OCR
RECOGNISING ACHIEVEMENT

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Wednesday 6 November 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	

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).
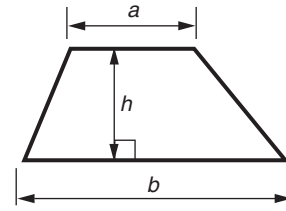* Do **not** write in the bar codes.

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**.
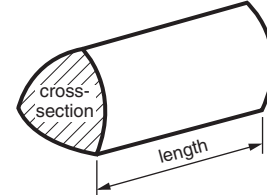* This document consists of **16** pages. Any blank pages are indicated.

You are permitted
to use a calculator
for this paper

Turn over

Formulae Sheet: Higher Tier

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

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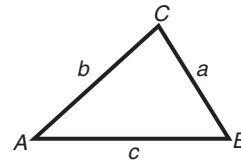

In any triangle *ABC*

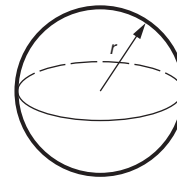**Sine rule** $\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule $\ a^2 = b^2 + c^2 - 2bc\cos A$
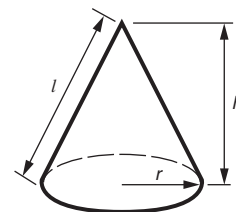
Area of triangle $= \frac{1}{2}ab\sin C$

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 $= \pi r l$

The Quadratic Equation

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

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

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Answer **all** the questions.

1 These are the ingredients for making 18 shortbread biscuits.

```
120 g   butter
 75 g   sugar
150 g   flour
```
Makes 18 biscuits

Robert opens a new 0.5 kg pack of butter.
He uses 160 g of butter to make some biscuits.

(a) How much butter is left in the pack?
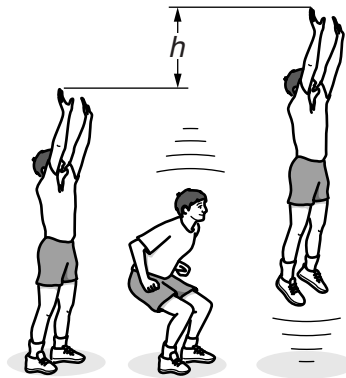
(a) _____ g **[2]**

(b) How many biscuits does he make?

(b) _____ **[2]**

Turn over

2 Most sports involve explosive leg power, for example judo, sprinting and basketball.

An athlete's vertical standing jump height, h cm, is used to calculate their leg power.

There are several formulae that can be used to calculate the leg power, P watts.
These are shown below.

Lewis Formula

$P = 2.2 \times$ (person's weight in kg) $\times$ (square root of person's jump height in cm)

Harman Formula

$P = 21 \times$ (person's jump height in cm) $+ 23 \times$ (person's weight in kg) $- 1393$

Johnson and Bahamonde Formula
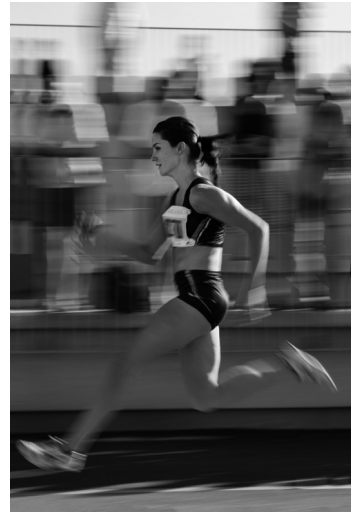
$P = 44h + 33w + 430 - 17p$

    h is person's jump height in cm
    w is person's weight in kg
    p is person's height in cm

Choy is a sprinter, here are her details:

*   jump height = 48 cm
*   weight = 60 kg
*   height = 170 cm.

(a) Use each formula to calculate Choy's leg power.

   (i) Lewis Formula

(a)(i) _____ watts **[1]**

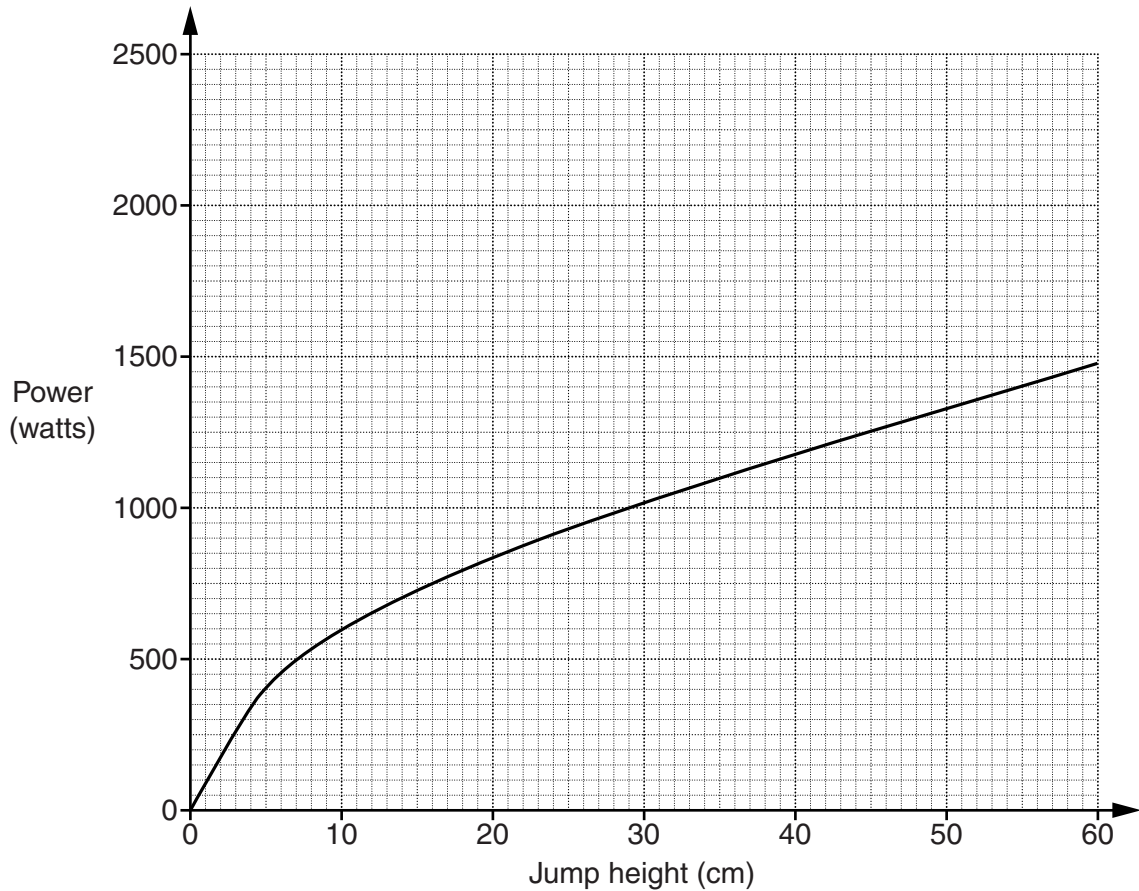   **(ii) Harman Formula**

(ii) _____ watts **[1]**

   (iii) Johnson and Bahamonde Formula

(iii) _____ watts **[2]**

(b) Make one comment about your **three** figures for Choy's leg power.

_____

_____ **[1]**

Turn over

(c) Frank plays basketball.
He uses this graph of the Lewis Formula to estimate his leg power.

(i) Use the graph to estimate Frank's leg power if his jump height is 26 cm.

(c)(i) _____ watts **[1]**

(ii) The Johnson and Bahamonde Formula for Frank is given by $P = 44h - 420$,
where h is the jump height.
Complete this table by working out P when $h = 30$.

Height, h	10	30	60
Power, P	20		2220

[1]

(iii) Draw the graph of $P = 44h - 420$ on the grid above. **[2]**

(iv) What is the height that Frank must jump so that both formulae give the same leg power?

(iv) _____ cm **[1]**

3 **(a)** Sam is driving his lorry along the motorway when he sees this sign.

> Wide loads over
> 9´6˝ leave at
> the next exit

Sam's load is 3.05 m wide.
He will need to leave the motorway at the next exit.

Use the information given to work out by how much
Sam's load is too wide.
Give the units of your answer.

| 9´6˝ is 9 feet 6 inches |
| 1 foot = 12 inches |
| 1 inch = 2.54 cm |

(a) _____ **[3]**

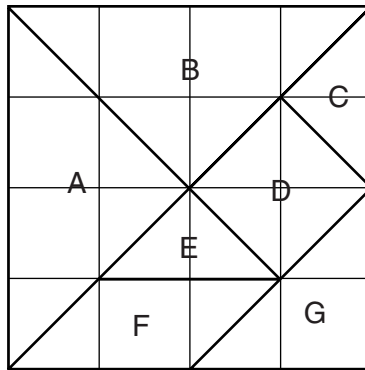**(b)** The petrol tank in Howard's car is $\frac{1}{4}$ full.

He puts 33 litres of petrol in the tank.

The tank is now $\frac{4}{5}$ full.

How much petrol does the tank hold when full?

(b) _____ litres **[4]**

Turn over

4   **(a)**   Sally has a tangram square made from seven pieces.
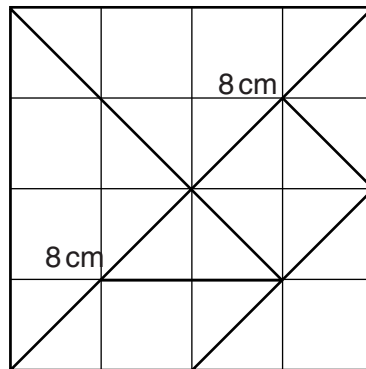

   (i)   Write down the letters of two pieces that are congruent.

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

   (ii)   Write down the letters of two pieces that are similar but not congruent.

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

(b)

   Not to scale

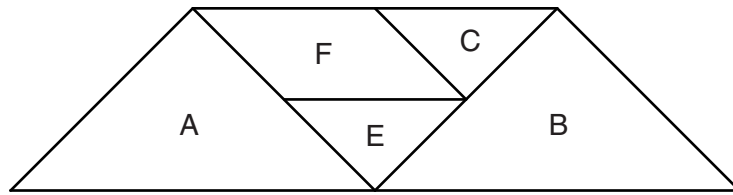   The length of the diagonal of the tangram square is 16 cm.

   (i)   Show that the area of the tangram square is 128 cm².

   _____

   _____ **[2]**

   (ii)   Hence, find the length of the side of the tangram square.
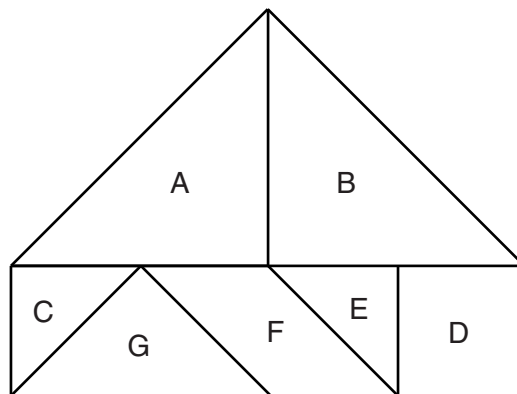
   (b)(ii) _____ cm **[1]**

(c) Sally uses five of the seven pieces to make this trapezium.

Work out the area of the trapezium as a percentage of the area of the tangram square.

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

(d) Sally rearranges all seven pieces to make this pentagon.

Work out the difference between the perimeter of the pentagon and the perimeter of the tangram square.
Give your answer correct to two decimal places.

(d) _____ cm **[3]**

Turn over

5 (a) The cost of a return train ticket between Cardiff and Swansea is £7.80.
A monthly season ticket costs £141.
Owain buys a monthly season ticket.

How many return journeys must he make in order to save money?

(a) _____ **[2]**

(b) Asif travels regularly between Cardiff and Bristol.
He buys a monthly season ticket.
He calculates that he will save £66.80 if he makes 20 return journeys and
he will lose £12.70 if he makes only 15 return journeys.

Work out the cost of a return ticket and the cost of a monthly season ticket.

(b) Return ticket costs £ _____

Season ticket costs £ _____ **[3]**

6 **(a)** Peter plays Solitaire on his computer.
At the end of June he had won a total of 296 games.
By the end of July the number of games won had increased by 25%.

How many games had he won in total by the end of July?

(a) _____ **[2]**

(b) Sian also plays Solitaire on her computer.
This table shows the statistics for the games she has played.

Games played	416
Games won	114
Highest score	5287

Work out the least number of games Sian must now play and win so that
she will have won at least one third of all the games played.

(b) _____ **[4]**

7 When the local time in London is 5 pm, the local time in Los Angeles is 9 am the same day.
Hank flew from London to Los Angeles, a distance of 5456 miles.
His flight left London at 11:50 am local time.
The average speed of the plane was 480 mph.

(a) What was the local time in Los Angeles when Hank arrived?

(a) _____ **[5]**

(b)* In London, £99.72 can be exchanged for $156.
In Los Angeles, £75 can be exchanged for $113.16.
Hank wants to change £950 into dollars.

How many more dollars would he receive by exchanging his pounds for dollars
at the better rate?

(b) $ _____ **[5]**

8 The average attendance at a football ground has decreased by 5% each season for the last three seasons.
The average attendance is now 2400.

What was the average attendance three seasons ago?

_____ **[3]**

9 Olga has some large and some small plant pots.
The pots are mathematically similar.
The height of a large pot is 60% more than a small pot.
Each large pot holds 10 litres of compost.
Olga is using a 72 litre bag of compost to fill the small pots.

What is the greatest number of small pots that she can fill?

_____ **[5]**

END OF QUESTION PAPER

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