



Coursebook

Maths

Lower Secondary

Authors

Andy Susanto
Veronica Dale

Support Deep Learning Approach

Include Problems Based on

Problem Solving Skills

Reasoning Skills

Critical Thinking Skills

Application Skills

The logo features a large blue number '8' on the left. To its right, the word 'Coursebook' is written in a small, grey, sans-serif font. Below 'Coursebook', the word 'Maths' is written in a large, bold, white, sans-serif font inside a pink rectangular box. Underneath the pink box, the words 'Lower Secondary' are written in a medium-sized, grey, sans-serif font.

Coursebook
Maths
Lower Secondary

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Introduction

Welcome to **Maths Lower Secondary 8: Coursebook**. Our series invites students to explore mathematics at a deeper and more challenging level, equipping them with the knowledge and skills needed for success in secondary school and beyond.

Aligned with the Merdeka Curriculum (Kurikulum Merdeka), our books are designed to do more than teach procedures. They cultivate problem-solving abilities, strengthen reasoning skills, and sharpen critical thinking. Each chapter encourages students to connect new ideas with what they already know, analyse situations, and apply mathematics to both familiar and new contexts.

Our approach promotes application skills by linking concepts to real-life problems, enabling students to see the value of mathematics in everyday decision-making and future learning. The coursebook also supports deep learning, where students go beyond memorising formulas to explore, connect, and apply ideas in ways that are meaningful and lasting.

We hope the **Maths Lower Secondary 8: Coursebook** becomes a valuable companion on each learner's journey, inspiring curiosity, building confidence, and developing a strong foundation in mathematical thinking that will prepare them for higher studies and lifelong learning.

— **The Publisher**

Key Features of the Series

Prep Time

Prep Time

Let's explore the generalised form of numbers. Let's recall the pattern of numbers in the number line.



Number	Number	Number	Number
1	2	3	4
5	6	7	8
9	10	11	12

Let's explore the pattern of numbers in the number line.

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Let's explore the pattern of numbers in the number line.

helps students recall prior knowledge and prepares them for new learning.

Maths Gem

Maths Gem

Honeybees build their hives using hexagonal cells, forming a perfect repeating pattern.

shares interesting facts and stories that reveal the wonders of mathematics.

Self-Reflection

Self-Reflection

- 1. Let's recall the pattern of numbers in the number line.
- 2. Let's explore the pattern of numbers in the number line.
- 3. Let's explore the pattern of numbers in the number line.
- 4. Let's explore the pattern of numbers in the number line.

invites students to review their progress and evaluate their learning.

Take Note!

Take Note!

Number patterns can go up, go down, or stay the same.



highlights the most important points students should remember in the lesson.



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Number Patterns

Have you ever seen lockers arranged in order, such as by even and odd numbers? Can you work out the pattern and explain how the numbers are organised?

Learning Objectives

- Recognise, extend, and create number and object patterns
- Identify number patterns and find the n -th term and its formula
- Calculate the sum of the first n terms in a sequence
- Solve real-life problems involving number and object patterns

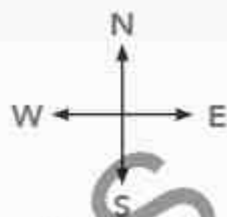
Maths Terminology

- Geometric patterns
- Number patterns
- Number sequences
- Pascal's triangle





Prep Time



Look at the illustration of house numbering in a housing complex below.



Complete the table below according to the house numbering illustration above.

Row of Houses on the North Side of the Street		Row of Houses on the South Side of the Street	
House Position	House Number	House Position	House Number
House number 1	1	House number 1	2
House number 2	3	House number 2	4
House number 3	...	House number 3	...
...
House number ...	17	House number ...	18
House number 10	...	House number 10	...

From the completed table above, we can write the number pattern as follows.

- Number pattern for houses on the north side: 1, 3, 5, 7, ...
- Number pattern for houses on the south side: 2, 4, 6, 8, ...

In this chapter, we will study number patterns.



Object Configuration Patterns

To help you understand number patterns more easily, let us first learn about object configuration patterns. To find out, complete the activity below.

Let's Do It

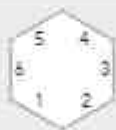
Do this activity with your classmates.

1. Prepare a box of matchsticks.
2. Arrange the matchsticks as shown in the picture.

Maths Gem

Honeybees build their hives using hexagonal cells, forming a perfect repeating pattern.

First arrangement



Second arrangement



Third arrangement



Fourth arrangement

Fifth arrangement

3. Count the number of matchsticks needed for each arrangement. Record your result in the table below and look for a pattern.

Arrangement (n)	Number of Matchsticks
1	6
2	...
3	...
4	...

Arrangement (n)	Number of Matchsticks
5	...
...	...
n	...

4. Answer these questions.

a. How many matchsticks are needed to form the 20th arrangement?

b. How many matchsticks are needed to form the n -th arrangement?

5. Write a short report describing your findings and submit it to your teacher.

An **object configuration pattern** is a way of arranging objects according to a particular rule so that they are easier to understand. It shows how objects are placed in relation to one another. The arrangement can be based on shape, colour, size, position, reflection, or the way objects are arranged.

In connection with number patterns, an object configuration pattern can also be seen from the number of objects in each step of the arrangement.

Example 1 : Draw the next pattern in each of the following object configurations.

a. 

b. 


Solution : a. Look at the number of dots in each step:

- 1st step \rightarrow 1 dot
- 2nd step \rightarrow 2 dots
- 3rd step \rightarrow 3 dots
- 4th step \rightarrow 4 dots

Each new step has **one more dot** than the previous one.

So the **5th step** will have **5 dots**.

The dots are arranged in a horizontal line.

Therefore, the picture for the 5th step is 

b. Look at the number of triangles in each step:

- Step 1 → 1 triangle
- Step 2 → 3 triangles
- Step 3 → 5 triangles

We can see that the number of triangles follows the pattern of **odd numbers** (1, 3, 5, 7, ...).

Each new step has **two more triangles** than the previous one.

So, the 4th step will have **seven triangles**.



Exercise 1.1

Draw the next three patterns in each of the object configurations shown below in your book.

1.



2.



3.



4.



5.



Finding and Continuing Number Patterns

A **number sequence** is an arrangement of numbers that follows a particular rule. This rule is what makes a sequence different from a random set of numbers. The rule that controls the sequence is called a **number pattern**.

Let us look at the numbers inside the boxes on the right.

Now, look carefully at the numbers inside the coloured boxes.

- 1, 2, 3, 4, 5, ...
- 31, 42, 53, 64, ...
- 40, 49, 58, 67, ...

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The three groups of numbers are called **number sequences**.

A number sequence is a set of numbers arranged in order that follows a particular pattern. Now, look at the first number sequence, the one in the green box.

1, 2, 3, 4, 5, ...

The sequence has the following pattern.



The pattern in this number sequence is that each number is always **1 more** than the previous number. In other words, the difference between two numbers that are next to each other is 1.

Now, you have learnt how to identify a pattern in a sequence and continue it in the **first number sequence**, apply the same steps to find the patterns and extend the next two sequences. Write your answers in your exercise book.

A **number sequence pattern** is the rule used to arrange the numbers in a sequence.

Special Forms of Number Patterns

In Mathematics, there are some special types of number patterns. Here are a few examples.

	Name of Number Pattern	Explanation
1.	<p>Odd Number Pattern</p> <p style="text-align: center;">1 3 5 7 ...</p>	<p>Rule:</p> <p>1st term = $2(1) - 1$ 2nd term = $2(2) - 1$ 3rd term = $2(3) - 1$... n-th term = $2n - 1$</p>
2.	<p>Even Number Pattern</p> <p style="text-align: center;">2 4 6 8 ...</p>	<p>Rule:</p> <p>1st term = $2(1)$ 2nd term = $2(2)$ 3rd term = $2(3)$... n-th term = $2n$</p>
3.	<p>Straight Line Pattern</p> <p style="text-align: center;">1 2 3 4 ...</p>	<p>Rule:</p> <p>1st term = 1 2nd term = 2 3rd term = 3 ... n-th term = n</p>
4.	<p>Triangle Pattern</p> <p style="text-align: center;">1 3 6 10 ...</p> <p style="text-align: center;">↓ ↓ ↓ ↓ ...</p> <p style="text-align: center;">1 3 6 10 ...</p>	<p>Rule:</p> <p>1st term = $\frac{1(1 + 1)}{2}$ 2nd term = $\frac{2(2 + 1)}{2}$ 3rd term = $\frac{3(3 + 1)}{2}$... n-th term = $\frac{n(n + 1)}{2}$</p>

	Name of Number Pattern	Explanation
5.	Square Pattern 	Rule: 1st term = 1×1 2nd term = 2×2 3rd term = 3×3 ... n -th term = $n \times n = n^2$
6.	Rectangular Pattern 	Rule: 1st term = $(1 + 1) \times 1$ 2nd term = $(2 + 1) \times 2$ 3rd term = $(3 + 1) \times 3$... n -th term = $(n + 1) \times n$ = $n^2 + n$
7.	Pascal's Triangle Pattern 	Rule: 1st term = $2^{(1-1)} = 2^0 = 1$ 2nd term = $2^{(2-1)} = 2^1$ 3rd term = $2^{(3-1)} = 2^2$... n -th term = $2^{(n-1)}$

Exercise 1.2

Solve the following problems.

1. Write the next three numbers in each of the following sequences.

- a. 3, 7, 11, 15, _____, _____, _____
 b. 1, 4, 7, 10, _____, _____, _____

2. Fill in the blanks so each line becomes a correct number sequence.

- a. 5, 8, _____, _____, _____, 20, 23
 b. 4, _____, _____, _____, 20, 24, 28

3. Find the two missing terms in each sequence.
- _____, 9, _____, 21, 27, 33
 - _____, 9, 13, _____, 21, 25
4. Arrange the following numbers to form a decreasing sequence.
- 1, 5, 3, 9, 7, 11 = _____
 - 15, 20, 10, 5, 25 = _____
5. Find the terms indicated in the odd number sequence.
- 12th term = _____
 - 35th term = _____
6. Find the terms indicated in the even number sequence.
- 15th term = _____
 - 50th term = _____

Finding the n -th Term of a Number Pattern

A number pattern or sequence can be written in two ways:

- By listing the first few terms
 - Example 1: 1, 4, 9, 16, ... → This is the pattern of **square numbers**.
 - Example 2: 2, 3, 5, 7, 11, 13, ... → This is the pattern of **prime numbers**.
- By using a formula for the n -th term

For example, if $U_n = n^2$ for $n = 1, 2, 3, 4, \dots$

Then, U_n represents the n -th term in the sequence.

This formula allows you to find any term such as the 1st, 10th, or even the 100th without writing out the entire sequence.

Example 2 : Write the first five terms of the sequence with the formula $U_n = 2n - 3$.

Solution : $U_n = 2n - 3$

$$\text{When } n = 1, U_1 = 2(1) - 3 = -1$$

$$n = 2, U_2 = 2(2) - 3 = 1$$

$$n = 3, U_3 = 2(3) - 3 = 3$$

$$n = 4, U_4 = 2(4) - 3 = 5$$

$$n = 5, U_5 = 2(5) - 3 = 7$$

So the first five terms are $-1, 1, 3, 5,$ and 7 .



Then, if a sequence is defined only by its first terms, how can you determine the 50th or the 100th term? You might calculate each term one by one until you reach the one you need, but that would take a lot of time. A quicker method is to use the **general form**.

The general form of a sequence can be written as:

$$a, a + d, a + 2d, a + 3d, \dots$$

where the first term (U_1) is a and the difference between the terms is d .

Let us examine the pattern of each term below.

$$U_1 = a + 0(d) = a + (1 - 1)d$$

$$U_3 = a + 2(d) = a + (3 - 1)d$$

$$U_2 = a + 1(d) = a + (2 - 1)d$$

$$U_4 = a + 3(d) = a + (4 - 1)d$$

According to this pattern, we get $U_{10} = a + (10 - 1)d = a + 9d$

...

$$U_{15} = a + (15 - 1)d = a + 14d$$

...

Therefore, the general form of the n -th term of a sequence is:

$$U_n = a + (n - 1)d \quad \dots (i)$$

This means that: $U_{n+1} = a + [(n + 1) - 1]d$

$$U_{n+1} = a + nd \quad \dots (ii)$$

From (i) and (ii) we obtain: $U_{n+1} - U_n = (a + nd) - [a + (n - 1)d]$

$$= a + nd - (a + nd - d)$$

$$= a + nd - a - nd + d$$

$$= d$$

$$U_{n+1} - U_n = d$$

