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Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3088304286

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/61**

Paper 6 (Extended) **October/November 2017**

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 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 **10** printed pages and **2** blank pages.

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

A INVESTIGATION EQUABLE SHAPES (20 marks)

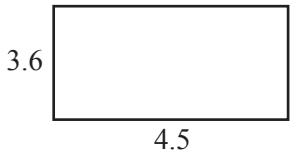
You are advised to spend no more than 45 minutes on this part.

In this investigation lengths are given in centimetres.
The area of a shape is A square centimetres and its perimeter is P centimetres.

This task investigates the dimensions of *equable* shapes.
The shape is *equable* if $A = P$.

All the diagrams in this investigation are not to scale.

1

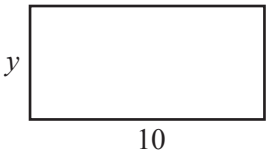


This rectangle is equable. Show by calculation that $A = P$.

.....

.....

2



(a) Write down an expression, in terms of y, for the area of this rectangle.

.....

(b) Write down an expression, in terms of y, for the perimeter of this rectangle.

.....

(c) This rectangle is equable.

Using your answers to **part (a)** and **part (b)** write an equation in terms of y.
Solve this equation.

.....

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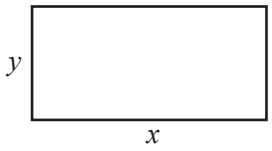
3



This rectangle is equable.

(a) Write down the equation $A = P$ in terms of x and y.

.....

(b) Show that $(x - 2)(y - 2) = 4$ is equivalent to your equation in **part (a)**.

(c) Use **part (b)** to find all the equable rectangles that have **integer** lengths and widths.

.....

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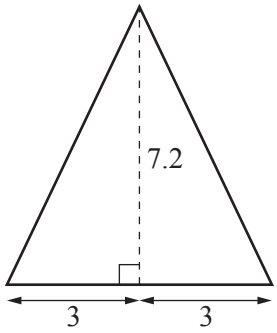
4



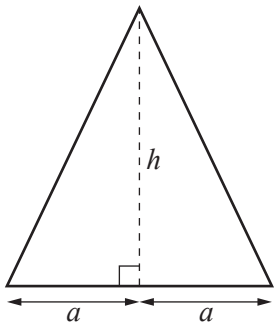
This isosceles triangle has base 6 and height 7.2 .

Its area is $\frac{1}{2}\times$ base $\times$ height

$= 3 \times 7.2$
$= 21.6$.

Show that it is equable.

5



This isosceles triangle has base $2a$ and height h.

(a) Find, in terms of a and h, an expression for A and an expression for P.

When $A = P$, show that $ah - 2a = 2\sqrt{a^2 + h^2}$.

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(b) **(i)** By squaring both sides of the equation in **part (a)** show that $a^2h - 4a^2 = 4h$.

(ii) Write a^2 in terms of h.

.....

(iii) For which values of h, the height of an equable isosceles triangle, is your formula for a^2 valid?

.....

(c) An equable isosceles triangle has a height of 4.5 .

Find its perimeter.

.....

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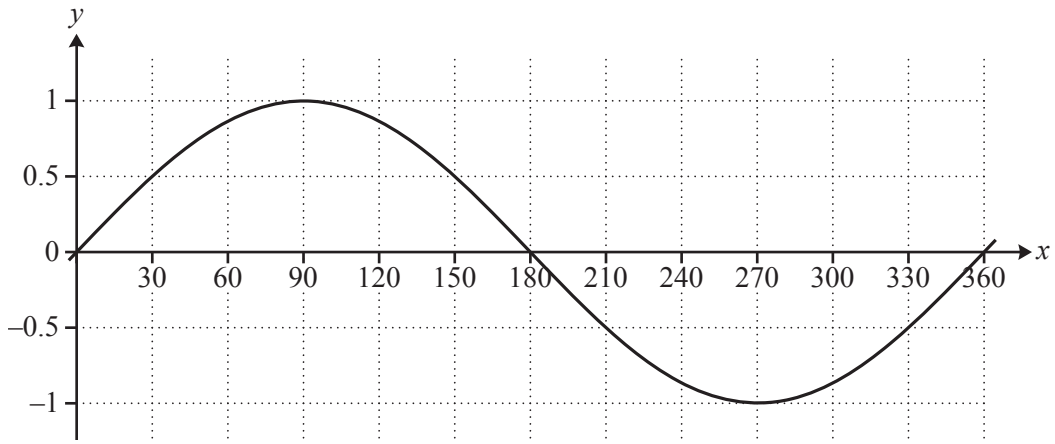
B MODELLING CARBON DIOXIDE MEASUREMENTS (20 marks)

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

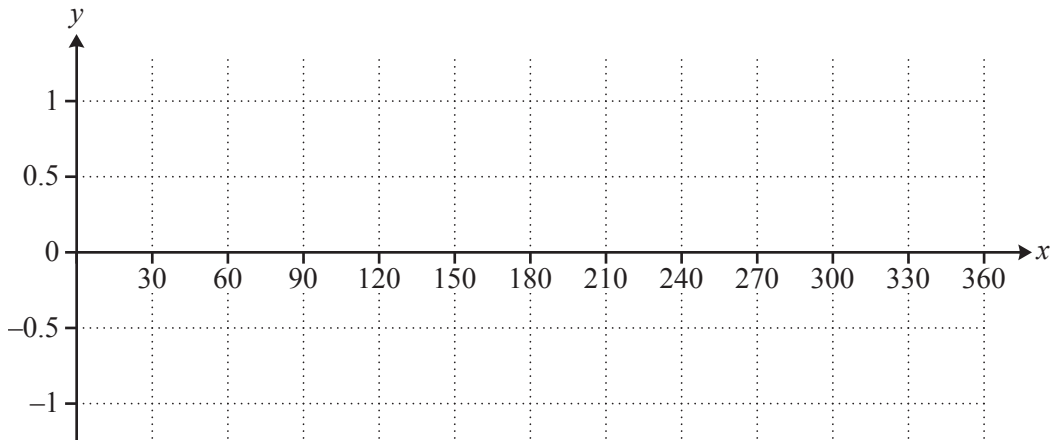
This task models data from Mauna Loa on the island of Hawaii.
Since 1958, scientists at Mauna Loa have been measuring the amount of carbon dioxide in the atmosphere.
The units of measurement are parts per million by volume (ppm).

The scientists use a sine wave to model the graph of the amount of carbon dioxide in the atmosphere.

Here is the graph of $y = \sin x°$. Its period is 360.



1 (a)



(i) On the grid, sketch the graph of $y = \sin(2x)°$ for $0 \leqslant x \leqslant 360$.

(ii) Write down the period of $y = \sin(2x)°$.

.....

(b) Write down the period of $y = \sin(6x)°$.

.....

(c) Find the value of k when the period of $y = \sin(kx)°$ is 40.

.....

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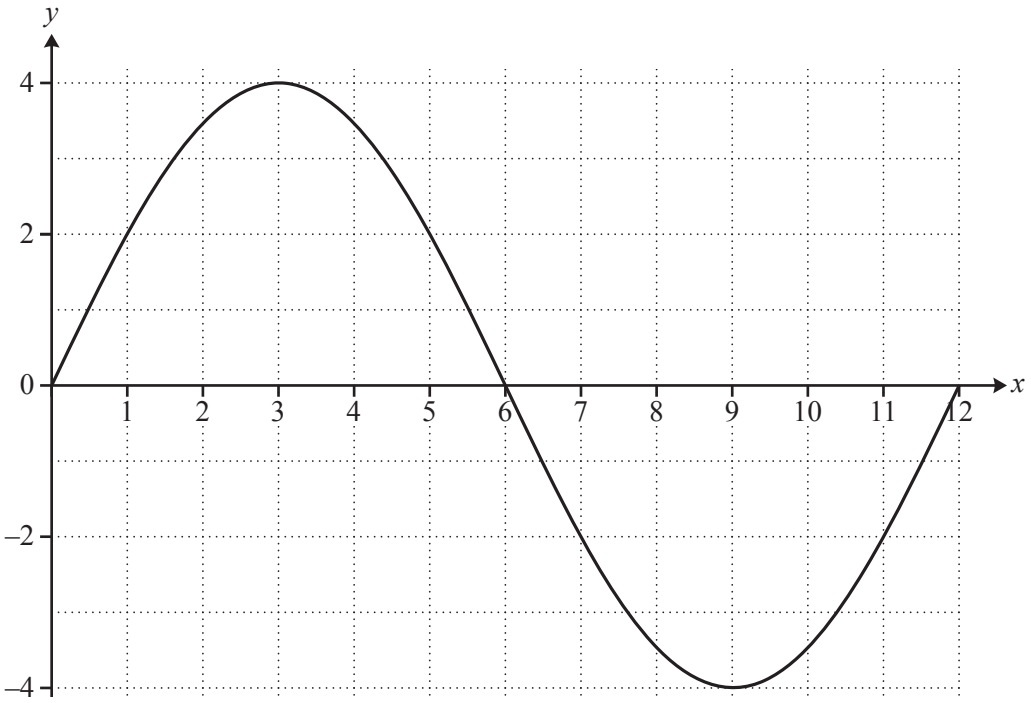
2 The graph below models the change in the amount of carbon dioxide at Mauna Loa in one year.

x is the number of months since the start of the year.
$x = 0$ is the beginning of January and $x = 12$ is the end of December.
y is the amount of carbon dioxide above a given level.



The equation of the graph is $y = a\sin(bx)°$.

(a) Write down the period of the graph and find b.

period = ...

b = ...

(b) Write down the value of a and the equation of the graph.

.....

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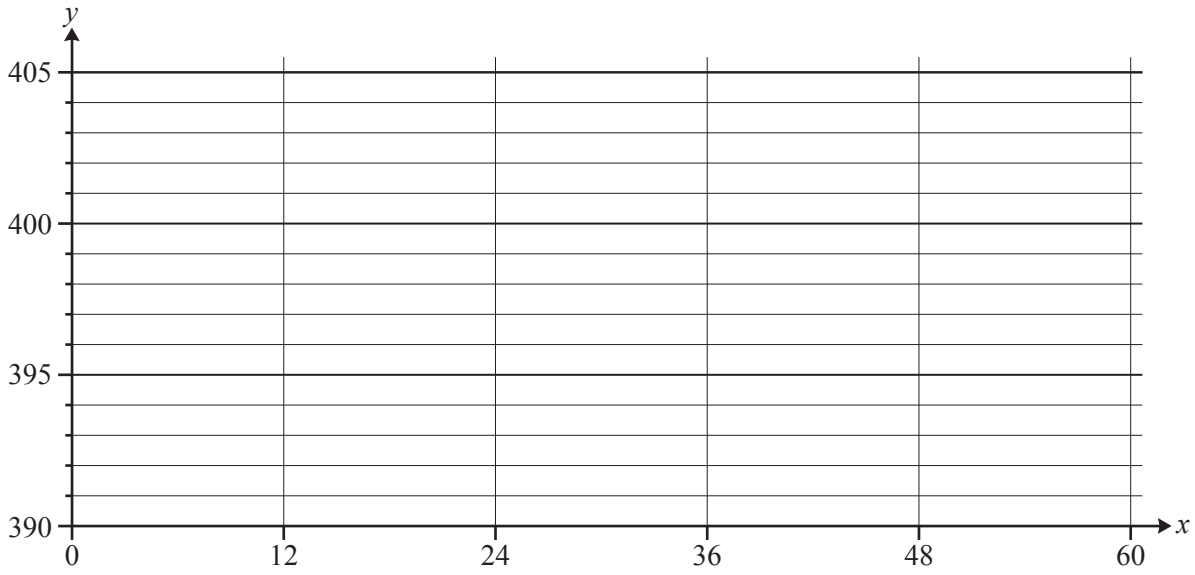
3 The table shows the amount of carbon dioxide at the beginning of each year.

Year	Number of months since the beginning of 2012 (x)	Amount of carbon dioxide in ppm (y)
2012	0	393
2013	12	395
2014	24	397
2015	36	399
2016	48	401
2017	60	403

(a) On the grid, plot these points.



(b) Find the equation for y in terms of x that fits the data.

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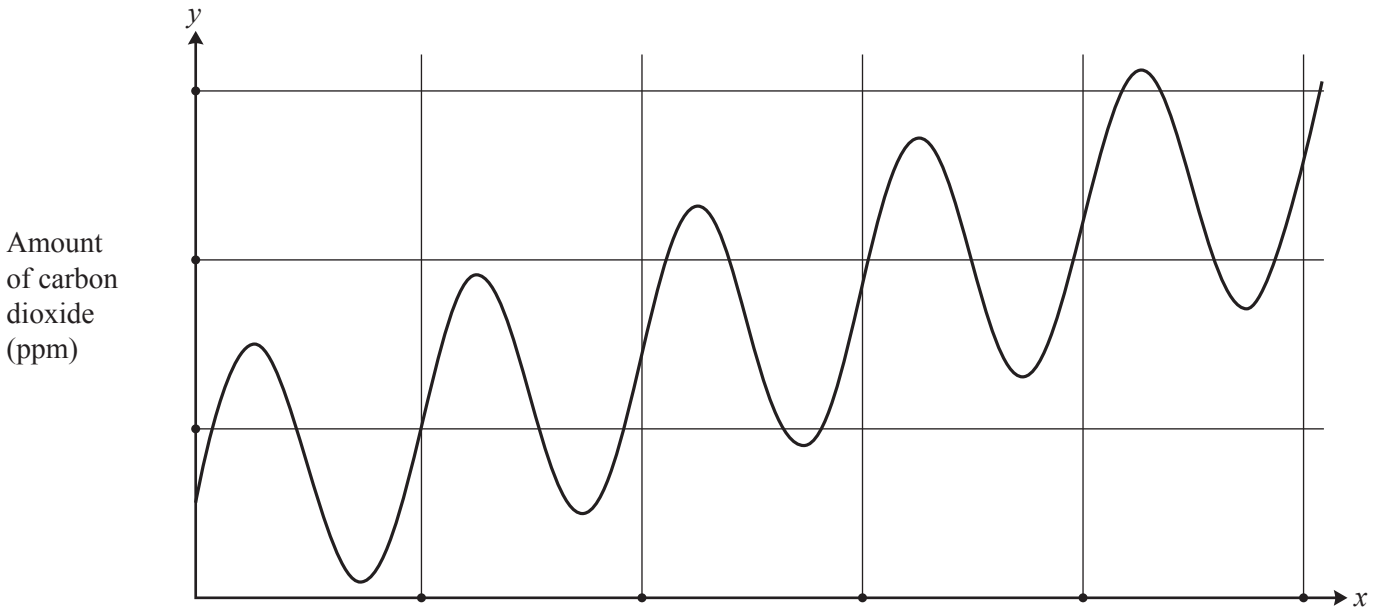
4 The expressions for y in **question 2** and **question 3** combine together to give the complete model.

Use one of the operations, addition, subtraction, multiplication or division, to write down the complete model.

.....

5 The graph shows the complete model for the amount of carbon dioxide between the beginning of 2012 and the beginning of 2017.

Label the points marked on the axes.



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6 Answer this question using your model from **question 4**.

(a) Find the highest amount of carbon dioxide in the atmosphere between the beginning of January 2012 and the beginning of January 2017.
Give your answer correct to 1 decimal place.

.....

(b) Find the amount of carbon dioxide at the end of May 2015.
Give your answer correct to 1 decimal place.

.....

7 Assume that the graph in **question 5** continues in the same way.
Find when the amount of carbon dioxide first reaches 410 ppm.
Write down the year and the month.

Year .....

Month .....

8 Explain why this model may not be appropriate for finding the amount of carbon dioxide in the atmosphere in the year 2050.

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