	UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONAL International General Certificate of Secondary Education	Anna, papa Cambridge.com
CANDIDATE NAME		
CENTRE NUMBER	CANDIDATE NUMBER	
CAMBRIDGE Paper 6 (Exten	INTERNATIONAL MATHEMATICS ded)	0607/06 May/June 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 are advised to spend 45 minutes on Part A and 45 minutes on Part 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 the marks for this paper is 40.

This document consists of 7 printed pages and 1 blank page.



Answer both parts A and B.

A. INVESTIGATION FERMAT'S LITTLE THEOREM (20 marks)

You are advised to spend 45 minutes on part A.

The division $46 \div 5$ gives 9 with a remainder of 1. A method for finding the remainder is

 $46 \div 5 = 9.2$ Because $9 \times 5 = 45$, the remainder is 46 - 45 = 1.

The division $921 \div 7$ gives a remainder of 4. A method for finding the remainder is

921 ÷ 7 = 131.571.... Because $131 \times 7 = 917$, the remainder is 921 - 917 = 4.

The division $2^{11} \div 13$ gives a remainder of 7. A method for finding the remainder is

 $2^{11} \div 13 = 157.5384...$ Because $157 \times 13 = 2041$, the remainder is $2^{11} - 2041 = 7$.

1 Find the remainder in these divisions.

(a) 1234 ÷ 7

(b) $2^9 \div 9$

www.papaCambridge.com

3 In 1640 the French mathematician Fermat found something interesting about the remainder dividing by a prime number. Some of his results are shown in the table below. Prime Division Remainder Division Remainder 3 $2^3 \div 3$ 1 1 1 1 1								
Prime	Division	Remainder	Division	Remainder	Division	Remainder	.age	
3	$2^3 \div 3$						OT	
5	$2^5 \div 5$		$3^5 \div 5$		$4^{5} \div 5$			
7	$2^7 \div 7$	2	$3^7 \div 7$		$4^7 \div 7$			
11	$2^{11} \div 11$							

Complete the unshaded boxes in this table. You may use the space below to show any working.

3 Use the patterns you have found in your table to complete the following statements.

	(a) 7 ¹	¹¹ ÷	has a rema	ainder of
	(b) 8 ¹	¹⁷ ÷	has a rema	ainder of
4	From the So	he table	$2^7 \div 7$ $2^7 - 2$	has a remainder of 2. has a prime factor of 7.
	Becaus			6 - 1) and 7 is not a factor of 2, has a prime factor of 7.
	(a) Co	omplete the foll	owing statem	ents to show why $5^{12} - 1$ has a prime factor of 13.
				has a remainder of 5.
	Sc)	$5^{13} - 5$	has a prime factor of
	Ве	ecause	$5^{13} - 5 =$	and is not a factor of 5,
			$5^{12} - 1$	has a prime factor of 13.
	(b) W	rite down a pr	ime factor of	$8^{16} - 1.$

5 Complete the general statement below.

 $a^{p-1}-1$ has a prime factor of _____.

4

www.papacambridge.com

This is known as Fermat's Little Theorem.

6 Fermat noted that *p* must not be a factor of *a*. Give an example to show the result is **not** true when *p* is a factor of *a*.

7 By writing $7^{24} - 1$ in different ways, you can use Fermat's Little Theorem to find prime factors.

Examples:

$$7^{24} - 1 = (7^{24})^{1} - 1 = (7^{24})^{2-1} - 1$$

Using Fermat's Little Theorem with $p = 2$, $7^{24} - 1$ has a prime factor of 2.

 $7^{24} - 1 = (7^8)^3 - 1 = (7^8)^{4-1} - 1$ Fermat's Little Theorem with p = 4 cannot be used because 4 is not a prime number.

Use the above method to find as many **prime** factors as you can of $7^{24} - 1$. Remember: *p* must not be a factor of *a*. Show all your working.

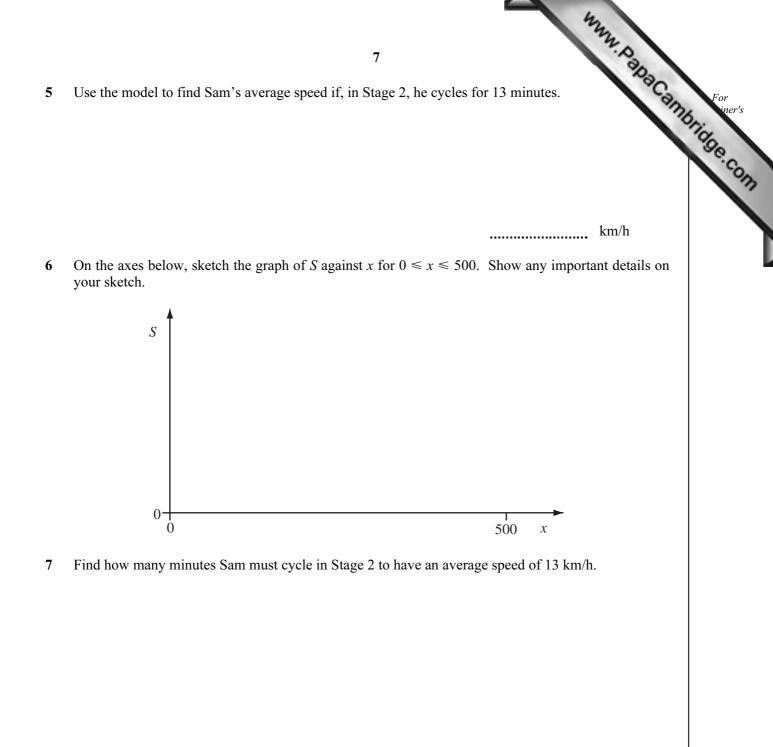


BLANK PAGE

Part **B** starts on **page 6**.

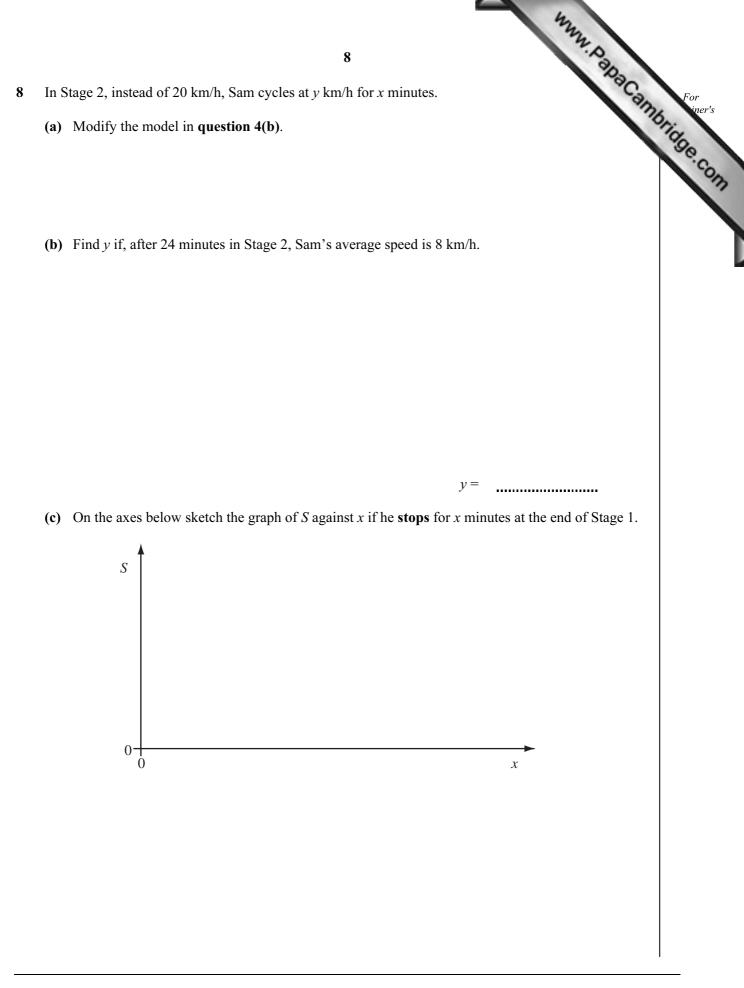
			man
		6	N.D.
B.	MODELLING	CHANGE OF AVERAGE SPEED (20 marks)	For
		You are advised to spend 45 minutes on part B .	hunn, papacamprilige com
In	m makes a journey in two Stage 1, he cycles at 10 I Stage 2, he cycles at 20 I		Com
1	In Stage 2, Sam cycles	for 30 minutes.	L
	(a) Find the total dist	ance he travels.	
	(b) Show that his ave	rage speed for the whole journey is 13.3 km/h.	km
2	If, in Stage 2, he cycles	s for 15 minutes, show that his average speed is now 12 km/h.	
3	If, in Stage 2, he cycles	s for 12 minutes, find his average speed.	
4	(a) In Stage 2, Sam cy Write down a forr	ycles for <i>x</i> minutes. nula for <i>S</i> , the average speed, in km/h.	km/h
	(b) Your formula is a Show that it simpl	mathematical model for the average speed.	

$$S = \frac{600 + 20x}{60 + x}.$$



min

Part B continues on page 8.



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.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of