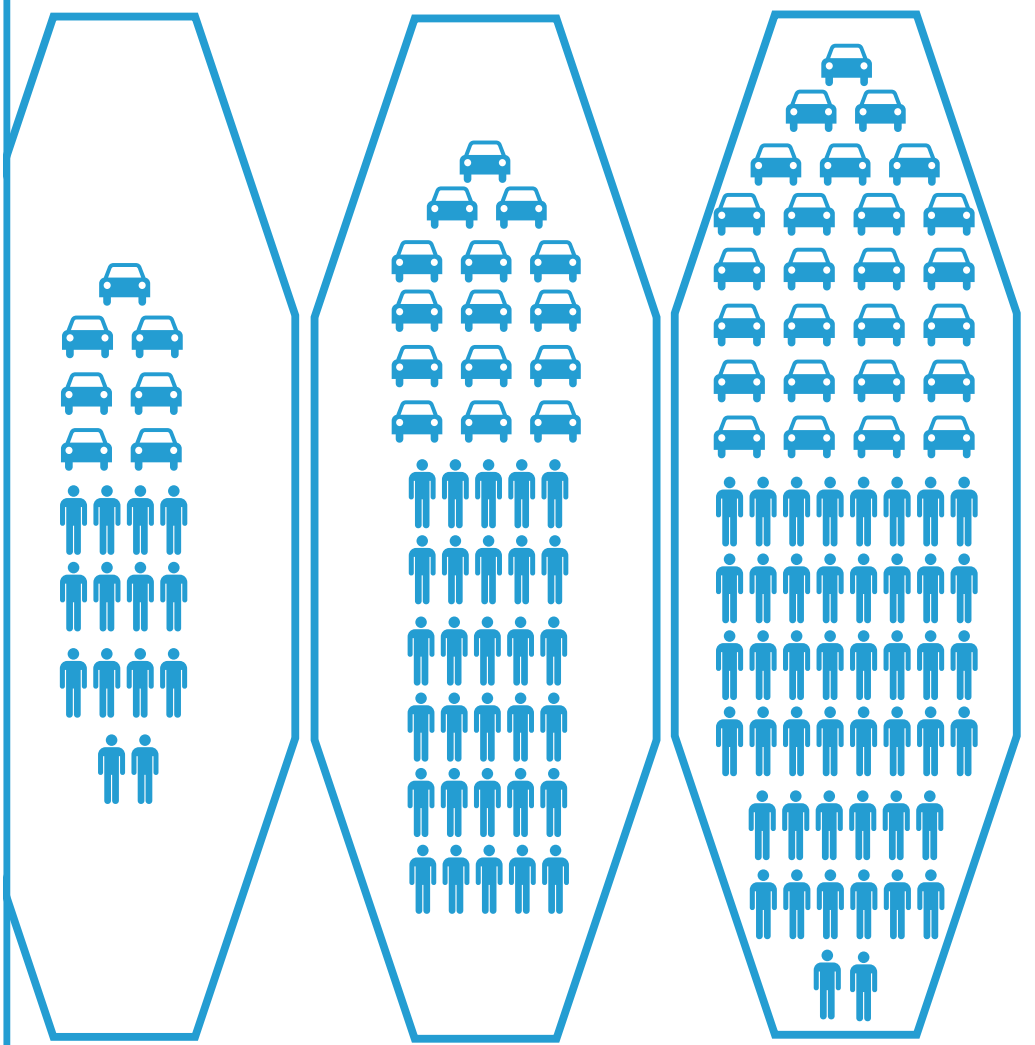
LITERACY FOUNDATIONS MATH



LEVEL 4
PATTERNS AND RELATIONS

To the Student

This resource covers topics from the British Columbia Ministry of Education's Literacy Foundations Math Level 4. You may find this resource useful if you're a Literacy Foundations Math student, or a K–12 student in grades 7 – 9.

We have provided learning material, exercises, and answers for the exercises, which are located at the back of each set of related lessons. We hope you find it helpful.

Literacy Foundations Math Prescribed Learning Outcomes

The Literacy Foundations Math Prescribed Learning Outcomes (PLOs) are grouped into four areas: Number (A), Patterns and Relations (B), Shape and Space (C), and Statistics and Probability (D). For a complete list of the PLOs in Level 5, search for Literacy Foundations Math curriculum on the BC Ministry of Education's website.

PLOs Represented in This Resource

The PLOs represented in this Level 4 resource are as follows:

Number

A6, A7, A9, A11 – A18

Patterns and Relations

All topics, B1 – B3

Shape and Space

C1 – C5, C7
*C3 topics are represented with the exception of angle construction

Statistics and Probability

D2

PLOs Not Represented in This Resource

The PLOs for which no material is included in this resource are as follows:

Number

There is no material for A1 – A5, read and write numbers, place value, and patterns for multiplying by 10, etc.; A8, compare decimal numbers; nor A10, patterns for multiplying and dividing by 1/10, etc.

Shape and Space

There is no material for C3, construct angles.

Statistics and Probability

There is no material for D1, graph data to solve problems.

Acknowledgements and Copyright

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Lesson 1
Describing Patterns

Learning Outcomes

By the end of this section you will be better able to:

- describe, in words, how a pattern is changing
- predict the next number in a pattern of numbers

Patterns are all around us. Maybe there's a pattern on the shirt you're wearing. Maybe there's a tile pattern on your floor. If you have ever said to someone, "I knew you were going to say that!" then you can recognize patterns in behaviours.

If you have ever been able to hum along with a song you're hearing for the first time, you can recognize patterns in rhythm and melody. Patterns come in many forms—behaviors, music, art, and in nature. So, what do we mean by the word pattern?

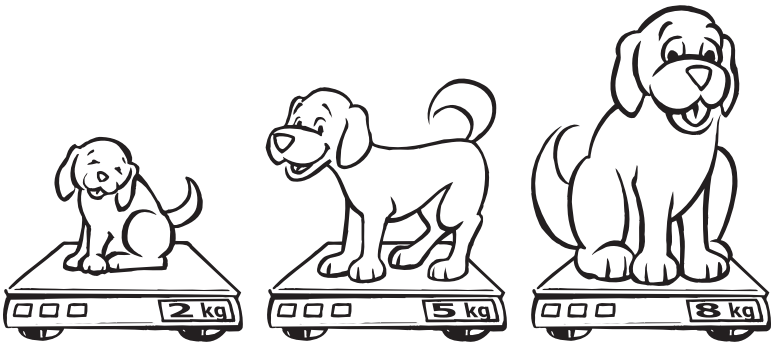
A **pattern** is a *predictable* sequence.

When you see or hear a pattern, you can predict what comes next.

Later in this section you will learn how to describe some patterns using math. Right now, let's take a close look at the way we describe patterns and relationships using words.

Example 1

Ranjot took her puppy to the vet once a month for a check-up. At each visit the puppy was weighed.



There are lots of ways to describe this pattern.

- At each visit, the puppy weighed 3 kg more.
- The puppy's weight increased by 3 kg.
- The puppy is gaining 3 kg per month.
- Add 3 each time.

Can you predict how much the puppy will weigh at the next check-up?

The puppy will probably weigh about 11 kg at the next check-up

Example 2

Michael had a great garden last year and he filled up his root cellar. He hopes that his family will be able to eat garden vegetables all winter.

At the beginning of September, he had 17 baskets of carrots.

At the beginning of October, he had 13 baskets of carrots.

At the beginning of November, he had 9 baskets of carrots.

Describe this pattern.

- The number of baskets of carrots goes down by 4 each month.
- Subtract 4 each time.
- Michael's store of carrots is decreasing by 4 baskets each month.
- Each time Michael counts, there are 4 fewer baskets than before.

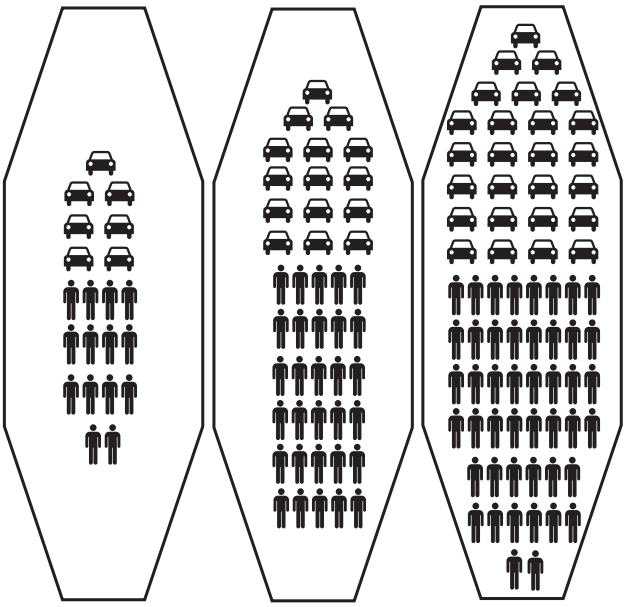
How many baskets of carrots can Michael expect to find at the beginning of December?

He will probably find 5 baskets at the beginning of December.

Does he have enough to get through the winter?

Example 3

Gareth works on a small ferry. He has noticed this pattern on some recent trips.



Is there a connection between the number of cars and the number of people?

- *The number of cars is half the number of people.*
- *The number of cars is always less than the number of people.*
- *The number of people is more than the number of cars.*
- *There are twice as many people as cars.*

If 18 cars drove onto the ferry, how many people could you expect to see?

You could expect to see 36 people.

If you noticed 24 people on the deck, how many cars would you expect to see driving off the ferry?

You would probably see 12 cars driving off the ferry.

Look back at the different ways we described patterns of numbers. Have a look at the chart below. Can you think of any other words that describe patterns? Add them to the chart.

Some words that describe patterns that go UP	Some words that describe patterns that go DOWN
more	less
increased by	goes down
gaining	decreasing
add	fewer
twice	subtract
	half

Exercises 1.1

1. Jana is counting the number of E. coli bacteria in her sample every twenty minutes. Describe this pattern in two ways.

Results:

Time	Bacteria Count (cells per mL)
2:00	3000
2:20	6000
2:40	12,000
3:00	24,000

2. When Evan was 5 years old, his brother Tosh was 9.

   When Tosh was 17, Evan was 13.

   Can you describe this pattern in two ways?

Turn to the Answer Key at the end of the module to check your work.

Lesson 2
Pre-Algebra

Learning Outcomes

By the end of this section you will be better able to:

- translate a mathematical expression into words
- translate an English expression into a mathematical expression

Each of the following phrases uses different words, but the pattern of numbers described in each of those situations is the same.

- *four more cats*
- *four years older*
- *four kilograms heavier*
- *four centimetres taller*

In this section you will learn to describe patterns with symbols—the symbols of math.

Look at a very simple relationship between numbers.

2	5
7	10
–2	1

The number on the right is
3 more than
the number on the left.

That sentence does a great job of describing the relationship between the pairs of numbers. For each row, that sentence is true. The specific numbers change, but that sentence still describes the relationship.

Can we do the same job with numbers and symbols?

"3 more than"—That sounds like adding 3. Try it. The number on the right is:

$$2 + 3$$

That works, but only for the first row. What's going on? The sentence was accurate for every row, but our numbers and symbols aren't. Isn't math supposed to be *better* at describing patterns of numbers?

Read that sentence again. *The number on the right is 3 more than the number on the left.* It doesn't say, "The number on the right is 3 more than 2." We need a symbol that will do the same job as the phrase *the number on the left.*

That's what a **variable** is for. A variable is a symbol in an expression. It is usually a letter. A variable stands for a number that might change.

Number starts with "n", so we'll use the letter *n* for our variable. Our variable *n* will be doing the same job as the phrase, *the number on the left.*

We're ready to try again. Describe the relationship using numbers and symbols. The number on the right is:

$$n + 3$$

We did it! We have expressed the idea, *3 more than the number on the left*, using only symbols.

Look at the examples below. In each case the numbers and symbols express the same idea as the descriptions that use words.

$n + 3$	three more than a number
$3n$	a number multiplied by three
$n - 3$	three less than a number
$\frac{n}{3}$	a number divided by three

The groups of numbers and symbols that we have been looking at have a name—they are called **expressions**.

Expressions have parts that are added together. Each part that is added is called a **term**. The following expression has two terms. Each term in the expression is underlined.

$$\underline{2x} + \underline{1}$$

The first term is "2x". You already know about variables. The variable here is x. The number in front of the x is called the **coefficient** of x. This term means "2 times x," even though the × is missing.

The second term is "1". There is no variable here. Nothing in this term can ever change, so we call this a **constant** term.

Look at one more expression before practising with these new words.

$$3m + 5n - 7$$

How many terms are in this expression? *three terms*

What are the variables in this expression? *m and n*

What are the coefficients? *3 and 5*

Let's take a close look at that last term before we answer the next question. Remember, terms are pieces of an expression that are *added* together. At the very beginning of this course, you learned that subtracting means the same as adding the negative of a number.

What is the constant? *−7*

Exercises 2.1

1. What number does each statement describe?

   a. a number that is 3 more than 9

   b. a number that is 5 less than 11

   c. a number that is half of 8

   d. This number increased by 6 is 2.

2. Match each description in words to the numbers and symbols that express the same idea.

a. $n - 6$	twice a number
b. $n + 3$	three more than a number
c. $2n$	five more than a number
d. $n + 5$	a number decreased by six

3. Write the description in words to the numbers and symbols that express the same idea.

   a. $\frac{n}{4}$ _____

   b. $4 - n$ _____

   c. $5n$ _____

   d. $n - 4$ _____

   e. $\frac{n}{2}$ _____

Turn to the Answer Key at the end of the module to check your work.

Answer Key

Lesson 1: Describing Patterns

Exercises 1.1

1. *Answers may vary.*

   The number of E. coli bacteria is doubling every twenty minutes.

   Each time Jana counts, there are twice as many bacteria as there were before.

2. *Answers may vary.*

   Tosh is 4 years older than Evan.

   Evan is 4 years younger than Tosh.

   Evan's age increased by 4 is Tosh's age

Lesson 2: Pre-Algebra

Exercises 2.1

1. a. 12
   b. 6
   c. 4
   d. –4

2. a. $n - 6$ a number decreased by six
   b. $n + 3$ three more than a number
   c. $2n$ twice a number
   d. $n + 5$ five more than a number

3. a. $\frac{n}{4}$ a number divided by four
   b. $4 - n$ four minus a number
   c. $5n$ five times a number
   d. $n - 4$ four less than a number
   e. $\frac{n}{2}$ half of a number or a number divided by two