

**Friday 11 January 2013 – Morning**

**GCSE APPLICATIONS OF MATHEMATICS**

**A381/02 Applications of Mathematics 1 (Higher Tier)**

Candidates answer on the Question Paper.

**OCR supplied materials:**  
None

- Other materials required:**
- Scientific or graphical calculator
  - Geometrical instruments
  - Tracing paper (optional)

**Duration:** 1 hour 15 minutes



Candidate forename		Candidate surname	
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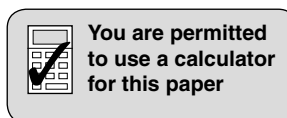
Centre number							Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

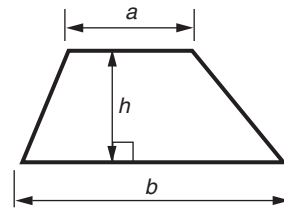
**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- Your Quality of Written Communication is assessed in questions marked with an asterisk (\*).
- The total number of marks for this paper is **60**.
- This document consists of **12** pages. Any blank pages are indicated.

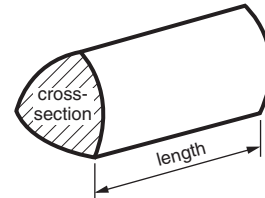


## Formulae Sheet: Higher Tier

**Area of trapezium** =  $\frac{1}{2}(a + b)h$



**Volume of prism** = (area of cross-section)  $\times$  length

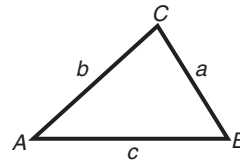


**In any triangle ABC**

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

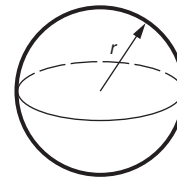
**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

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



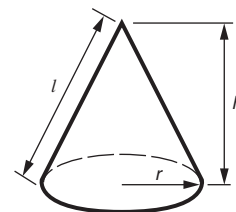
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$ ,  
where  $a \neq 0$ , are given by

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

**PLEASE DO NOT WRITE ON THIS PAGE**

1 Megan thinks of a number.

She carries out the following steps.

Step 1: Subtract 3 from the number

Step 2: Multiply the answer by 2

Step 3: Subtract 5 from the answer

(a) Megan thinks of 13.

What is her final answer?

(a) \_\_\_\_\_ [1]

(b) (i) Megan uses  $x$  to represent the number she thinks of.

Write down, and simplify, an expression in terms of  $x$ , for her final answer.

(b)(i) \_\_\_\_\_ [2]

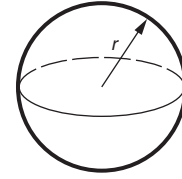
(ii) Megan thinks of a **new** number.  
Her final answer is  $-3$ .

Write an equation in  $x$  and solve it to find Megan's new number.

(ii) \_\_\_\_\_ [2]

- 2 The volume of a sphere is  $487 \text{ cm}^3$ .

The radius,  $r$ , of this sphere is given by this calculation.



$$r = \sqrt[3]{\frac{3 \times 487}{4 \times 3.142}}$$

- (a) Round each of 487 and 3.142 correct to one significant figure.

(a) \_\_\_\_\_ and \_\_\_\_\_ [1]

- (b) Use your answers to part (a) to estimate  $r$ .

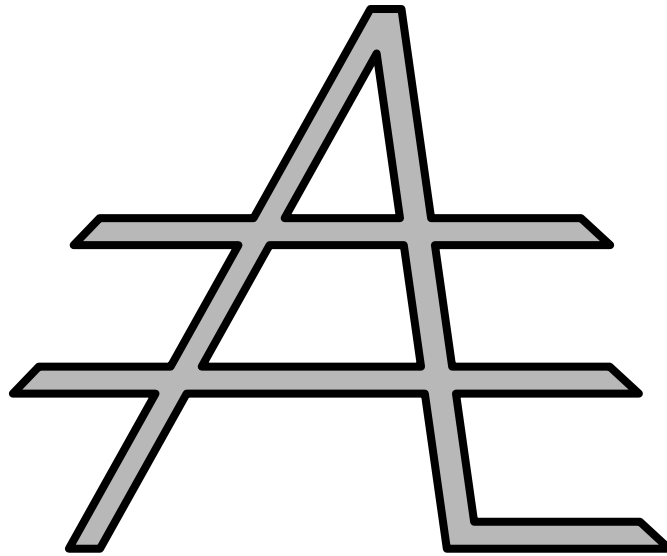
(b) \_\_\_\_\_ cm [1]

- 3 In a village, 65% of all the homes are owned by couples.  
Of the **remaining** homes, 40% are owned by single women.  
All the other homes are owned by single men.

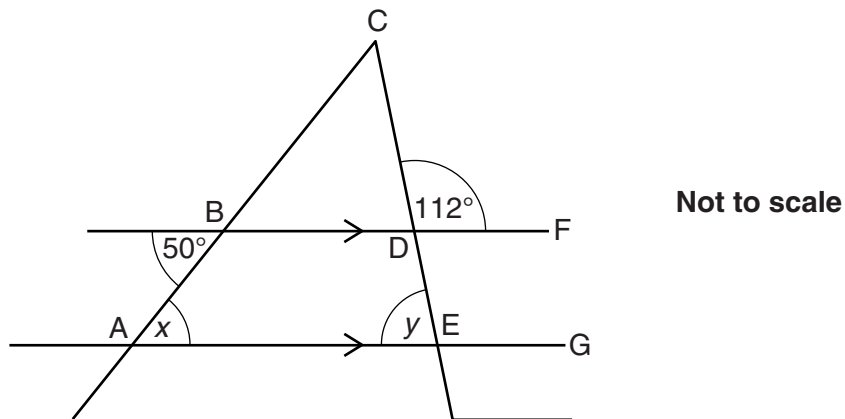
What percentage of all the homes are owned by single men?

\_\_\_\_\_ % [3]

- 4 Alan Engineering uses this logo.



The logo has been drawn, using straight lines, to this design.



- (a) Find the size of angle  $x$ .  
Give a reason for your answer.

$x =$  \_\_\_\_\_  $^{\circ}$  because \_\_\_\_\_ [1]

- (b) Find the size of angle  $y$ .  
Give a reason for each step of your answer.

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(b)  $y =$  \_\_\_\_\_  $^{\circ}$  [3]

- 5 Mandy finds this information in a book about ice cream making.

Fluffiness of ice cream is measured by its overrun.

The higher the overrun the more fluffy the ice cream.

The volume of mixture put into the ice cream maker and the volume of ice cream it produces are measured.

$$\text{Volume of ice cream produced} = \frac{(\text{overrun} + 100) \times (\text{volume of mixture})}{100}$$

$$\text{Overrun} = \frac{(\text{volume of ice cream produced} - \text{volume of mixture}) \times 100}{(\text{volume of mixture})}$$

- (a) What is the overrun for an ice cream mixture that has a volume of 500 ml and which produces 980 ml of ice cream?

(a) \_\_\_\_\_ [2]

- (b) Soft ice cream, as sold from ice cream vans, has an overrun of 30. Mandy has 500 ml of ice cream mixture.

What volume of soft ice cream, as sold from ice cream vans, can she produce?

(b) \_\_\_\_\_ ml [2]

- 6 In a supermarket, broccoli is priced at £1.95 per kilogram. Sam buys 2.4 kg of broccoli and 3.8 kg of carrots. He pays with a £20 note. He is given change of £12.66.

Work out the cost of 1 kg of carrots.

£ \_\_\_\_\_ [4]

- 7 Colin travelled by car from A to B and then from B to C. The distance from A to B is 620 km and from B to C is 310 km. The petrol consumption of the car from A to B was 7.1 litres per 100 km. The petrol consumption of the car from B to C was 7.8 litres per 100 km.

(a) Calculate the total amount of petrol used.

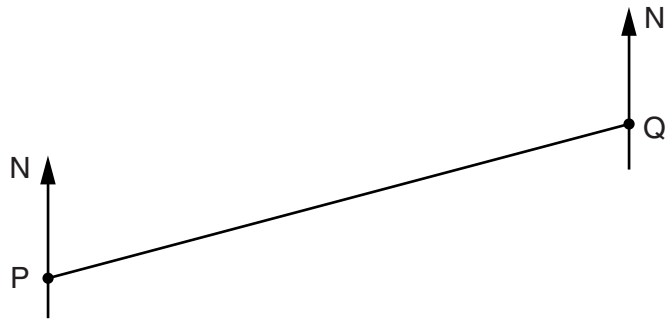
(a) \_\_\_\_\_ litres [2]

(b) Calculate the average petrol consumption for the whole journey.

(b) \_\_\_\_\_ litres per 100 km [2]

8 The scale drawing shows two airports P and Q.

Scale: 1 cm represents 20 km



(a) A helicopter is 160 km from P on a bearing of  $142^\circ$ .

Construct and mark the position of the helicopter.  
Label it H.

[2]

(b) What is the bearing of P from Q?

(b) \_\_\_\_\_  $^\circ$  [2]



- 9 140 students took a music exam.  
The grades available were Distinction, Merit and Ungraded.

- 12 more boys than girls took the exam
- 25 boys achieved a Distinction
- 36 girls achieved a Merit
- 18 students were Ungraded,  $\frac{2}{3}$  of these were boys

How many girls achieved a Distinction?

\_\_\_\_\_ [4]

- 10 Two families go to a musical.  
Both families sit in the stalls.  
The Morgan family, one adult and three children, pay a total of £107.50 .  
The Davies family, two adults and one child, pay a total of £90.

The cost of an adult's ticket is £ $x$ .  
The cost of a child's ticket is £ $y$ .

Write two equations and solve them to find the cost of an adult's ticket and the cost of a child's ticket.

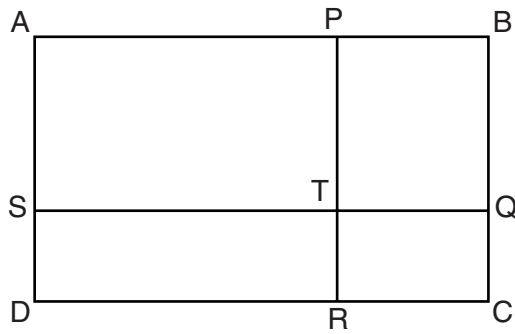
Adult's ticket costs £ \_\_\_\_\_

Child's ticket costs £ \_\_\_\_\_

[4]



13 ABCD is a rectangle.



Not to scale

PR is parallel to AD and SQ is parallel to AB.

$AP = \frac{3}{4}$  of AB and  $AS = \frac{2}{3}$  of AD.

(a) Show that the area of PBQT is  $\frac{1}{6}$  of the area of ABCD.

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[2]

(b) How many times bigger is the area of DSTR than the area of PBQT?  
Give your answer as a mixed number.

(b) \_\_\_\_\_ [4]

(c) The lengths and widths of each of the four parts of ABCD are whole numbers of centimetres.

When DSTR is a square, find the smallest possible area of ABCD.

(c) \_\_\_\_\_ cm<sup>2</sup> [3]

TURN OVER FOR QUESTION 14

- 14 A restaurant sells strawberry milkshakes in two sizes, large and small. The glasses they are served in are mathematically similar. The glasses are filled to the top with milkshake. The table shows some information about the two sizes.

	Height of glass (cm)	Number of calories	Amount of fat (g)
Large	11.8		9.2
Small	10	488	

- (a) Calculate the number of calories in a large strawberry milkshake.

(a) \_\_\_\_\_ [3]

- (b) Calculate the amount of fat in a small strawberry milkshake.

(b) \_\_\_\_\_ g [2]

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