

OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE

**A381/02**

**APPLICATIONS OF MATHEMATICS**

**Applications of Mathematics 1  
(Higher Tier)**

**MONDAY 9 JUNE 2014: Morning**

**DURATION: 1 hour 15 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**Scientific or graphical calculator**

**Geometrical instruments**

**Tracing paper (optional)**

<p><b>YOU ARE PERMITTED TO USE A CALCULATOR FOR THIS PAPER</b></p>
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**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. 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).**

## **INFORMATION FOR CANDIDATES**

**The number of marks is given in brackets [ ] at the end of each question or part question.**

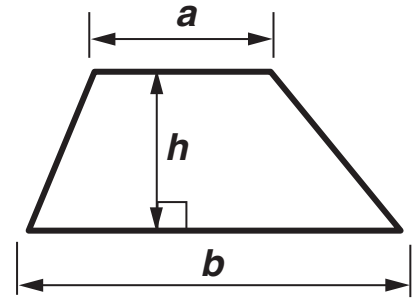
**Your quality of written communication is assessed in questions marked with an asterisk (\*).**

**The total number of marks for this paper is 60.**

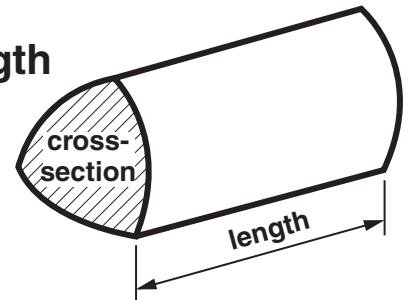
**Any blank pages are indicated.**

## FORMULAE SHEET: HIGHER TIER

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



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

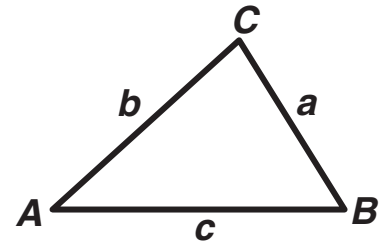


In any triangle  $ABC$

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

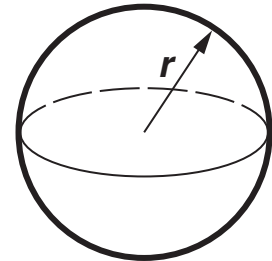
Cosine rule  $a^2 = b^2 + c^2 - 2bc \cos A$

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



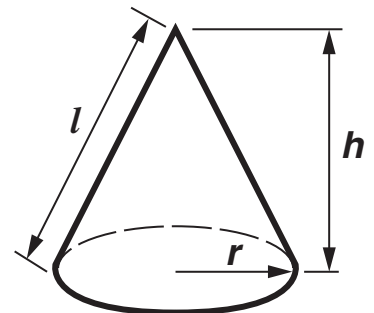
Volume of sphere =  $\frac{4}{3} \pi r^3$

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

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

**Answer ALL the questions.**

- 1 A restaurant sells red wine by the glass and by the bottle.**

**(a) This table lists the costs.**

<b>Bottle</b>	<b>750ml</b>	<b>£18.60</b>
<b>Glass</b>	<b>125ml</b>	<b>£3.10</b>
<b>Glass</b>	<b>175ml</b>	<b>£4.50</b>
<b>Glass</b>	<b>250ml</b>	<b>£6.20</b>

**Show that the cost of a glass of wine is NOT  
always directly proportional to the amount of wine.**

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**[2]**

- (b) The cost of a 750 ml bottle of white wine is £19.50. The restaurant owner decides to sell the wine by the glass. The cost of each glass of wine will be directly proportional to the amount of wine in the glass and in a bottle.**

**Calculate the cost of each glass of wine.**

**(b) Glass 125 ml   £ \_\_\_\_\_**

**Glass 175 ml   £ \_\_\_\_\_**

**Glass 250 ml   £ \_\_\_\_\_   [3]**

- (i) A 3000 m high mountain weighs about  $10^{18}$  tonnes.  
1 tonne =  $10^3$  kg.**

**Write the weight, in kg, of a 3000 m high mountain as a power of 10.**

(a)(i) 10  kg [1]

## Mountains above a certain height will collapse under their own weight.

**This formula gives the approximate maximum height,  $h$  metres, that a mountain can reach.**

$$h = \frac{s}{dg}$$

## For most rocks

**$s$  (strength) =  $10^8$ ,**

$$d \text{ (density)} = 10^3,$$

**$g$  (the acceleration due to gravity) = 10.**

**All these values are approximate and are in the correct units.**

**(ii) Work out, AS A POWER OF TEN, the value of  $dg$ .**

(ii) 10  [1]

**(iii) Use the formula to calculate the maximum height that a mountain can reach. Give your answer in KILOMETRES.**

(iii) \_\_\_\_\_ km [2]

**(b) Temperature drops the higher up a mountain you go.**

**A group of friends are walking up a mountain. They use this formula to estimate the temperature at a particular height on the mountain.**

$$T = 18 - \frac{h}{200}$$

**$T$  is the temperature in degrees Celsius**

**$h$  is the height in metres**

**(i) Work out an estimate of the temperature on the mountain at a height of 800 m.**

**(b)(i) \_\_\_\_\_ °C [2]**

**(ii) The temperature at the top of the mountain is  $-7^{\circ}\text{C}$ .**

**Find the height of the mountain.**

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

**(iii) Teresa and Robert are at different heights on the mountain.**

**The difference in temperature at these two heights on the mountain is 9 degrees.**

**Work out the difference in these heights on the mountain.**

**(iii) \_\_\_\_\_ m [2]**

- 3 (a) 'Cenydd Printers' use this formula to calculate the cost of printing leaflets.

$$C = 50 + 0.18n$$

$C$  is the cost in pounds

$n$  is the number of leaflets

Work out the cost of printing 1000 leaflets.

(a) £ \_\_\_\_\_ [2]

**(b) Some choir singers are organising charity concerts.  
They hire a local community hall for four days, Wednesday to Saturday.  
The hire cost for Wednesday and Thursday is £150 each day.  
The hire cost for Friday and Saturday is £200 each day.  
They buy 1000 leaflets from ‘Cenydd Printers’ to advertise the concerts.  
They have no other costs.**

**(i) Work out the total cost of the leaflets and hiring the hall.**

**(b)(i) £ \_\_\_\_\_ [2]**

**(ii) Tickets for the concerts cost £4 each.**

**Find the minimum number of tickets that need to be sold to cover the cost of the hall and the leaflets.**

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

**(iii)\* Wednesday is used to set up the hall.  
One concert is held on each of Thursday,  
Friday and Saturday.  
There are 215 tickets on sale for each concert.  
The singers expect to sell 80% of all the  
tickets.**

**Work out the amount of profit the singers may  
expect to make altogether.**

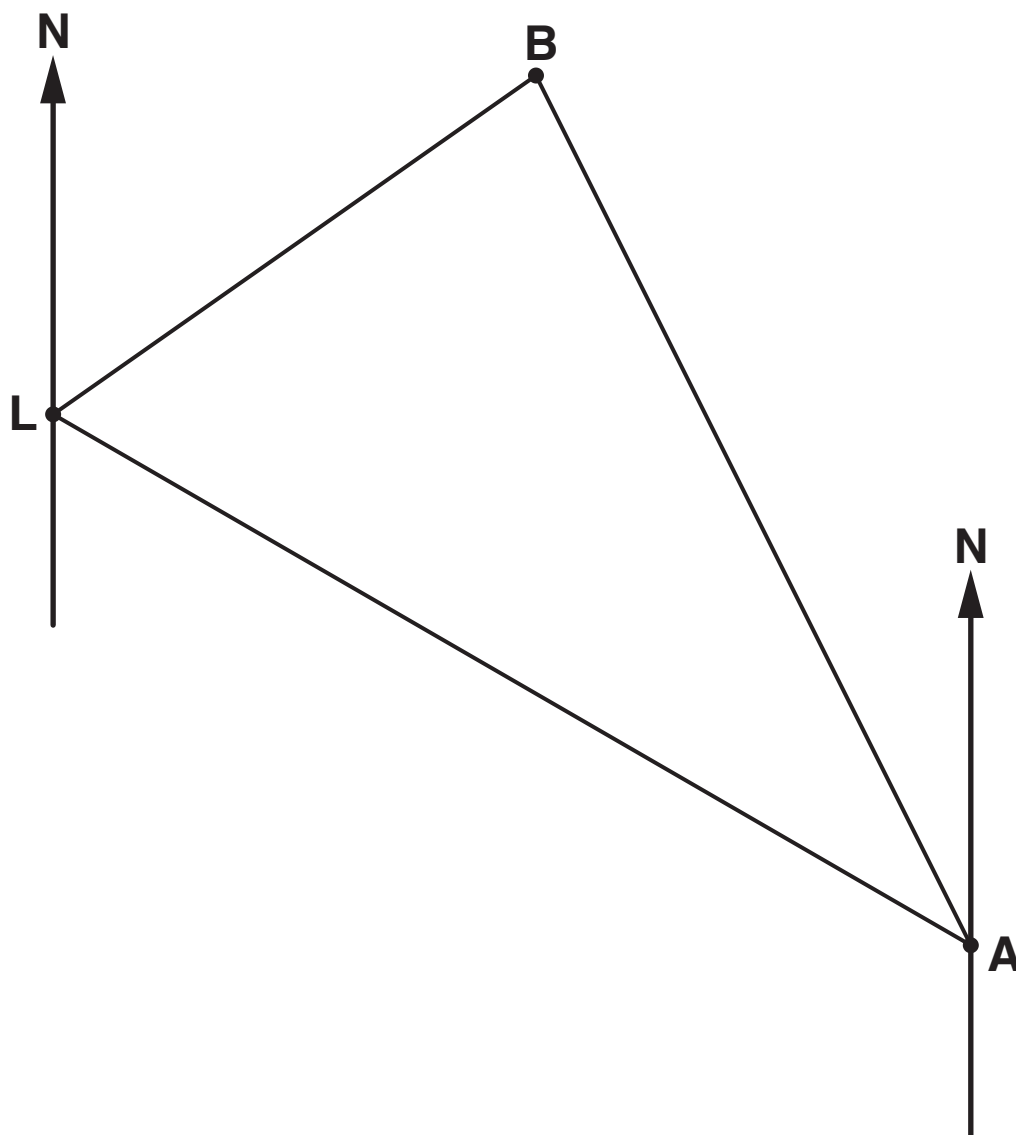
**(iii) £ \_\_\_\_\_ [4]**

- (c) A group of six friends attend one of the concerts. They hire a taxi to get to and from the concert. The total cost for the tickets and the taxi is £51.56.**

**Calculate the cost for the taxi as a percentage of their total cost.**

**(c) \_\_\_\_\_ % [3]**

- 4 The scale diagram shows the position of a lifeboat station, L, an airfield, A, and a boat, B.



- (a) (i) Measure the bearing of the boat from the lifeboat station.

(a)(i) \_\_\_\_\_ ° [1]

**(ii) Measure the bearing of the boat from the airfield.**

**(ii) \_\_\_\_\_ ° [1]**

**(b) The boat sends out a distress signal.  
A lifeboat is launched from L and sails at an average speed of 26 miles per hour.  
It reaches the boat in 1½ hours.**

**(i) Work out the distance of the boat from the lifeboat station.**

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

**(ii) Complete this sentence about the scale of the diagram.**

**SCALE: 1 cm represents \_\_\_\_\_ miles.  
[2]**

- (iii) A rescue helicopter takes off from the airfield 24 minutes after the launch of the lifeboat. It arrives at the boat's position 31 minutes before the lifeboat.**

**Work out the average speed, in miles per hour, of the helicopter.**

**(iii) \_\_\_\_\_mph [5]**

- 5 (a) (i) A scrap metal merchant pays £113.40 for 36 kg of scrap copper.

Find the value of 1 tonne of scrap copper.  
1 tonne = 1000 kg.

(a)(i) £ \_\_\_\_\_ [2]

- (ii) The density of copper is  $8.92 \text{ g/cm}^3$ .

Calculate the volume of the scrap copper that the merchant buys.

(ii) \_\_\_\_\_  $\text{cm}^3$  [3]

- (b) At the start of June the scrap value of bronze was £1.80 per kg.  
The value is expected to rise each month by 6% of its value at the start of the month.**

**Calculate the expected scrap value of bronze at the start of September.**

**(b) £ \_\_\_\_\_ per kg [3]**

- 6 A company makes bronze statues in two sizes. The small statue has a surface area of  $320\text{ cm}^2$  and a volume of  $420\text{ cm}^3$ . The larger statue is mathematically similar and has a surface area of  $720\text{ cm}^2$ .**

- (a) The volume of the large statue is given by this calculation.**

$$\text{Volume} = 420 \times \left( \frac{720}{320} \right)^{\frac{3}{2}}$$

**Work out the volume of the large statue.  
Give your answer correct to three significant figures.**

**(a) \_\_\_\_\_  $\text{cm}^3$  [2]**

**(b) The height of the large statue is 25.5 cm.**

**Calculate the height of the small statue.**

**(b) \_\_\_\_\_ cm [3]**

- 7 A company produces packets of biscuits.  
The packets measure 18 cm by 10 cm by 5 cm.  
The company ships the packets of biscuits in boxes  
of two different sizes.**

**(a) One box is in the shape of a cube.  
There is no wasted space after filling the box.**

**(i) What is the length of a side of the smallest  
cube that could be used?**

**(a)(i) \_\_\_\_\_ cm [3]**

**(ii) How many packets fit in the box?**

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

- (b) The other box is a cuboid.  
It holds 48 packets with no wasted space.  
Each side of the box is greater than 20 cm and less than 50 cm.**

**What is the size of the box?**

\_\_\_\_\_ cm by \_\_\_\_\_ cm by \_\_\_\_\_ cm [3]

**END OF QUESTION PAPER**

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