Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2774477453

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 Investigation and Modelling (Extended) **October/November 2022**

1 hour 40 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer both part **A** (Questions 1 to 6) and part **B** (Questions 7 to 10).
- 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 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

© UCLES 2022

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

A INVESTIGATION (QUESTIONS 1 to 6)

TWO-STEP SEQUENCES (30 marks)

You are advised to spend no more than 50 minutes on this part.

This investigation looks at *two-step sequences*.
These are sequences which use two steps to get from one term to the next.

> The first term in every sequence is 1.
>
> The two steps are:
> - multiply by a given number
> - then add a given number.

1 In this question the two steps are:
- multiply by 2
- then add 1.

1st term = 1

2nd term = 1st term $\times$ 2 + 1 = $1 \times 2 + 1$ = 3

3rd term = 2nd term $\times$ 2 + 1 = $3 \times 2 + 1$ = 7

4th term = 3rd term $\times$ 2 + 1 = $7 \times 2 + 1$ = 15

(a) Work out the 5th term of this sequence.

1, 3, 7, 15, ... [2]

(b) The nth term of another sequence is 2^n.

Calculate the 2nd, 3rd and 4th terms of this sequence.

2, ... , ... , ... , 32 [1]

(c) Look at your answers to **part (a)** and **part (b)**.

Write down an expression, in terms of n, for the nth term of the sequence in **part (a)**.

..... [1]

© UCLES 2022

2 In this question the two steps are:
- multiply by 2
- then add 3.

The first term is 1.

(a) Work out the 2nd, 3rd and 4th terms of this sequence.

1 , ... , ... , ... , 61 [2]

(b) The nth term of this sequence is $a \times 2^n + b$.

(i) Substituting $n = 1$, to get the first term of the sequence, gives the equation $2a + b = 1$.

Substitute another value for n to make another equation in terms of a and b.

..... [1]

(ii) Solve the simultaneous equations in **part (i)** to show that the nth term of the sequence is

$$2 \times 2^n - 3.$$

[2]

3 In this question the two steps are:
- multiply by 2
- then add 5.

The first term is 1.
The expression for the nth term is $3 \times 2^n - 5$.

Show that this expression gives the correct value for the 4th term of this sequence.

[3]

4 In this question the two steps are always:
- multiply by 2
- then add k.

The first term is 1.

(a) Complete the table.
Use your answer to **Question 1(c)** and any patterns you notice.

Steps to get the next term	Expression for the nth term
Multiply by 2, then add 1	.....
Multiply by 2, then add 3	$2\times 2^n - 3$
Multiply by 2, then add 5	$3\times 2^n - 5$
Multiply by 2, then add 7	.....
Multiply by 2, then add	..... $- 9$

[2]

(b) An expression for the nth term of this sequence is $a\times 2^n + b$.

Find expressions for a and b in terms of k.

Write down the expression for the nth term of the sequence.

$a =$ .....

$b =$ .....

nth term = ... [3]

(c) The 5th term of a sequence using the *n*th term in **part (b)** is 286.

Complete the two steps.

- multiply by 2
- then add ..... [3]

5 In this question the two steps are:
- multiply by 3
- then add 2.

The expression for the *n*th term is $a \times 3^{(n-1)} + b$.

(a) The first term is 1.

(i) Find the value of the second term of the sequence.

..... [1]

(ii) Use the first two terms to write two equations in terms of a and b.

.....

..... [2]

(b) Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [3]

6 **(a)** Complete the table.
Use your answer to **Question 5(b)** and any patterns you notice.

Steps to get the next term	Expression for the nth term
Multiply by 2, then add 1	$2 \times 2^{(n-1)} - 1$
Multiply by 3, then add 2	
Multiply by 4, then add 3	
Multiply by 5, then add 4	
Multiply by 6, then add 5	$2 \times 6^{(n-1)} - 1$

[1]

(b) For the sequence in the last row of the table,
the first term has the value 1 and the second term has the value 11.

Find which term has its value closest to 20 000 000.

..... [3]

B MODELLING (QUESTIONS 7 to 10)

DRIVING TO MY PLACE OF WORK (30 marks)

You are advised to spend no more than 50 minutes on this part.

This task looks at a model for the time that I take to drive from my home to my place of work.

I live 20 km from my place of work.
When I leave my home at 7.00 am, I drive at an average speed of 50 km/h.

7 **(a)** Calculate the time, in minutes, to drive to work when I leave home at 7.00 am.

..... [3]

(b) The time that it takes me to drive to work is m minutes.

Find, in its simplest form, a model for m when my average speed is v km/h.

..... [1]

8 When I leave home after 7.00 am, there is more traffic, and my average speed is less than 50 km/h.

My average speed decreases steadily by 1 km/h for every 2 minutes after 7.00 am that I leave home. For example, when I leave at 6 minutes after 7.00 am, my average speed is 3 km/h less, which is 47 km/h.

(a) I leave home at 7.40 am.

(i) Find my average speed.

..... [2]

(ii) Show that the time to drive to work is 40 minutes.

[1]

(b) I leave home x minutes after 7.00 am.

Show that a model for the time, T minutes, to drive to work is $T = \frac{2400}{100 - x}$.

[2]

(c) Sketch the graph of the model $T = \frac{2400}{100 - x}$ for $0 \leqslant x \leqslant 90$.



[2]

(d) I do not want to drive for more than 30 minutes.

Find the latest time that I should leave home.

..... [2]

(e) I must be at work by 9.00 am.
One day I oversleep and leave home at 8.35 am.

(i) Use the model to find how late I will be for work.
Give your answer in hours and minutes.

..... [3]

(ii) Make a statement about the suitability of the model.

..... [1]

9 I leave home x minutes after 7.00 am.

(a) Explain why a model for A, the number of minutes after 7.00 am when I arrive at work, is

$$A = x + \frac{2400}{100 - x}.$$

..... [1]

(b) I must be at work by 9.00 am, which is two hours after 7.00 am.
So my maximum value of A is 120.

(i) Show that, for this maximum value of A, x is a solution to the equation

$$x^2 - 220x + 9600 = 0 \ .$$

[3]

(ii) Find this value of x.

..... [3]

(iii) Find the latest time that I can leave home to arrive at work on time.

..... [1]

10 I move to a new home and now live d km from my work.

When I leave my new home at 7.00 am, my average speed is v km/h.
As before, my average speed decreases steadily by 1 km/h for every 2 minutes after 7.00 am that I leave home.

(a) I leave my new home x minutes after 7.00 am.

Show that a model for the time, T minutes, to drive to work is $T = \dfrac{120d}{2v - x}$.

[2]

(b) I want to leave my new home at 7.30 am and arrive at work at 9.00 am.

Find a model for v in terms of d.

..... [3]

© UCLES 2022

BLANK PAGE

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.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2022