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Cambridge Assessment International Education

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4995106493

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/52**

Paper 5 Investigation (Core) **February/March 2023**

1 hour 10 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly, including sketches, to gain full marks for correct methods.
- In this paper you will be awarded marks for providing full reasons, examples and steps in your working to communicate your mathematics clearly and precisely.

INFORMATION

- The total mark for this paper is 36.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages. Any blank pages are indicated.

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[Turn over

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The investigation starts on page 3.

Answer **all** the questions.

INVESTIGATION **SPLIT NUMBERS**

This investigation looks at numbers that are split into two parts.

A start number is split into two parts
the units, called the *units* and
the remaining multiple of ten, called the *stem*.

Examples

start number	stem	units
37	30	7
125	120	5
1526	1520	6

1 **(a)** Complete the table for the start number 163.

start number	stem	units
163		

[1]

(b) **(i)** For the start number 34, calculate stem − units.

..... [2]

(ii) For the start number 125, $\text{stem}^2 - \text{units}^2 = 120^2 - 5^2$
$= 14\,400 - 25$
$= 14\,375.$

For the start number 34, calculate $\text{stem}^2 - \text{units}^2$.

..... [2]

(c) For the start number 42, calculate $\dfrac{\text{stem}^2 - \text{units}^2}{\text{stem} - \text{units}}$.

..... [3]

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(d) Complete the table.
Use your answers to **part (b)** and **part (c)** to help you.

start number	stem	units	stem^2	units^2	$\text{stem}^2 - \text{units}^2$	stem − units	$\frac{\text{stem}^2 - \text{units}^2}{\text{stem} - \text{units}}$
125	120	5	14400	25	14375	115	125
34							34
	40	2					
50		0	2500			50	
		1		1	22499		151
		0			49000000		

[7]

(e) What do you notice about the start number and the value of $\frac{\text{stem}^2 - \text{units}^2}{\text{stem} - \text{units}}$ for each row of the table in **part (d)**?

..... [1]

2 For the number 125, stem + units is $120 + 5 = 125$.

(a) Copy your answers from **Question 1(d)** into the shaded columns.

Complete the table.

start number	stem	units		$\text{stem}^2 - \text{units}^2$	stem + units	$\frac{\text{stem}^2 - \text{units}^2}{\text{stem} + \text{units}}$
125	120	5		14375	125	115
34					34	
	40	2			42	38
50		0			50	
		1		22499		
		0		49000000		

[3]

(b) Use your tables from **Question 1(d)** and **Question 2(a)** to complete this statement.

$\frac{\text{stem}^2 - \text{units}^2}{\text{stem} + \text{units}} =$ ..... [1]

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3 **(a)** Copy your answers from **Question 1(d)** and **Question 2(a)** into the shaded columns.

Complete the table.

start number	stem + units	stem − units	(stem + units) × (stem − units)
125	125	115	14 375
34	34		
	42		
50			
			22 499
			49 000 000

[2]

(b) Use your table from **Question 1(d)** to help you complete this statement.

(stem + units) × (stem − units) = ... [1]

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4 For the rest of the investigation, T is the stem and U is the units of any start number.

(a) (i) Use algebra to show that $(T-5)(T+5) = T^2 - 5^2$.

[1]

(ii) Write down the value of T for the start number 185 and use this to check the result in **part (i)**.

[3]

(b) Use algebra to show that $T^2 - U^2$ is always the product of the factors $(T-U)$ and $(T+U)$.

[2]

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5 This question is about $T^2 + U^2$.
$T+U$ and $T-U$ are not always factors of $T^2 + U^2$.

(a) Use the table to help you investigate the start numbers from 35 to 40.
Find whether $T+U$ or $T-U$ or both are factors of $T^2 + U^2$ for these start numbers.

You may not need to use all the columns.

start number	T	U	T^2	U^2					
35	30	5	900	25					
36	30	6	900	36					
37	30	7	900	49					
38	30	8	900	64					
39	30	9	900	81					
40	40	0	1600	0					

[5]

(b) A start number is a multiple of 10.

Use algebra to explain why $T+U$ and $T-U$ are always factors of $T^2 + U^2$.

[2]

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