UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 6 3 5 7 0 1 2 4 7 7 *

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/06**

Paper 6 (Extended) **October/November 2010**

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.

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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UNIVERSITY *of* CAMBRIDGE International Examinations

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

A INVESTIGATION THE FIBONACCI SEQUENCE 24 mar

You are advised to spend no more than 55 minutes on this part.

The Fibonacci sequence is a sequence of numbers that is found in many real-life situations.

The Fibonacci sequence begins

1 1 2 3 5 …….

where, apart from the first two terms, each term is the sum of the previous two terms.

For example

1 + 1 = **2**, 1 + 2 = **3**, 2 + 3 = **5** and so on.

1 Complete the table for the first 15 Fibonacci numbers.
You must show your working.

Term position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fibonacci number	1	1	2	3	5	8	13	21	34	55	89	144	233		

2 **(a)** The table shows Fibonacci numbers that are multiples of 2.

Complete the table.

Term position	3		9	
Fibonacci number	2	8		

Notice that: 2 is the third term in the Fibonacci sequence, 8 is the sixth term in the Fibonacci sequence, and so on.
Every **third** term in the Fibonacci sequence is a **multiple of 2**.

(b) The next two tables show other patterns.

Complete the tables and the statements that follow.

(i)

Term position	4	8	12	
Fibonacci number	3			

3 is the .... term in the Fibonacci sequence.

Every .... term in the Fibonacci sequence is a multiple of 3.

(ii)

Term position				20
Fibonacci number	5	55		6765

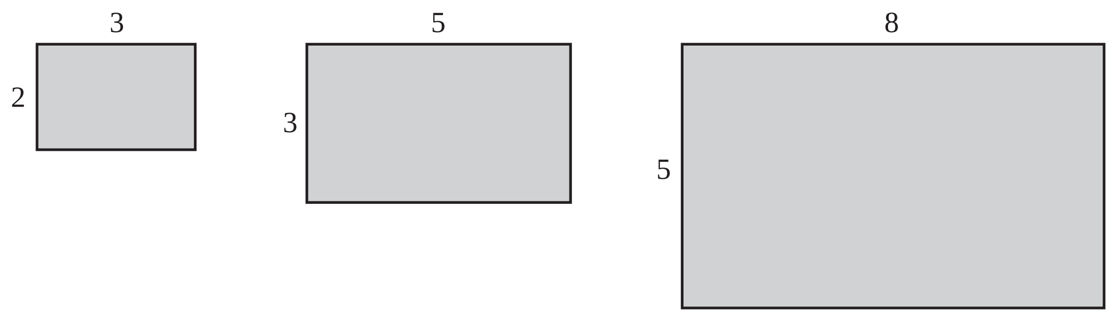
5 is the .... term in the Fibonacci sequence.

Every .... term in the Fibonacci sequence is a multiple of ....

(c) Complete the following statement.

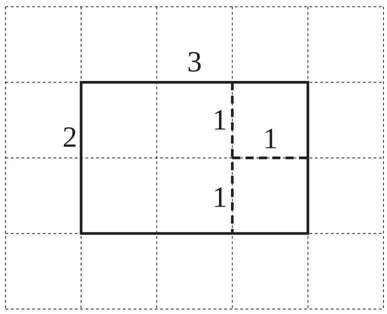
Every .... term in the Fibonacci sequence is a multiple of 8.

3 A Golden Rectangle is a rectangle with width and length that are **consecutive** Fibonacci numbers.

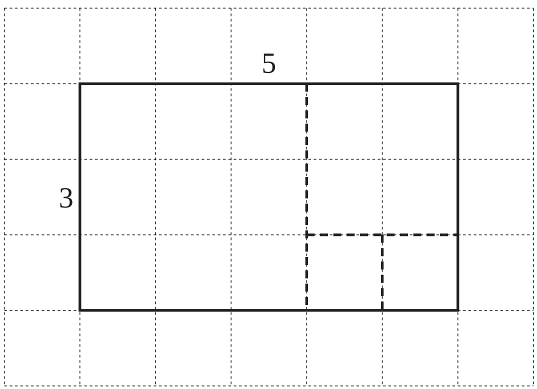


etc.

When a Golden Rectangle is divided into the **least number** of squares, the length of the side of each square is a Fibonacci number.



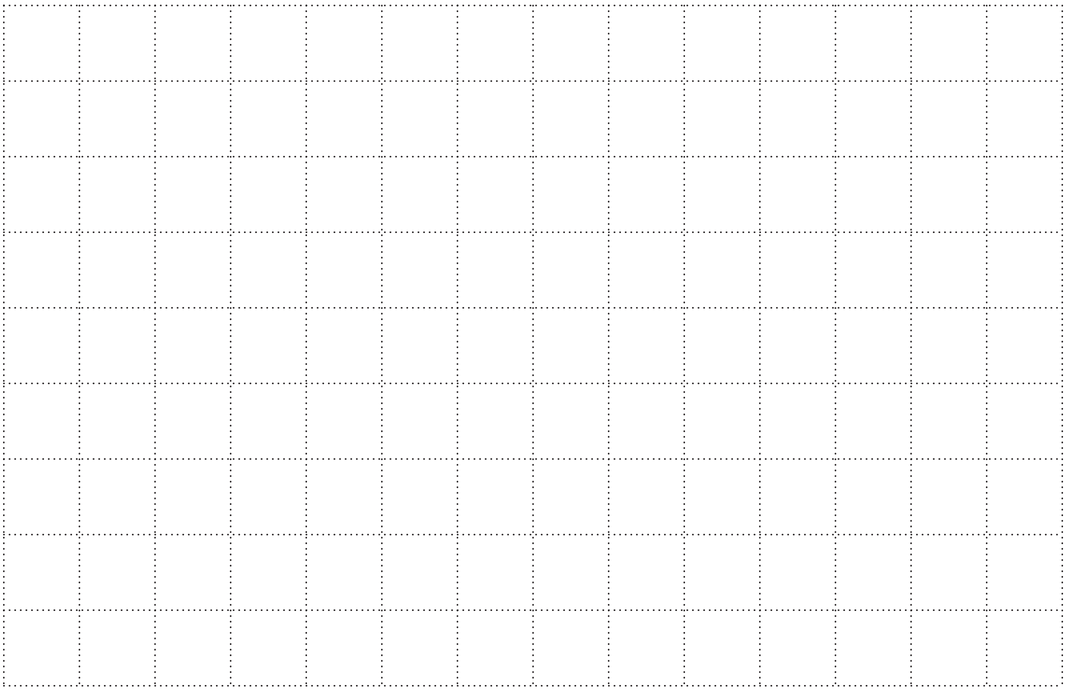
The diagram above shows the 2 by 3 Golden Rectangle.
The least number of squares it can be divided into is three.
These squares have sides 1, 1 and 2.



The diagram above shows the 3 by 5 Golden Rectangle.
The least number of squares it can be divided into is four.
These squares have sides 1, 1, 2 and 3.

(a) On the grid below, draw the 5 by 8 Golden Rectangle.
Show how this can be divided into the least number of squares.
These squares have sides 1, 1, 2, 3 and 5.

(b) On the grid below, draw the 8 by 13 Golden Rectangle.
Show how this can be divided into the least number of squares.



(c) **(i)** Complete the table to show the least number of squares in each of the ... Golden Rectangles.

Size of rectangle	1 by 1	1 by 2	2 by 3	3 by 5	5 by 8	8 by 13
Least number of squares	1			4		

(ii) Write down the least number of squares there are in the 21 by 34 Golden Rectangle.

....

(iii) When the least number of squares is 11, write down the width and the length of this Golden Rectangle.

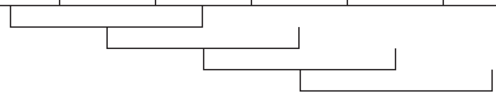
.... and ....

(d) When the width and the length of a Golden Rectangle are the $(n-1)$th and the nth terms of the Fibonacci sequence, write down the least number of squares in terms of n.

....

(e) In this part, numbers that are **two** positions apart in the Fibonacci sequence are used for the width and length of a rectangle. For example, 1 by 2, 1 by 3, 2 by 5, 3 by 8 and so on.

Term position	1	2	3	4	5	6	...
Fibonacci number	1	1	2	3	5	8	...



Write down, in words, the connection between the term positions of the two Fibonacci numbers used for the width and length of a rectangle and the least number of squares in the rectangle.

....

....

B MODELLING THE SOLAR SYSTEM

You are advised to spend no more than 35 minutes on this part.

Logarithms to base 10 are written as log.

1 The table below shows information about seven planets in the Solar System.

Planet	Distance from the Sun (S km)	Time to orbit the Sun (T days)	log S	log T
Mercury	5.79×10^7	88	7.8	1.9
Venus	1.08×10^8	225	8.0	2.4
Earth	1.50×10^8	365	8.2	2.6
Mars	2.28×10^8	687		
Jupiter	7.78×10^8	4330		
Saturn	1.43×10^9	10800		
Pluto	5.91×10^9	90800	9.8	5.0

Complete the table of values for log S and log T.
Give each value correct to 2 significant figures.

2 **(a)** On the grid opposite, plot the seven points (log S, log T).

(b) Plot the mean point (8.6, 3.2) and use this to draw a line of best fit.
(Do this by eye. Do not use your calculator.)

3 The time taken for the planet Uranus to orbit the Sun is 30685 days.

Use your graph to estimate the distance of Uranus from the Sun.
Give your answer correct to 2 significant figures.

.... km

4 Let $x = \log S$ and $y = \log T$.
The equation of the line of best fit is $y = mx + c$.

Use your calculator to find the values of m and c.
Give each answer correct to 2 significant figures.

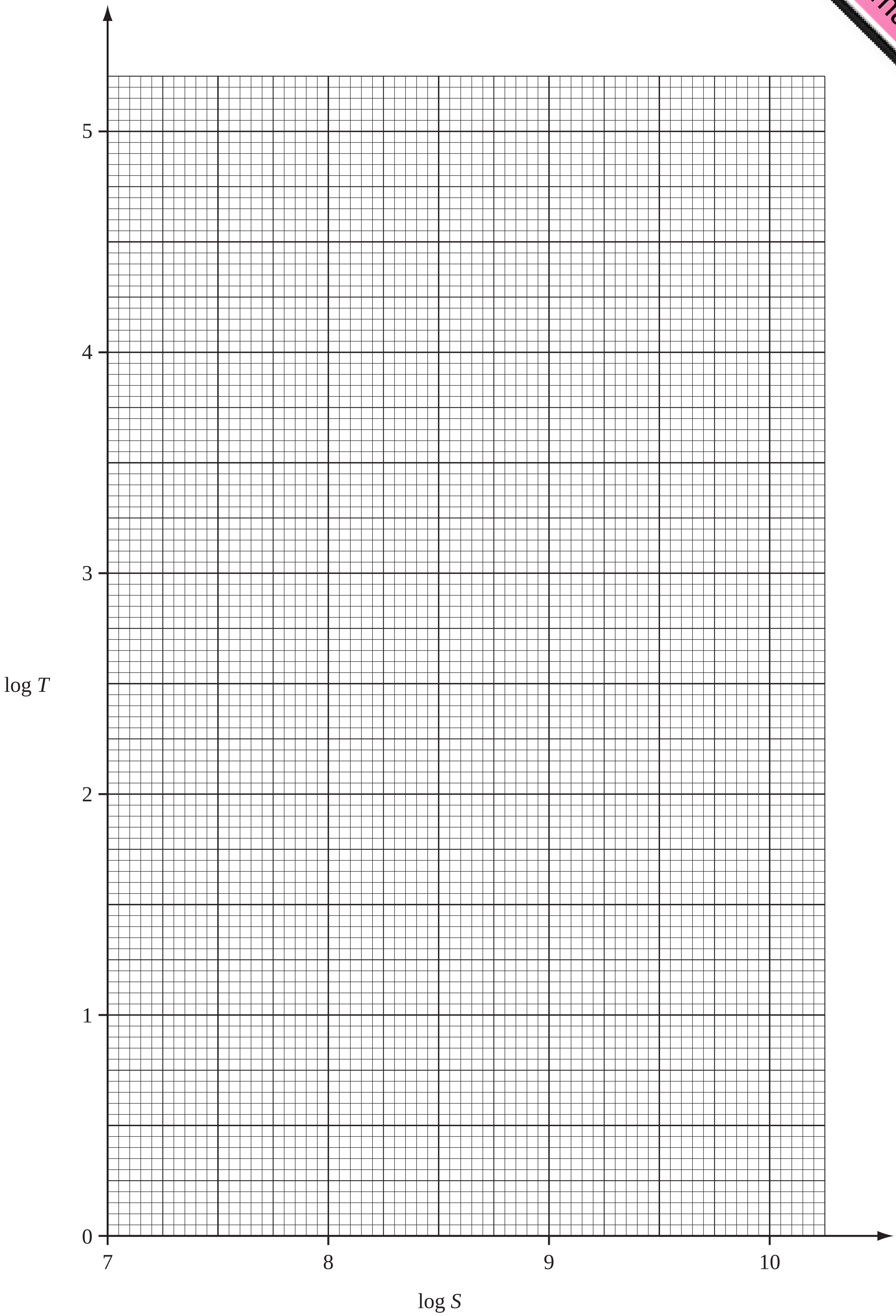
$m =$ ....

$c =$ ....

5 A model for this is $\log T = m\log S + c$.
The distance of the planet Neptune from the Sun is 4.50×10^9 km.

Use the model to find the time taken for Neptune to orbit the Sun.
Give your answer in standard form correct to 2 significant figures.

.... days



Question 6 is on the next page.

6 Writing c as $\log k$, the model can be written as $\log T = m \log S + \log k$.

(a) Show that $T = kS^m$.

(b) Find the value of k.

$k =$ ....

(c) Write the model $T = kS^m$ using your values of k and m.
Use the data for Earth to test this model.

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