pays £350 for her quarterly fuel charge.
    She estimates that if she insulates her house she will reduce her quarterly fuel charge
    by 18%.

    What will her expected quarterly fuel charge be after an 18% reduction?

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

2   (a)   Use your calculator to work out 5^6

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                        Answer ....   *(1 mark)*

2   (b)   Explain why the units digit of any positive integer power of 5 will always be 5

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                                                                                (2 marks)

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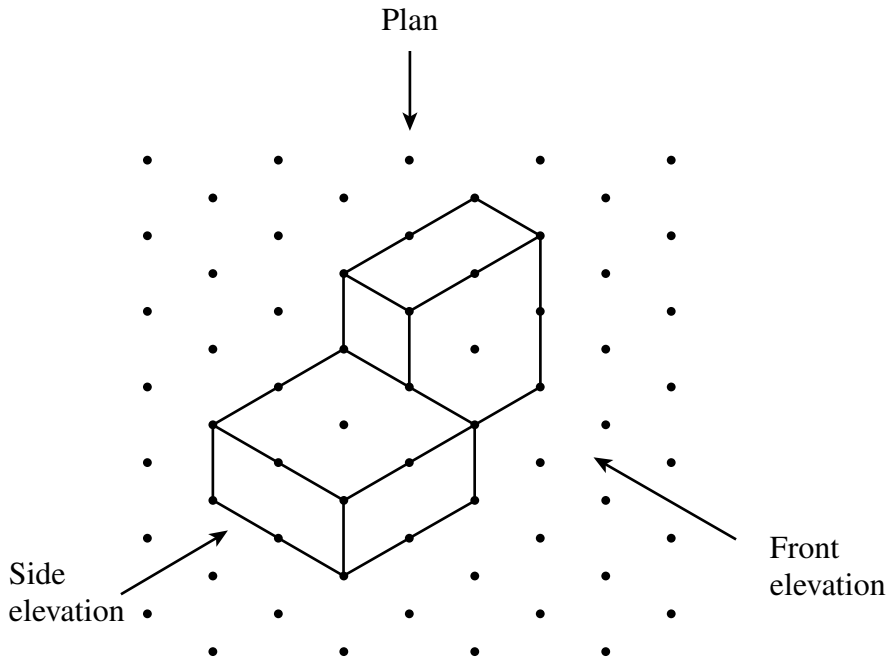
Plan

The diagram shows a solid made from 2 cuboids.
Each cuboid is 1 cm by 2 cm by 2 cm.
Draw the plan, side elevation and front elevation of the solid on the grids below.

Side elevation

Front elevation

Plan
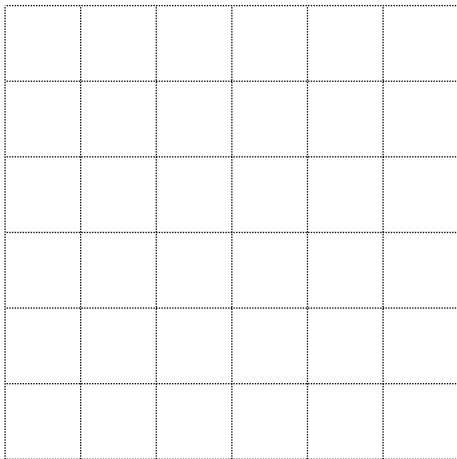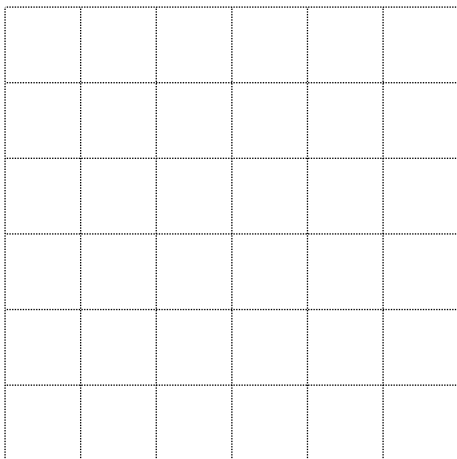
Side elevation   Front elevation
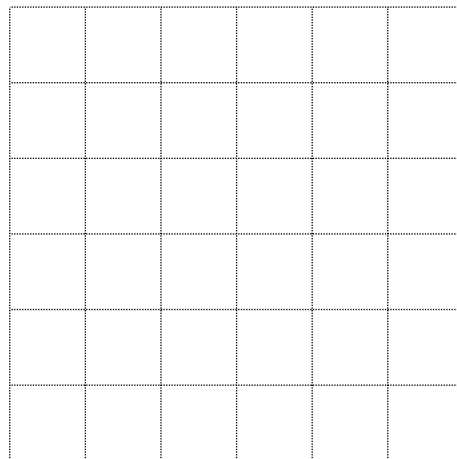
(3 marks)

4 Shapes are made from quarter circles and rectangles.
For example
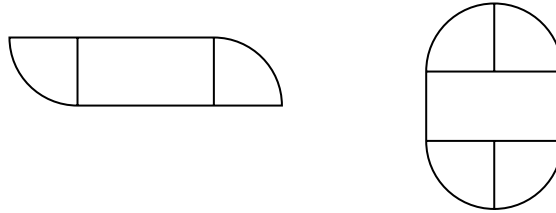
The area of a quarter circle is $Q\,cm^2$.
The area of a rectangle is $R\,cm^2$.

4 (a) Explain why $2Q < R$

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(1 mark)

4 (b) (i) This shape   has an area of $2Q + R\,cm^2$.

Write down the area of this shape in terms of Q and R.
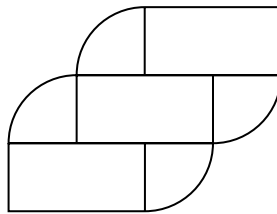
Answer .... cm^2 *(1 mark)*

4 (b) (ii) This shape   has an area of $R - Q\,cm^2$.

Write down the area of this shape in terms of Q and R.

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

7

Turn over ▶

*Areas outside
the box will
not be scanned
for marking*
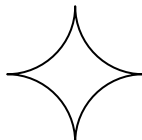
5 Use your calculator to work out

$$\frac{1.27 + 3.89}{4.87 - 2.15}$$

5 (a) Write down all the figures in your calculator display.

Answer .... *(1 mark)*

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

Answer .... *(1 mark)*

6 Solve the equation $7x - 9 = 3x + 5$

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

7 The ratio of pupils taking French, German or Spanish is

French : German : Spanish = 5 : 1 : 3

The Head of Languages wants to draw a pie chart to show this data.

Work out the angle for each sector.

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Answer   French .... degrees

German .... degrees

Spanish .... degrees   *(3 marks)*

8 Two points A and B are shown on the diagram.
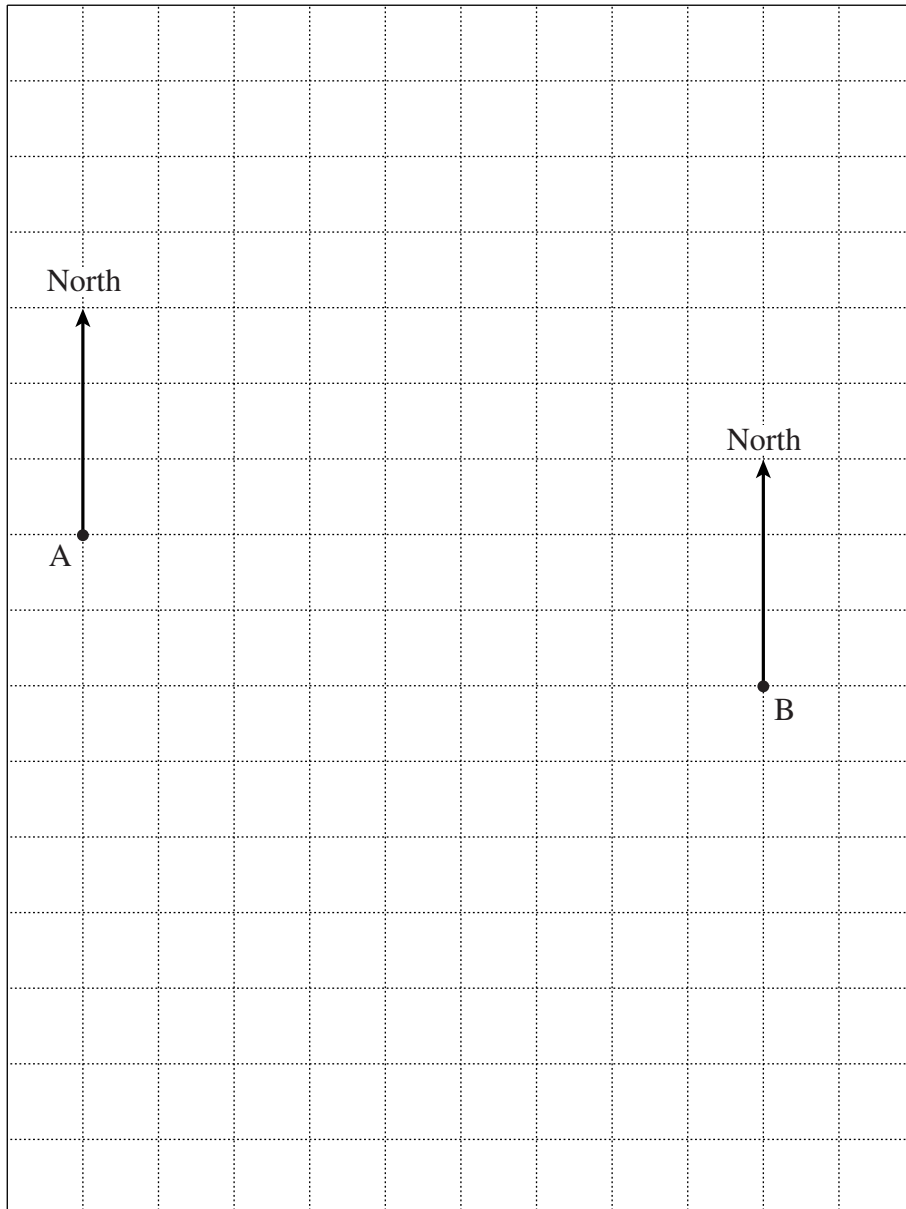
The point C is North-East of point A.
The point C is on a bearing of 310° from point B.

Mark the position of point C on the diagram.

(3 marks)

11

Turn over ▶

9 Amy and Baz want to buy some CDs.
They see this advert.

Buy your CDs online.

Each CD is £7.99 plus post and packing charges as shown in the table.

Special Offer
For every 3 CDs you buy you get the 3rd half-price (£3.99).

Number of CDs	Post and packing charges
1	£1.99
2	£2.99
3	£3.69
4	£3.99
5 or more	Free

Amy wants four CDs and Baz wants two CDs.

9 (a) It will cost Baz £18.97 to buy two CDs including post and packing.

Show that it will cost Amy £31.95 to buy four CDs including post and packing.

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(1 mark)

9 (b) They decide **not** to send two separate orders.
They decide to buy six CDs in one order.

How much will they save?

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Answer £ .... *(3 marks)*

10   One solution of $x^3 + 5x = 130$ is between 4 and 5

Use trial and improvement to find this solution.
Give your answer to one decimal place.

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

Turn over for the next question

7

Turn over ▶

11 (a) Write down the *n*th term of the sequence

4, 9, 14, 19, 24, ……

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Answer .... *(2 marks)*

11 (b) The *n*th term of a sequence is given by

$$\frac{2n - 1}{n + 1}$$

The first three terms are $\frac{1}{2} = 0.5$, $\frac{3}{3} = 1$ and $\frac{5}{4} = 1.25$

Show that the 6$^{\text{th}}$ term of the sequence is the first one that is **not** a terminating decimal.

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(3 marks)

12 Draw the graph of $y = 2x + 1$ for $-3 \leqslant x \leqslant 3$

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(3 marks)

8
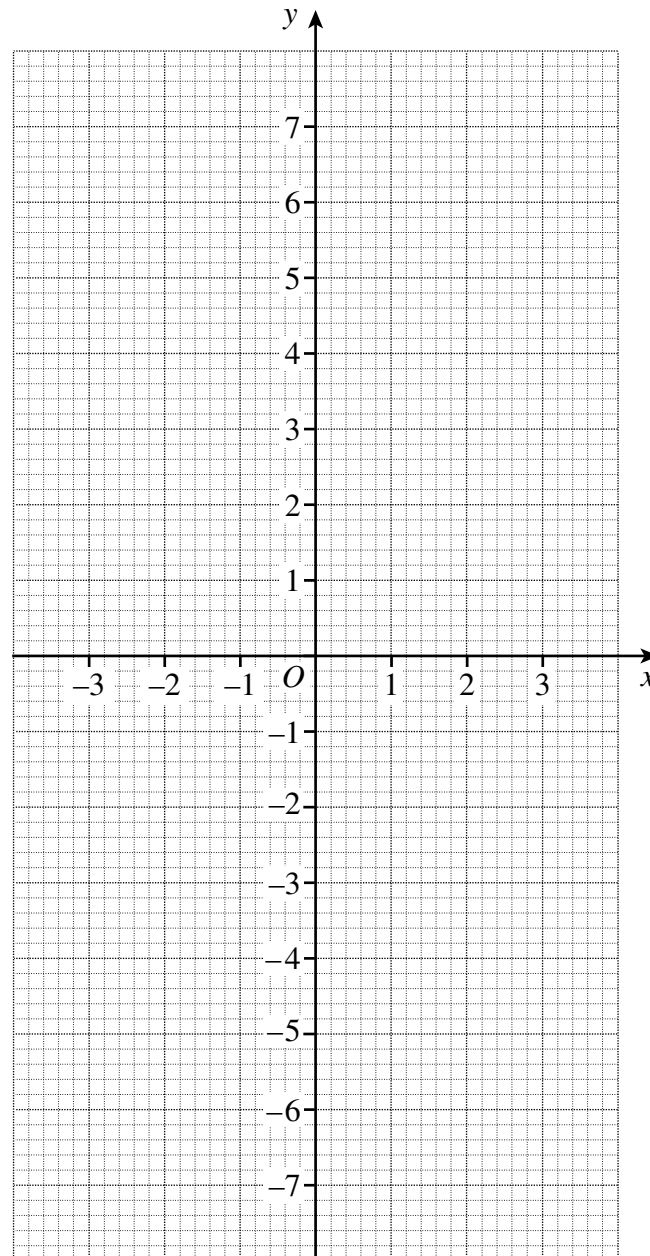
Turn over ▶

13 Rio tested a 5-sided spinner.
He spun it 100 times and recorded the results.
His results are shown in the table.
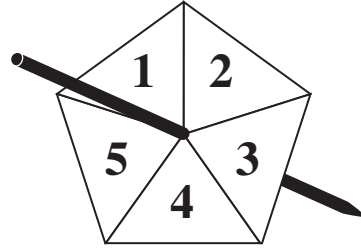
Score	1	2	3	4	5
Frequency	19	37	21	12	11
Relative Frequency					

13 (a) Fill in the values of the relative frequencies of each score.

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(2 marks)

13 (b) Do these results suggest that the spinner is biased?

☐ Yes   ☐ No

Give a reason for your answer.

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(1 mark)

14 The diagram shows a square and two quarter circles.
The square has sides of 6 cm.
The radius of each circle is 3 cm.

6 cm

3 cm
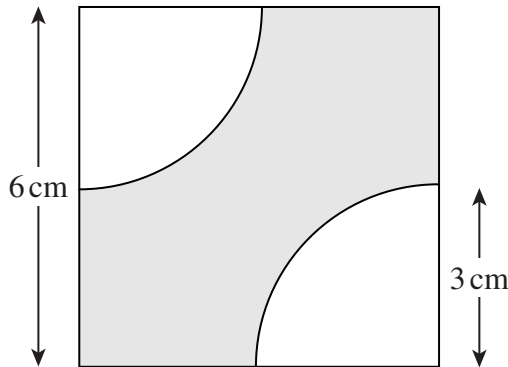
Not drawn
accurately

Find the area of the shaded region.

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

15 Here is some information about class 7J.

There are 30 pupils altogether.
There are 2 more girls than boys.
A quarter of the girls are left-handed.
There are 7 left-handed pupils altogether.

Use this information to complete the two-way table below.

	Boys	Girls	Total
Left-handed			
Right-handed			
Total			30

(2 marks)

8

Turn over ▶

1 3

16 Solve the equation

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

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

17 The VAT rate in Spain is 16%
A hotel bill, including VAT, was €324.80

What was the bill before VAT was added?

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Answer € .... *(3 marks)*

18 The table shows the numbers of candidates who sat a GCSE French examination in June and November from June 2005 until November 2008.

Date	Jun 05	Nov 05	Jun 06	Nov 06	Jun 07	Nov 07	Jun 08	Nov 08
Number	82 300	4700	79 800	5200	76 400	5400	72 100	6100

18 (a) The data is used to predict the entries for 2009.

Explain why a 2-point moving average would be appropriate.

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(1 mark)

18 (b) Calculate the first 2-point moving average for the data.

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(2 marks)

Turn over for the next question

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19 A bag contains 6 blue and 4 white balls.
A ball is taken from the bag at random and replaced.
Another ball is then taken from the bag at random.

19 (a) Complete the tree diagram.

First ball   Second ball

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                                              0.6        Blue
                              Blue
              0.6                       ............    White
                                        ............    Blue
          ............    White
                                        ............    White
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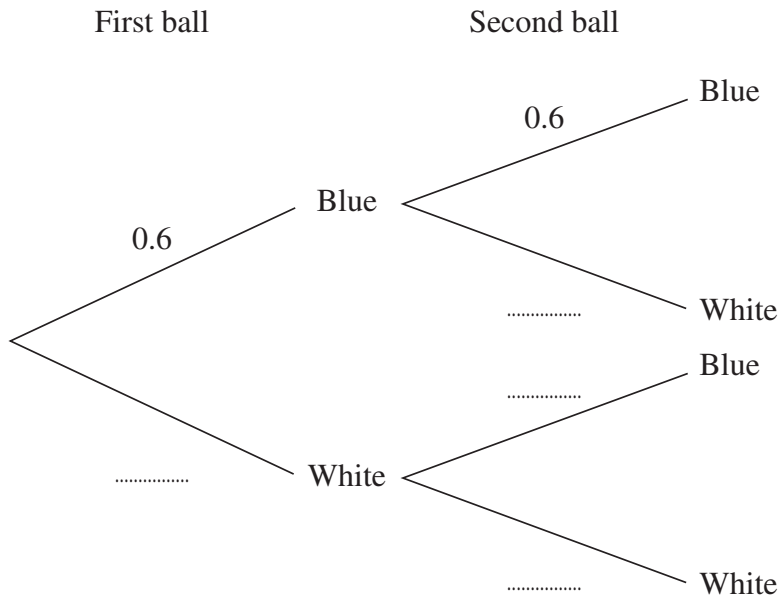
(1 mark)

19 (b) What is the probability that both balls are the same colour?

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Answer ....   *(3 marks)*

20 *ABCD* is a quadrilateral.

The region R is defined as the set of points inside *ABCD* that are:

closer to the side *AB* than the side *AD*

and   closer to the point *D* than the point *C*.
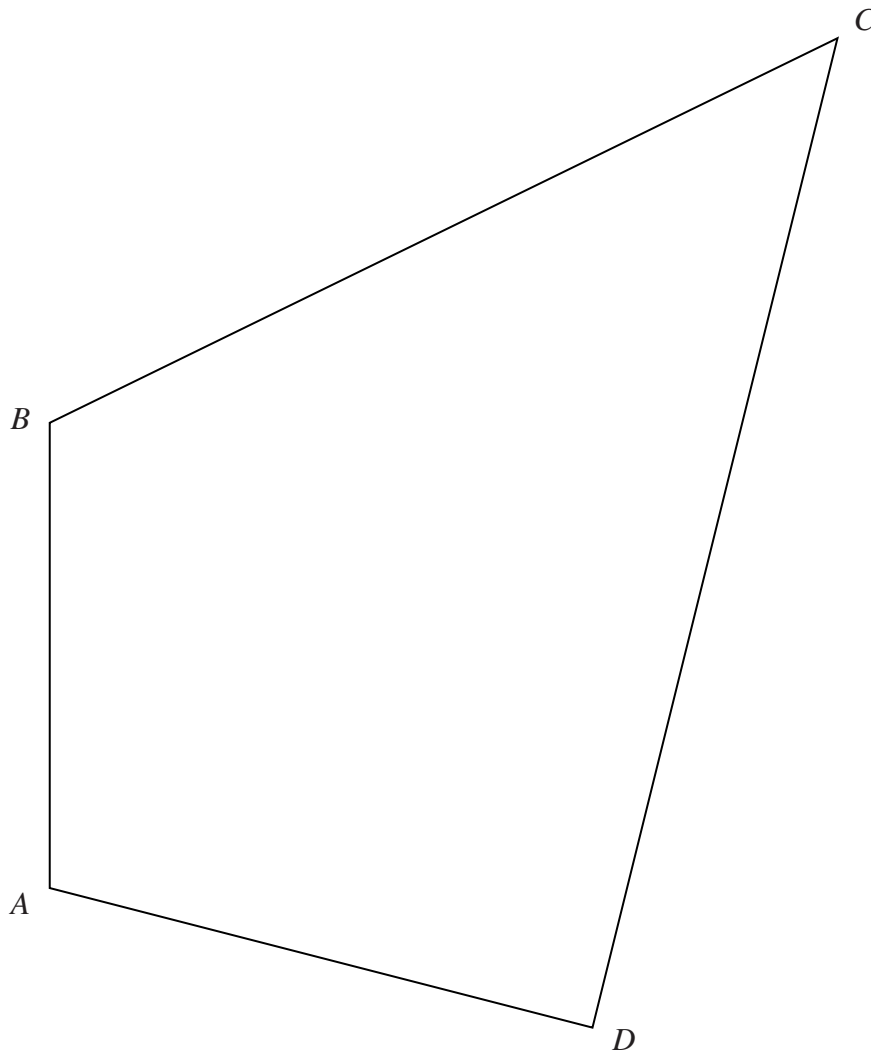
Using a ruler and compasses construct **accurately** the region R.
Label the region clearly with the letter R.

(4 marks)

Turn over ▶

8

21 (a)
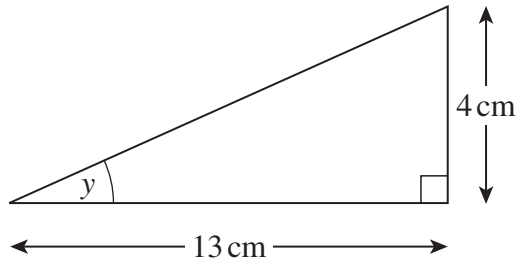
Not drawn
accurately

Calculate the size of angle *y*.

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

21 (b) The diagram shows a cuboid *ABCDEFGH* with sides of 4 cm, 5 cm and 12 cm.
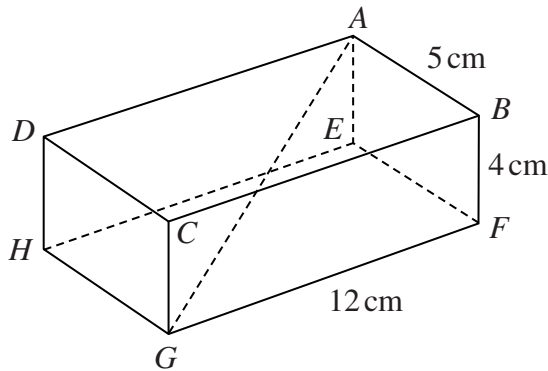
Calculate the length of the diagonal *AG*.

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

22 Enlarge the shaded triangle by a scale factor of $-\dfrac{1}{2}$, about centre $(0, -1)$.
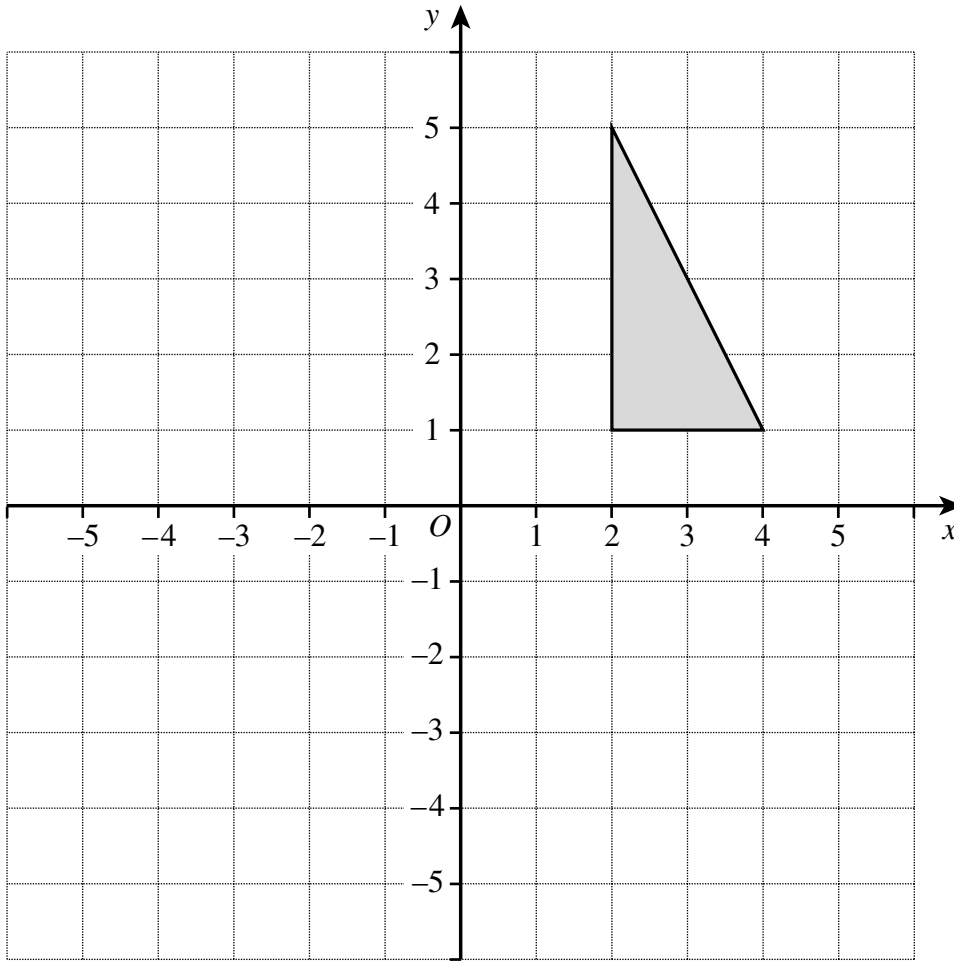
(2 marks)

23 (a) Write as single powers of x

23 (a) (i) $x^6 \times x^{-2}$

Answer .... *(1 mark)*

23 (a) (ii) $x^8 \div x^{-4}$

Answer .... *(1 mark)*

23 (b) Simplify the expression $(3x^2y)^3$ by removing the brackets.

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Answer .... *(2 marks)*

12

Turn over ▶

20

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24 The histogram shows the distribution of the masses of 100 young sparrows.
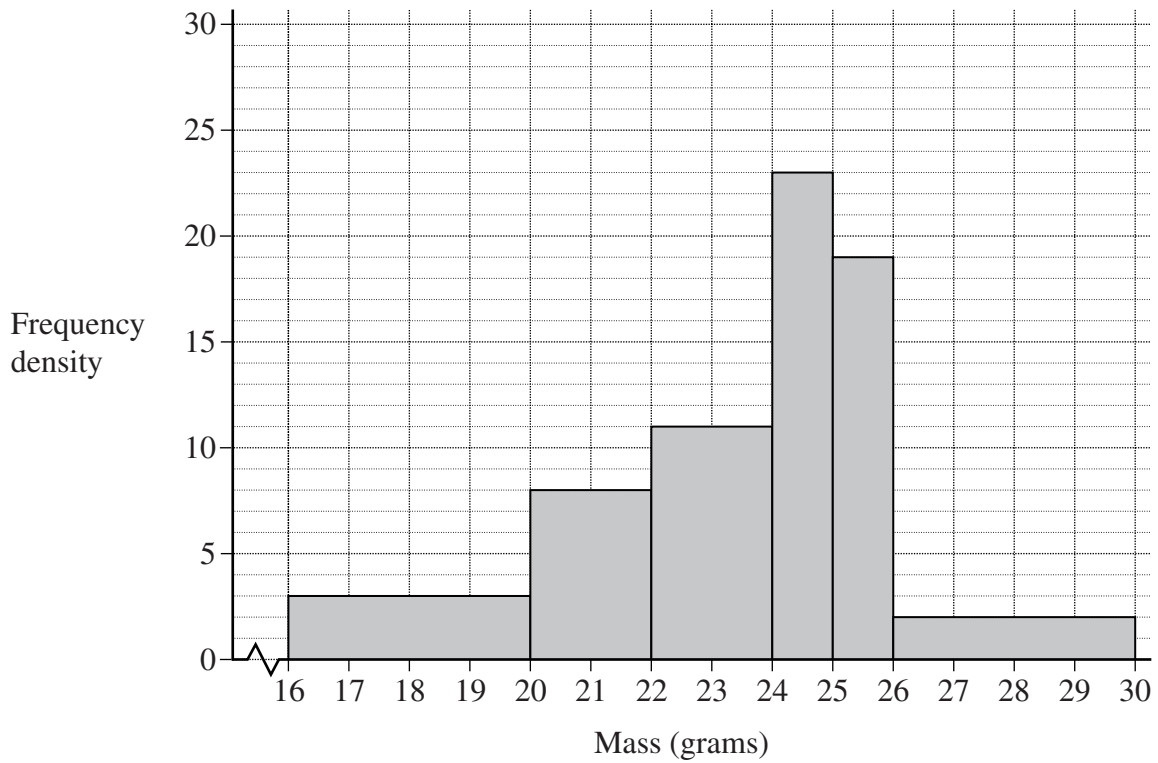
Calculate an estimate of the mean mass.

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

25 Write $0.0\dot{3}\dot{7}$ as a fraction.
Give your answer in its simplest form.

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Answer .... *(2 marks)*

26 Solve the equation $x^2 - 2x - 6 = 0$
Give your answers to two decimal places.

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Answer .... *(3 marks)*

Turn over for the next question

9

Turn over ▶

27 *ABCD* are points on the circumference of a circle.
The line *CD* is extended to *E*.
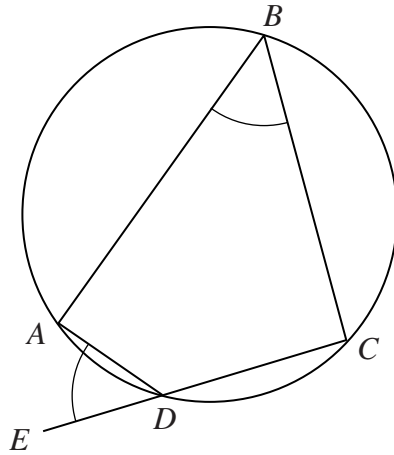
Not drawn
accurately

Prove that $\angle ABC = \angle ADE$

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(3 marks)

28 (a) A line is measured as 6.0 cm to the nearest mm.

Which of the following is the upper limit of the length of the line?
Circle the correct answer.

6.04 cm   6.05 cm   6.1 cm   6.5 cm

(1 mark)

28 (b) Marlon constructs the triangle *ABC* using a ruler and protractor.
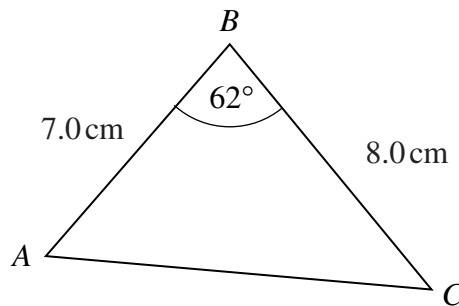He draws *AB* = 7.0 cm, to the nearest mm.
He draws *BC* = 8.0 cm, to the nearest mm.
He draws angle *ABC* = 62° to the nearest degree.

Not drawn
accurately

Calculate the greatest possible area of the triangle.

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Answer .... cm² *(4 marks)*

Turn over for the next question

8

Turn over ▶

29 Solve the simultaneous equations

$$x = 3 + 2y$$

$$x^2 + 2y^2 = 27$$

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

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Answer .... *(6 marks)*

END OF QUESTIONS

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