OCR
RECOGNISING ACHIEVEMENT

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Tuesday 11 June 2013 – Morning

GCSE APPLICATIONS OF MATHEMATICS

A381/02 Applications of Mathematics 1 (Higher Tier)

A317040613

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

A381 02

Candidate forename		Candidate surname	

Centre number						Candidate number				

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.

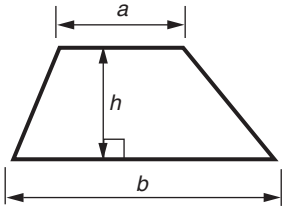
INFORMATION FOR CANDIDATES

- 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.

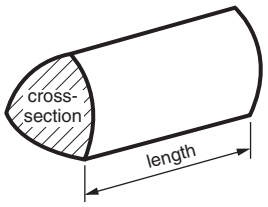
You are permitted to use a calculator for this paper

Formulae Sheet: Higher Tier

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



Volume of prism = (area of cross-section) × length

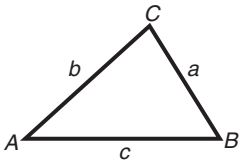


In any triangle *ABC*

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

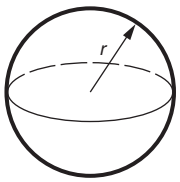
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



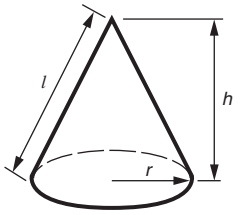
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

Curved surface area of cone $= \pi rl$



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 **(a)** Niluka took five end-of-term tests.
These are the marks he was given.

Physics	DT	Maths	English	ICT
$\frac{12}{20}$	$\frac{30}{40}$	$\frac{35}{50}$	$\frac{68}{100}$	$\frac{84}{120}$

(i) In which two subjects did he do equally well?
Show how you decide.

(a)(i) _____ and _____ **[3]**

(ii) Niluka was hoping for a better mark in Physics than DT.

Work out the minimum number of **extra** marks out of 20 he would have needed to make his Physics mark better than his DT mark.

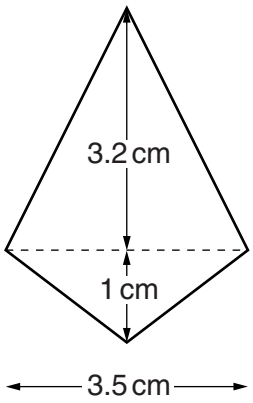
(ii) _____ **[2]**

(b) In Niluka's year group, three grades were awarded in Maths.
They were Distinction, Merit and Pass. Nobody failed.
$\frac{2}{5}$ of the students were awarded a Merit and $\frac{3}{8}$ were awarded a Pass.

What fraction of the year group were **not** awarded a Merit grade or a Pass grade?

(b) _____ **[3]**

2 Jasmine makes copper pendants.
The sketch shows the cross-section of one of these pendants.



Not to scale

(a) Calculate the area of the cross-section of the pendant.

(a) _____ cm^2 **[3]**

(b) The volume of copper in the pendant is given by this formula.

Volume = area of cross-section × thickness

The thickness of the pendant is 0.3 cm.

Work out the volume of copper in the pendant.

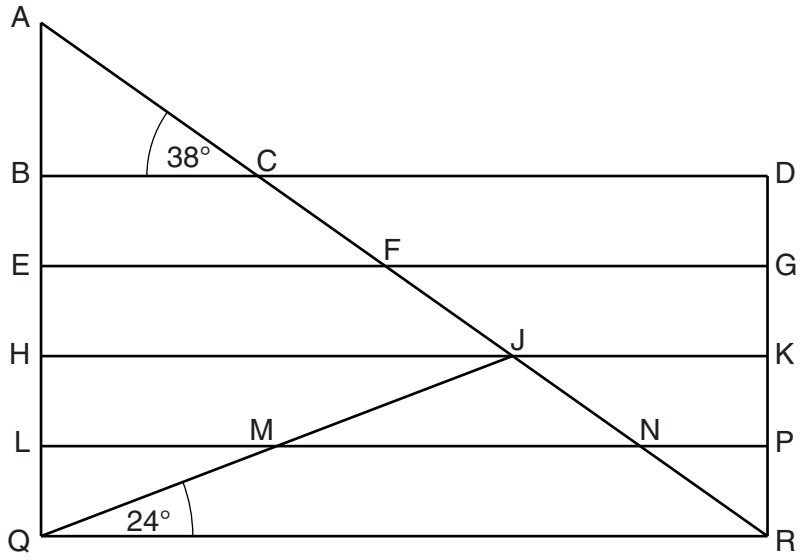
(b) _____ cm^3 **[1]**

(c) The pendant weighs 19.7 grams.

Calculate the density of copper.

(c) _____ g/cm^3 **[2]**

3 The diagram shows the design for a five-bar gate.



Not to scale

BD, EG, HK, LP and QR are equally spaced, horizontal parallel bars.
AQ and DR are vertical parallel bars.
AR and QJ are straight bars.

(a) Write down the letters of two triangles that are similar to triangle ABC.

(a) _____ and _____ **[1]**

(b) The four angles of trapeziums BCFE and EFJH are equal.

Explain why the trapeziums are **not** similar.

_____

_____ **[1]**

(c) Calculate the size of angle QJR.
Give reasons for each step of your working.

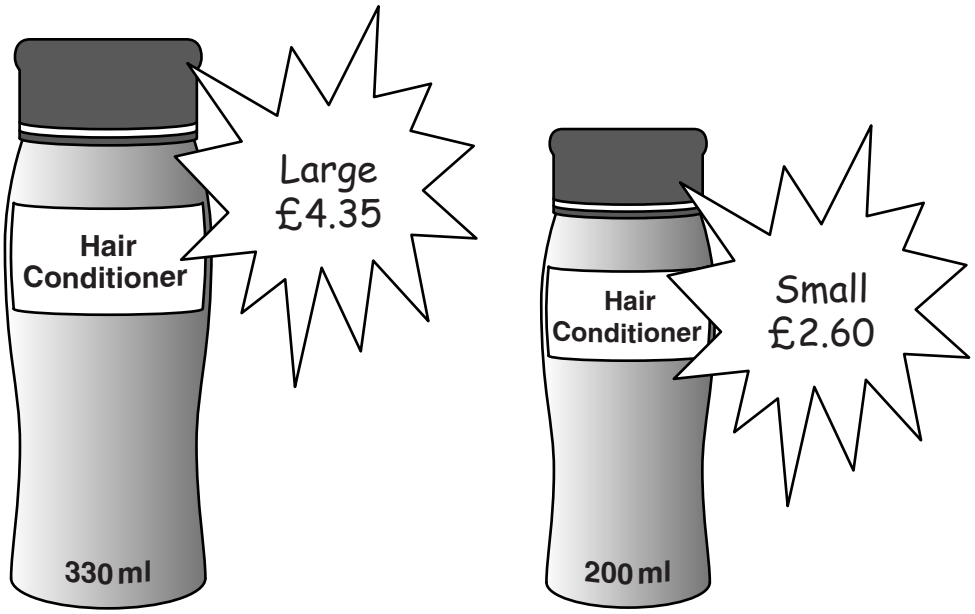
_____

_____

_____

Angle QJR = _____ ° **[4]**

4 **(a)*** A shop sells two sizes of the same brand of hair conditioner.



Which size gives better value for money?

_____

_____

_____

_____

_____

_____

(a) _____ **[3]**

(b) The shop also sells two sizes of the same brand of shampoo.
The bottles are mathematically similar.
This table gives some information about the two sizes.

Small bottle:	height	12 cm
	cost	£1.08
Large bottle:	height	17.9 cm
	contents	250 ml
	cost	£1.75

(i) Show that the small bottle holds 75 ml, correct to the nearest ml.

_____

_____

_____

_____ **[2]**

(ii) Show that the cost per millilitre of the shampoo in the small bottle is just over double the cost per millilitre of the shampoo in the large bottle.

_____

_____

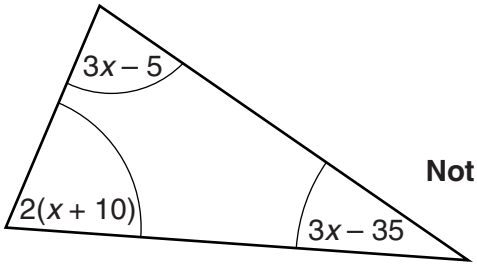
_____

_____

_____ **[4]**

5 Solve this puzzle that Tim found in an old maths workbook.

The diagram shows a sketch of a triangle.
Expressions for each of the three angles are given.



Not to scale

(a) Find an expression, in terms of x, for the sum of the three angles.
Simplify your answer.

(a) _____ **[2]**

(b) Form an equation in x and solve it.

(b) _____ **[2]**

(c) Use your value of x to find the size of each of the angles.

(c) _____° _____° _____° **[3]**

(d) Write down the correct mathematical name for this type of triangle.

(d) _____ **[1]**

6 **(a)** The value of Lorraine's house in January 2009 was £225 000.
Each year, for the next three years, the house increased in value by 2.4% of its value at the start of that year.

Calculate the value of the house in January 2012.

(a) £ _____ **[3]**

(b) The value of Trevor's house in January 2012 was £171 000.
This was a decrease of 5% of its value in January 2011.

Work out the value of the house in January 2011.

(b) £ _____ **[2]**

(c) Trevor invested some money for four years.
The annual rate of interest, R%, on his investment is given by this calculation.

$$R = 100 \times \left(\left(\frac{17900}{15000} \right)^{\frac{1}{4}} - 1 \right)$$

Work out R.
Give your answer correct to three significant figures.

(c) _____ % **[2]**

7 Sandra and Dawn each have more than 12 marbles.
The highest common factor of their two numbers of marbles is 10.
The lowest common multiple of their two numbers of marbles is 300.

Find one possible pair of numbers of marbles for Sandra and Dawn.

Sandra _____

Dawn _____ **[4]**

8 Here is a puzzle.
In the puzzle, □ has one value and ○ has a different value.

□□ ○○○	□ ○○	55
□□□□□ ○	□□□ ○○	
67		

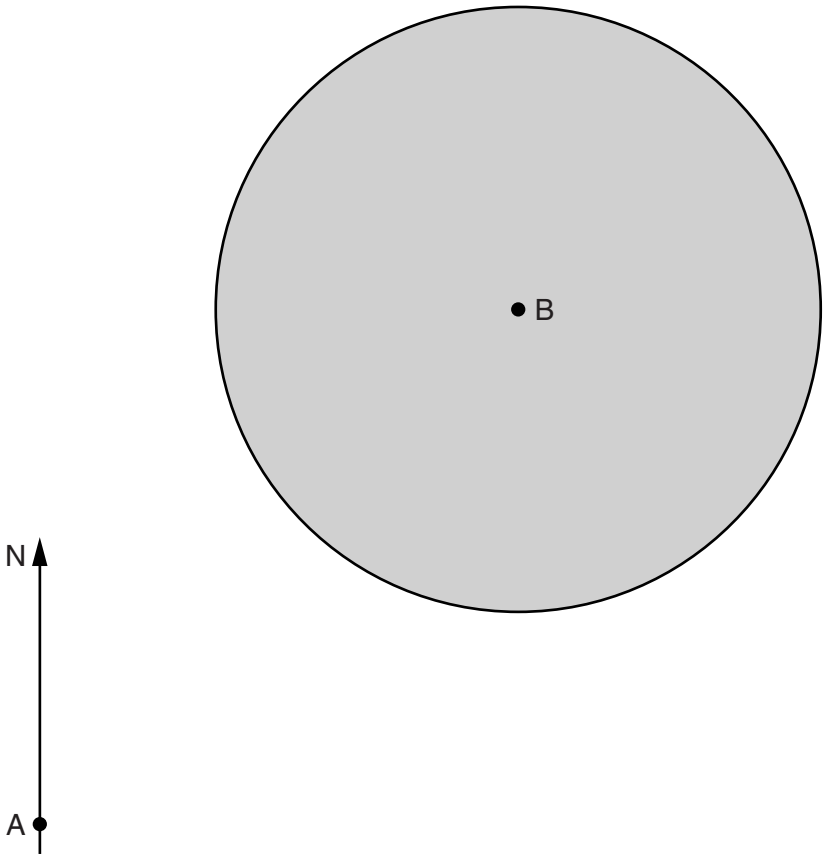
The eight symbols in the first row have a total value of 55.
The eleven symbols in the first column have a total value of 67.
The other three totals are missing.

Use an algebraic method to work out the total value of all nineteen symbols.

_____ **[5]**

TURN OVER FOR QUESTION 9

9 The scale drawing shows an airport, A, and an air traffic control centre, B.
The scale is **1 cm represents 40 miles**.
The shaded circle shows the area covered by the control centre's radar.



(a) Find the maximum distance from B that the radar can detect an aircraft.

(a) _____miles **[1]**

(b) An aircraft leaves the airport and flies at 120 mph on a bearing of 030°.

Draw the flight path of the aircraft. **[1]**

(c) Find the length of time that the aircraft is within range of the radar.
Give your answer in hours and minutes, correct to the nearest minute.

(c) _____hours _____minutes **[5]**

END OF QUESTION PAPER