Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8622603693

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/63**

Paper 6 (Extended) **May/June 2015**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Graphics Calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.
You may use an HB pencil for any diagrams or graphs.
DO **NOT** WRITE IN ANY BARCODES.

Answer both parts **A** and **B**.
You must show all the relevant working to gain full marks for correct methods, including sketches.
In this paper you will also be assessed on your ability to provide full reasons and communicate your mathematics clearly and precisely.
At the end of the examination, fasten all your work securely together.
The total number of marks for this paper is 40.

This document consists of **12** printed pages.

© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

Answer **both** parts **A** and **B**.

A INVESTIGATION T-VALUES (20 marks)

You are advised to spend no more than 45 minutes on this part.

A grid of any length and width 10 is numbered 1, 2, 3, ...

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

The grid has a letter T placed on it, as shown.
The T has a horizontal bar of length 3 and a vertical bar of length 2.
The T shown is shape 1 because the number in the top left square of the T is 1.

T-values are found using this method.

Method	Calculation of T-value for shape 1
Square the number at the bottom of the T.	$22^2 = 484$
Multiply together the numbers at each end of the horizontal bar.	$1 \times 3 = 3$
Take the second answer from the first answer to find the T-value.	$484 - 3 = 481$

The T-value for shape 1 is $T_1 = 481$.

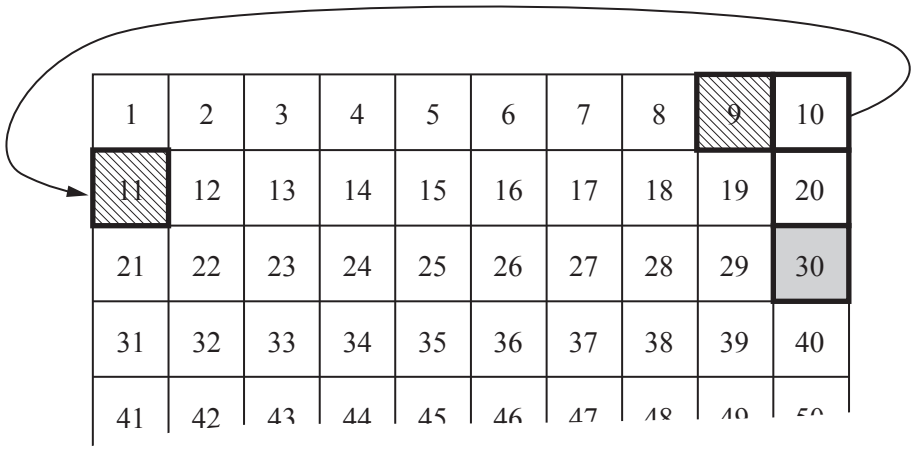
This investigation is about finding T-values.

1 (a) Complete this table.

Shape number n	Working	T-value T_n
1	$22^2 - 1 \times 3 = 484 - 3$	$T_1 = 481$
2	$23^2 - 2 \times 4 = 529 - 8$	$T_2 = 521$
3		$T_3 =$
4		$T_4 =$
5		$T_5 =$

© UCLES 2015

(b) When a T is placed at the end of a line, it still has a T-value.
The T "wraps round" like this.



Work out T_9.

T_9 = ...

(c) $T_1, T_2, T_3, T_4, T_5, \ldots$ form a sequence.

Find a formula, in terms of n, for T_n.

T_n = ...

(d) When $T_n = 2641$, find the value of n.

n = ...

(e) Explain why 843 cannot be a T-value.

.....

.....

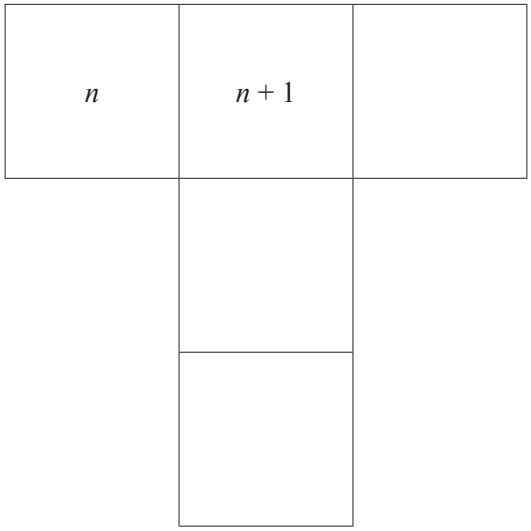
2 The T is now placed on a new grid that is 11 squares wide.

1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55

(a) Complete this statement for the numbers in the grid.

In each row the numbers increase by 1 and in each column the numbers increase by ..... .

(b) Complete the squares in this T using expressions in terms of n.



(c) Complete this working to show that $T_n = 44n + 529$.
The first line of working is started for you.

$$T_n = (n + ...)^2 - n(n + ...)$$

3 The T is now placed on a grid that is 12 squares wide.

Find a formula, in its simplest form, for T_n.

$T_n =$ .....

4 The T is now placed on a grid that is w squares wide.

(a) (i) Show that $T_n = 4w^2 + 4(n + 1)w + 1$.

(ii) Find the width of the grid when $T_9 = 1501$.

.....

(b) Use **part (a)(i)** to explain why T_n must always be odd.

.....

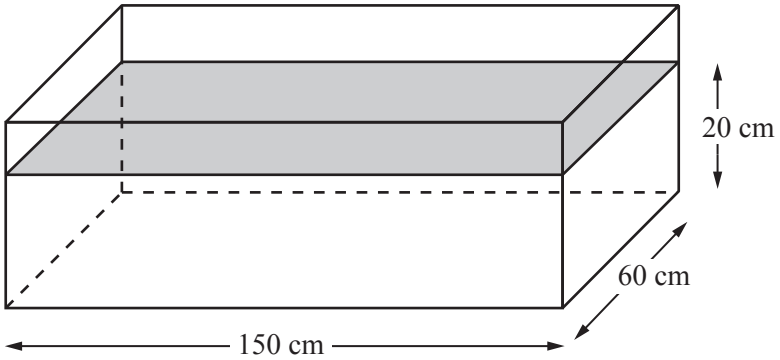
.....

B MODELLING FILLING A BATH (20 marks)

You are advised to spend no more than 45 minutes on this part.

Karen wants to work out how much it would cost to fill a bath every day for 1 year.

1 She assumes that a bath is a cuboid that is 150 cm long, 60 cm wide and 30 cm deep.



NOT TO SCALE

(a) Find the number of litres of water needed to fill this bath to a depth of 20 cm.

.....litres

(b) Water costs 20 cents per 100 litres.

(i) Find the cost, in dollars, of filling a bath with water to a depth of 20 cm each day for 1 year (365 days).

$ .....

© UCLES 2015

(ii) Show that a model for the cost, \$$C$, of filling a bath to a depth, d cm, every day for 1 year is

$$C = 6.57d.$$

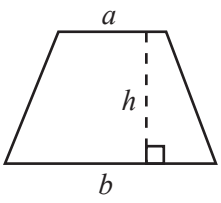
(iii) In 1 year all baths are filled to the same depth, d cm.
The total cost of the water is \$157.68 .

Use the model in **part (ii)** to find the value of d.

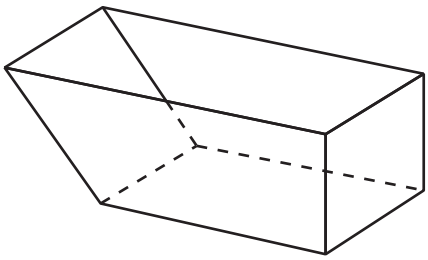
.....

You may use this information in the remainder of the task.

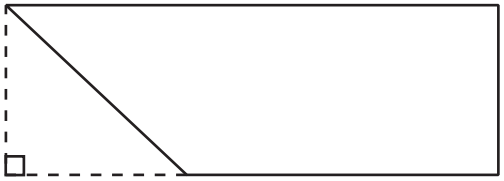
The area, A, of a trapezium is $\frac{h(a+b)}{2}$.



2 Karen notices that one end of her bath slopes.

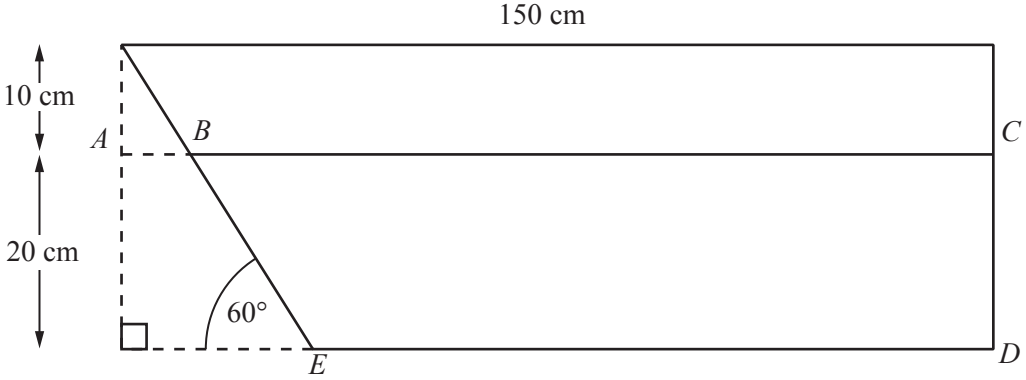


From the side, her bath looks like this.



NOT TO SCALE

She estimates that the angle of slope is 60°.
The depth of water in the bath is 20 cm.



NOT TO SCALE

(a) Show that $AB = 5.77\,\text{cm}$, correct to 3 significant figures.

(b) $BC = 144\,\text{cm}$, correct to 3 significant figures.

Find the volume of water in the bath, giving your answer in litres.

..... litres

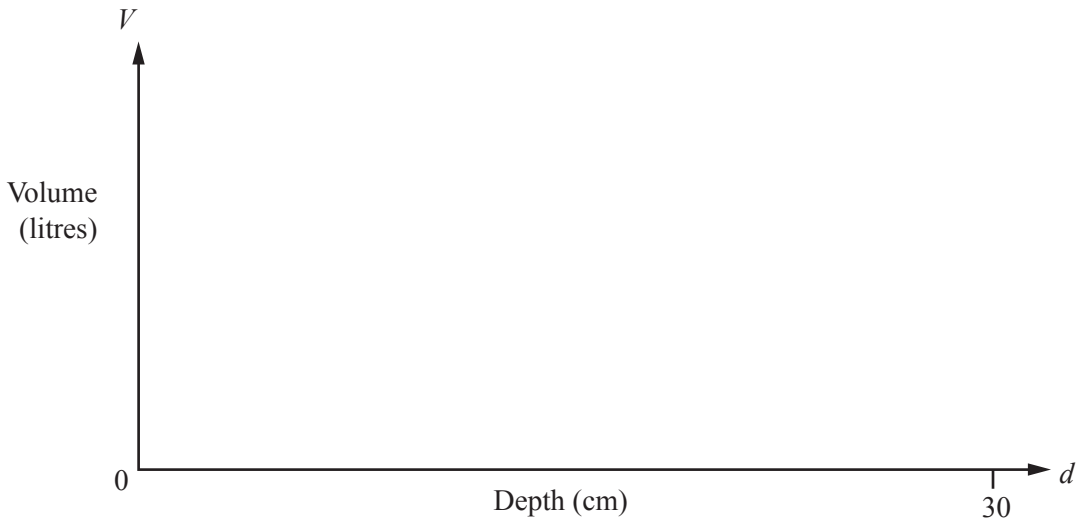
© UCLES 2015

[Turn over

(c) Show that a model for the volume of water in the bath, V litres, with angle of slope 60° and depth d cm is

$$V = 0.03d\left(300 - \frac{(30-d)}{\tan 60°} - \frac{30}{\tan 60°}\right).$$

(d) On these axes, sketch the graph of V for $0 \leqslant d \leqslant 30$.



(e) Find the depth of water in the bath when the volume is 150 litres.

..... cm

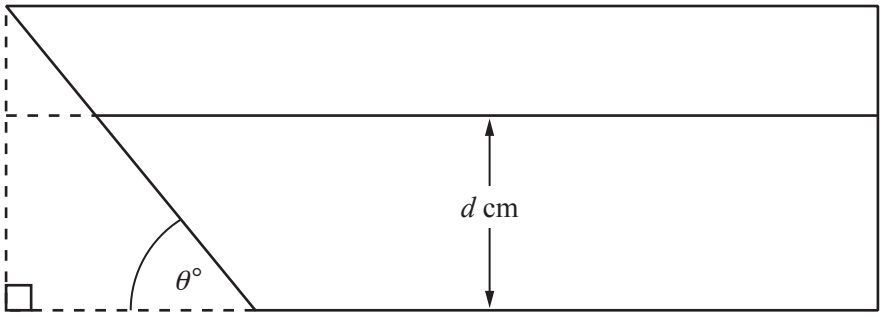
© UCLES 2015

3 The depth of water in her bath is d cm.
Water costs w cents per 100 litres.

(a) Change the model in **question 2(c)** to find the cost, \$$C$, of filling her bath every day for 1 year.

$C =$ .....

(b) (i) Change your model in **part (a)** to find C when the angle of slope is $\theta°$.



$C =$ .....

Parts (b)(ii), (b)(iii) and (c) are printed on the next page.

(ii) Describe the effect on the volume of water in her bath when θ decreases.

.....

.....

(iii) Why is the design of this bath not suitable when θ is small?

.....

.....

(c) Use your model from **part (b)** to find the cost of filling her bath every day for 1 year when

- $\theta = 50°$
- $d = 25$ cm
- water costs 21 cents per 100 litres.

$ .....

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2015