UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/06**

Paper 6 (Extended) **October/November 2011**

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, highlighters, glue or correction fluid.
You may use a pencil for any diagrams or graphs.
DO **NOT** WRITE IN ANY BARCODES.

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

You must show all 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.

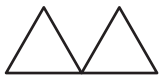
This document consists of **12** printed pages.

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

A INVESTIGATION MAXIMISING THE PERIMETER (20 marks)

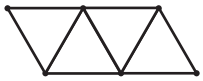
Identical shapes can be joined to make larger shapes.

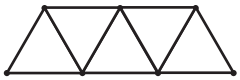
1 Equilateral triangles of side 1 cm may be joined edge to edge, for example 

but **not** like this.  

(a) The diagram below shows a shape made of 4 equilateral triangles and a shape made of 5 equilateral triangles.

Draw a different shape made of 4 equilateral triangles and a different shape made of 5 equilateral triangles.



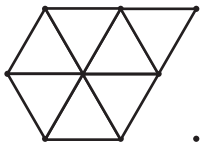


(b) **(i)** The diagram below shows a shape, made of 6 equilateral triangles, with a perimeter of 6 cm.

Draw a different shape, made of 6 equilateral triangles, with a perimeter **greater** than 6 cm.

(ii) The diagram below shows a shape, made of 7 equilateral triangles, with a pe of 7 cm.

Draw a different shape, made of 7 equilateral triangles, with a perimeter **greater** than 7 cm.



(c) **(i)** This table shows the **greatest** possible perimeters for shapes made of equilateral triangles.

Complete the table.

Number of equilateral triangles	2	3	4	5	6	7	8
Greatest perimeter (cm)	4						10

You may use the grid below to help you.

(ii) Write down the greatest perimeter for a shape made of 20 equilateral triangles.

..... cm

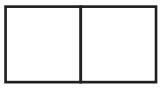
(iii) How many equilateral triangles make the shape when the greatest perimeter is 32 cm?

.....

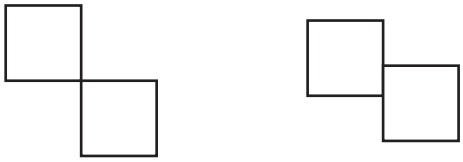
(d) Write down an expression, in terms of x, for the greatest perimeter for a shape made of x equilateral triangles.

.....

2 Squares of side 1 cm may be joined edge to edge, for example



but **not** like this.



(a) Find the greatest perimeter for a shape made of 6 squares.

..... cm

You may use the grid opposite to help you.

(b) **(i)** Complete this table.

Number of squares	2	3	4	5	6	7	8	9	10
Greatest perimeter (cm)	6			12					22

(ii) Write down the greatest perimeter for a shape made of 17 squares.

..... cm

(iii) How many squares make the shape when the greatest perimeter is 32 cm?

.....

(c) Write down an expression, in terms of x, for the greatest perimeter for a shape made of x squares.

.....

3 **(a)** This table shows the greatest perimeters for shapes made of regular hexagons of side 1 cm.

Complete the table.

Number of regular hexagons	2	3	4	5	6
Greatest perimeter (cm)					26

(b) Write down an expression, in terms of x, for the greatest perimeter for a shape made of x regular hexagons.

.....

4 Find an expression, in terms of x, for the greatest perimeter for a shape made of x regular octagons.

.....

5 **(a)** Write down an expression, in terms of x and y, for the greatest perimeter for a shap of x regular polygons each with y sides.

.....

(b) The greatest perimeter for a shape made of x regular polygons, each with y sides is 26 cm.

Find three possible pairs of values of x and y.

$x =$ ..... $y =$ .....

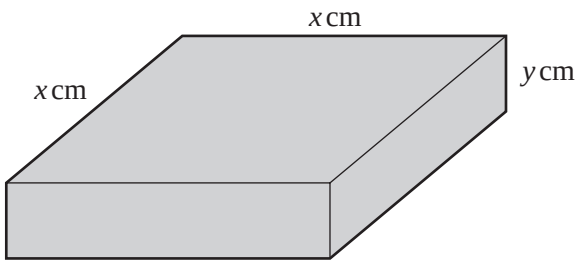
$x =$ ..... $y =$ .....

$x =$ ..... $y =$ .....

B MODELLING COVERING CAKES (20 marks)

Different shaped cakes are made each with a volume of 4000 cm^3.
The top and sides of each cake are covered in chocolate.

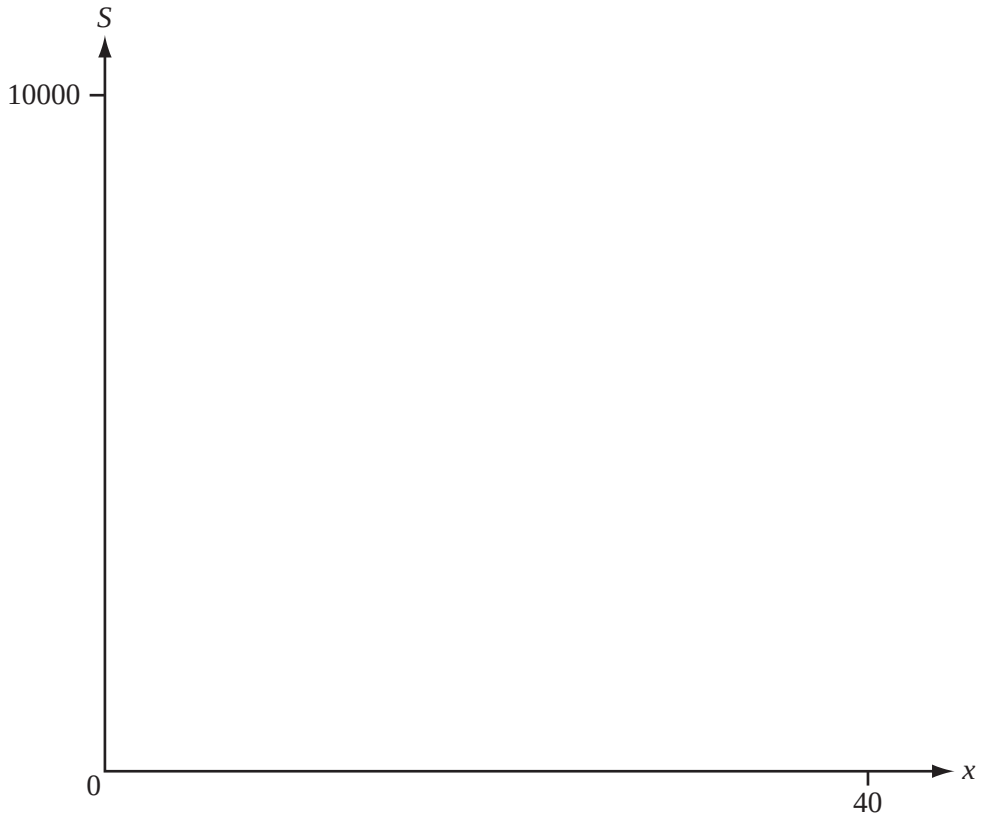
1 A square-based cake measures x cm by x cm by y cm, as shown in the diagram.



(a) Show that $y = \dfrac{4000}{x^2}$.

(b) The area covered in chocolate is S cm^2. By finding an expression for S in terms of x and y show that $S = x^2 + \dfrac{16\,000}{x}$.

(c) Sketch the graph of S against x for $2 \leqslant x \leqslant 40$ and $0 \leqslant S \leqslant 10000$ on the axes below.



(d) Find the minimum surface area to be covered in chocolate.

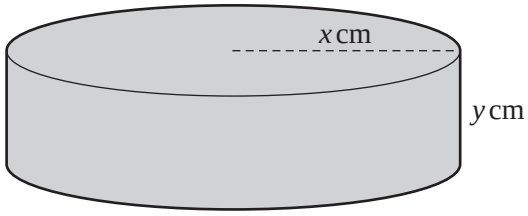
Write down the values of x and y.

minimum surface area = ... cm^2

x = ...

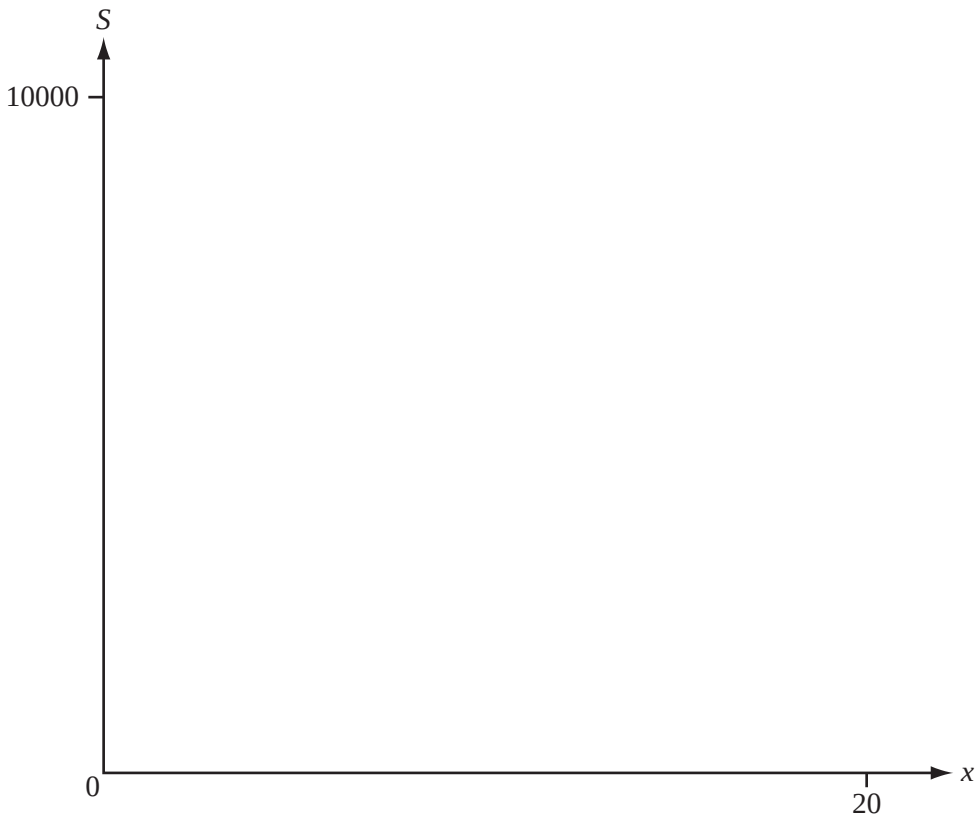
y = ...

2 A circular-based (cylindrical) cake has a radius of x cm and a height of y cm.
The area to be covered in chocolate is S cm^2 and the volume of the cake is 4000 cm^3.



(a) Show that $S = \pi x^2 + \frac{8000}{x}$.

(b) Sketch the graph of S against x for $1 \leqslant x \leqslant 20$ and $0 \leqslant S \leqslant 10000$ on the axes below.



(c) Find the minimum surface area to be covered in chocolate.

Write down the values of x and y.

minimum surface area = ... cm^2

x = ...

y = ...

3 $S = x^2 + \frac{16000}{x}$ and $S = \pi x^2 + \frac{8000}{x}$ are models for the amount of chocolate required to cover the top and sides of each cake.

(a) Explain how you could use these models for surface area to find the volume of chocolate required.

.....

.....

.....

(b) Comment on whether the models give realistic results for the volume of chocolate.

.....

.....

.....

Question 4 is printed on the next page

4 For a cake with **minimum** surface area, bakers use the following rule:

> *There is twice as much chocolate on the sides as on the top.*

Test this rule on both cakes.
Show your working.