

**THIRD
EDITION**

**Lower Secondary
Mathematics**

7

SAMPLE MATERIAL

We are working with Cambridge Assessment International Education to gain endorsement for this forthcoming title.

**Ric Pimentel
Frankie Pimentel
Terry Wall**


Boost

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EDUCATION

Please note this is a sample
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We are working with Cambridge Assessment International Education to gain endorsement for this forthcoming series.

Help students engage with and fully understand topics they are studying, with an emphasis on mathematical thinking and working, following the new Cambridge Lower Secondary Mathematics curriculum framework (0862) from 2020.

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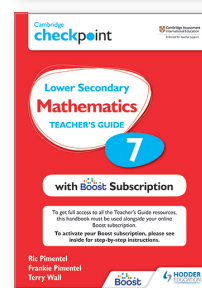
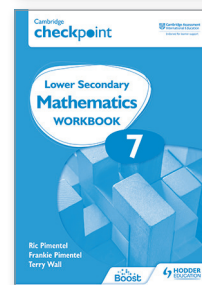
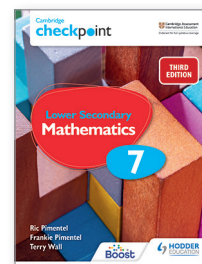
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Contents

The units in this book have been arranged to match the Cambridge Lower Secondary Mathematics curriculum framework. Each unit is colour coded according to the area of the syllabus it covers:

-  Number
-  Geometry & Measure
-  Statistics & Probability
-  Algebra

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- Unit 3** Data collection and sampling
- Unit 4** Area of a triangle
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- Unit 6** Algebra beginnings – using letters for unknown numbers
- Unit 7** Organising and presenting data
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- Unit 9** Multiples and factors
- Unit 10** Probability and the likelihood of events

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Unit 14 Manipulating algebraic expressions

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How to use this book

To make your study of Cambridge Checkpoint Maths as rewarding as possible, look out for the following features when you are using the book:

The Greeks

This section gives some historical background to the material in the section.

These aims show you what you will be covering in the unit.

LET'S TALK

Talk with a partner or a small group to decide your answer when you see this box.

Worked example

These show you how you would approach answering a question.

KEY INFORMATION

These give you hints or pointers to solving a problem or understanding a concept.

This highlights ideas and things to think about



This book contains lots of activities to help you learn. The questions are divided into levels by difficulty. Green are the introductory questions, amber are more challenging and red are questions to challenge yourself. Some of the questions will also have symbols beside them to help you answer the questions.

Exercise 15.2



- 1 Work out the answer to the following calculations. Show your working clearly and simplify your answers where possible.

a $\frac{2}{5} + \frac{1}{6}$

d $\frac{3}{13} - \frac{3}{26}$

b $\frac{7}{12} + \frac{1}{5}$

e $\frac{1}{8} + \frac{5}{16} - \frac{5}{24}$

c $\frac{9}{14} - \frac{2}{7}$

f $\frac{13}{18} - \frac{8}{9} + \frac{1}{6}$

- 2 Sadiq spends $\frac{1}{5}$ of his earnings on his mortgage. He saves $\frac{2}{7}$ of his earnings. What fraction of his earnings is left?

- 3 The numerators of two fractions are hidden as shown.

$$\frac{\boxed{}}{8} + \frac{\boxed{}}{5} = \frac{23}{40}$$

The sum of the two fractions is $\frac{23}{40}$. Calculate the value of both numerators.

Look out for these symbols:



This green star icon shows the thinking and working mathematically (TWM) questions. This is an important approach to mathematical thinking and learning that has been incorporated throughout this book.

Questions involving TWM differ from the more straightforward traditional question and answer style of mathematical learning. Their aim is to encourage you to think more deeply about the problem involved, make connections between different areas of mathematics and articulate your thinking.



This indicates where you will see how to use a calculator to solve a problem.



These questions should be answered without a calculator.



This tells you that content is related to another subject.



This tells you that content is available as audio. All audio is available to download for free from www.hoddereducation.com/cambridgeextras



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- Understand term-to-term rules, and generate sequences from numerical and spatial patterns (linear and integers).
- Understand and describe n th term rules algebraically.

Sequences and patterns

A **sequence** is an ordered set of numbers. Each number in the sequence is called a term. The terms of a sequence form a pattern.

Below are examples of three different types of sequences.

LET'S TALK

What other well-known sequences of numbers can you think of? Have they got special names?

• $2 \xrightarrow{+2} 4 \xrightarrow{+2} 6 \dots 8 \ 10 \ 12$

In this sequence we are adding 2 to each term in order to produce the next term.

• $1 \xrightarrow{\times 2} 2 \xrightarrow{\times 2} 4 \dots 8 \ 16 \ 32$

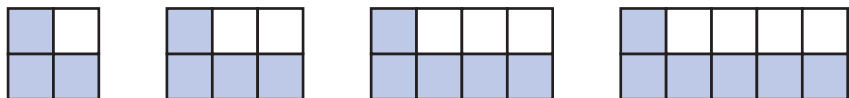
In this sequence we double each term in order to produce the next term.

• $1 \xrightarrow{+3} 4 \xrightarrow{+5} 9 \xrightarrow{+7} 16 \xrightarrow{+9} 25 \xrightarrow{+11} 36$

Here, the difference between consecutive terms increases by 2 each time. It is also the sequence of square numbers.

Sequences in diagrams

Sequences can also be expressed as a series of diagrams. The example below shows the first four diagrams in a sequence of tile patterns.



We can see that the tile patterns grow according to a rule. We can enter the numbers of white and blue tiles in each pattern into a table of results.

Number of white tiles	1	2	3	4
Number of blue tiles	3	4	5	6

SECTION 3

KEY INFORMATION

This is known as a **term-to-term rule**.

KEY INFORMATION

This is known as a **position-to-term rule**. The position number is the same as the number of white tiles.

There are two types of rules which describe the sequence of blue tiles:

- The number of blue tiles increases by 1 each time.
- The number of blue tiles is always 2 more than the number of white tiles.

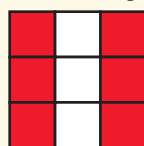
The second rule is useful if we know the number of white tiles and want to work out the number of blue tiles. For example, if there are 100 white tiles, how many blue tiles are there?

$$\text{Number of blue tiles} = \text{number of white tiles} + 2$$

$$\text{Number of blue tiles} = 100 + 2 = 102$$

Exercise 21.1

- 1 These diagrams show the first three patterns in a sequence of growing tile patterns.



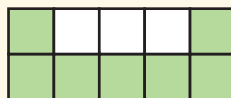
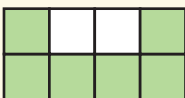
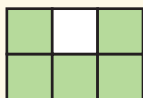
- a Draw the next two diagrams in the sequence.
b Copy and complete this table.

Number of white tiles	1	2	3	4	5
Number of red tiles					

- c Describe the pattern linking the number of white tiles and the number of red tiles.
d Use your rule in part (c) to predict the number of red tiles in a pattern with 100 white tiles.



2



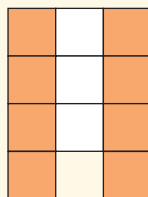
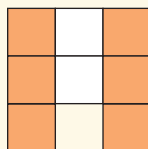
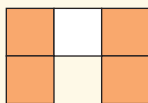
- a Draw the next two diagrams in the sequence.
b Copy and complete this table.

Number of white tiles	1	2	3	4	5
Number of green tiles					

- c Describe the pattern linking the number of white tiles and the number of green tiles.
- d Use your rule in part (c) to predict the number of green tiles in a pattern with 100 white tiles.



3



Look at the diagrams to understand the relationship between the white and green tiles, rather than just looking for a pattern in the table of numbers.

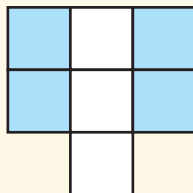
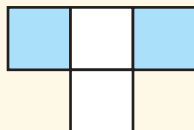
- a Draw the next two diagrams in the sequence.
- b Copy and complete this table.

Number of white tiles	1	2	3	4	5
Number of orange tiles					

- c Describe the pattern linking the number of white tiles and the number of orange tiles.
- d Use your rule in part (c) to predict the number of orange tiles in a pattern with 100 white tiles.



4



- a Draw the next two diagrams in the sequence.
- b Copy and complete this table.

Number of white tiles	1	2	3	4	5
Number of blue tiles					

- c Describe the pattern linking the number of white tiles and the number of blue tiles.
- d Use your rule in part (c) to predict the number of blue tiles in a pattern with 100 white tiles.

Term-to-term rules

A rule which describes how to get from one term to the next is called a term-to-term rule.

SECTION 3

Worked examples

- 1 Here is a sequence of numbers.

4 9 14 19 24

- a Describe the term-to-term rule.

The term-to-term rule for this sequence is $+5$.



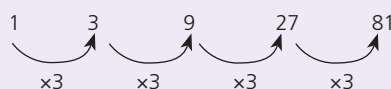
- b What is the tenth term?

To calculate the tenth term in the sequence, the pattern can be continued using the term-to-term rule:

4 9 14 19 24 29 34 39 44 **49**

- 2 Here is a sequence of numbers.

1 3 9 27 81



- a Describe the term-to-term rule for this sequence

The term-to-term rule for this sequence is $\times 3$.

- b What is the eighth term in the sequence?

To calculate the eighth term in the sequence, the pattern can be continued using the term-to-term rule:

1 3 9 27 81 243 729 **2187**

LET'S TALK

What is a disadvantage of this type of rule for working out other terms?

Exercise 21.2

- 1 For each of the following sequences:

- Describe the term-to-term rule.
- Write down the next two terms of the sequence.
- Calculate the tenth term.

a 2 4 6 8 10

b 1 3 5 7 9

c 4 7 10 13 16

d 2 6 10 14 18

e 1 8 15 22 29

f 5 10 20 40 80

g 2 6 18 54 162

h 9 7 5 3 1

i 32 28 24 20 16

j 144 132 120 108

The n th term

The method used above for calculating the 10th term of a sequence relies on knowing the term before in order to work out the next one. This method works but can take a long time if the 100th term is needed and only the first five terms are given! A more efficient rule is one which is related to a term's position in a sequence as seen earlier with the tile patterns. This is known as a **position-to-term** rule or the rule for the **n th term**.

Worked examples

- 1 This table gives the first five terms of a sequence and their positions in the sequence.

Position	1	2	3	4	5
Term	5	6	7	8	9

- a Describe the position-to-term rule.

By looking at the sequence it can be seen that the term is always the position number $+4$.

- b Write the position-to-term rule as a rule for the n th term.

The position can be represented by the letter n .

Therefore, the **n th term** can be given by the expression $n+4$.

Position	1	2	3	4	5	n
Term	5	6	7	8	9	$n+4$

- c Use your rule for the n th term to calculate the 50th term.

For the 50th term, $n=50$, therefore the 50th term is $50+4=54$.

- 2 This table gives the first five terms of a sequence and their positions in the sequence.

Position	1	2	3	4	5
Term	4	8	12	16	20

- a Describe the position-to-term rule.

By looking at the sequence it can be seen that the term is always the position number $\times 4$.

SECTION 3

Remember in algebra $4n$ means the same as $n \times 4$ or $4 \times n$.



- b Write the position-to-term rule as a rule for the n th term.
The position can be represented by the letter n .
Therefore, the **n th term** can be given by the expression $4n$.
- c Use your rule for the n th term to calculate the 75th term.
For the 75th term, $n=75$, therefore the 75th term is $4 \times 75 = 300$.

Exercise 21.3

1 In the following sequences:

i) Write down the next two terms.

ii) Give an expression for the n th term.

a 6 7 8 9 10

b 9 10 11 12 13

c 2 4 6 8 10

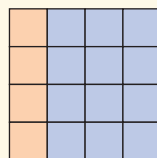
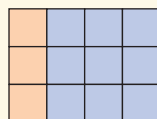
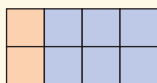
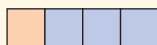
d 8 16 24 32 40

e -5 -4 -3 -2 -1

f 100 200 300 400 500

g -3 -6 -9 -12 -15

2 Look at the tile pattern sequence below.



a Copy and complete the table.

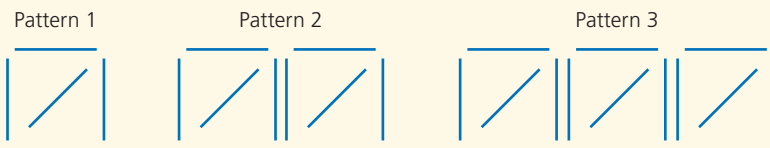
Number of pink tiles	1	2	3	4	5
Number of blue tiles					

- b Describe the relationship between the number of pink and the number of blue tiles.
- c Write an expression for the n th term of the sequence, where n represents the number of pink tiles.
- d If there are 65 pink tiles, how many blue tiles will there be?
- e If there are 540 blue tiles, how many pink tiles are there?





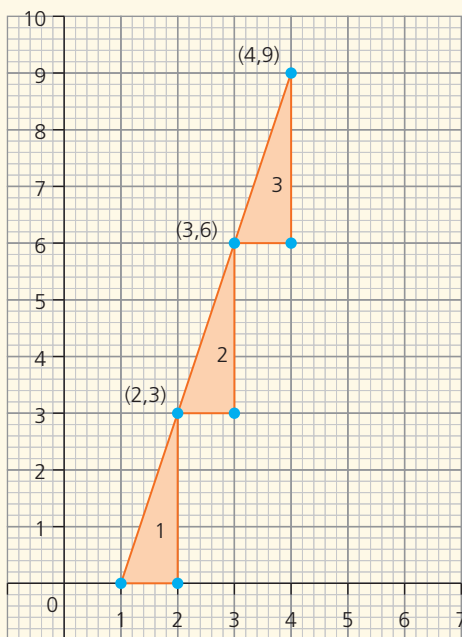
- 3 The sequence of patterns below is made of matchsticks.



- Write the number of matchsticks in the first five patterns as a sequence of numbers.
- Generalise by writing down the n th term of the sequence, where n is the pattern number.
- How many matchsticks are there in the 20th pattern?
- Explain why no pattern will have 232 matchsticks.



- 4 The grid below shows a pattern of triangles. The first three are shown. The coordinates of the top vertex of each triangle are given and form a sequence.



- What are the coordinates of the top vertex of the 20th triangle? Justify your answer.
- A triangle in the sequence has a top vertex with coordinates of $(56, y)$.
 - Which triangle has these coordinates? Justify your answer.
 - Calculate the value of y .
- A triangle in the sequence has a top vertex with coordinates of $(x, 360)$. Calculate the value of x . Justify your answer.



Now you have completed Unit 21, you may like to try the Unit 21 online quiz if you are using the Boost eBook.

Help students engage with and fully understand topics they are studying with an emphasis on mathematical thinking and working throughout.

- Provide activities to increase student's subject knowledge and develop the skills necessary to think and work mathematically.
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