

INTRODUCTION

In Grade 4 mathematics, students build on what they have already learned and are introduced to several new concepts. While working through the different topics, it is important that students work on their **Social and Emotional Learning** skills, using applications and activities from each content area.

CONTENT

The mathematical content in Grade 4 includes working with numbers up to 10 000, including **Number Sense** and **Number Operations** with both whole numbers and rationals. These ideas are applied in a chapter on **Financial Literacy** that covers the use of money in everyday life.

Students will also work with **Patterns, Variables, and Equations**, including patterns in tables and charts, variables, equations and inequalities.

Measurement provides an introduction to time, angles, length, perimeter, and the area of rectangles.

The chapter on **Geometric and Spatial Sense** covers the properties of rectangles, graphing points in the first quadrant, and translations on a grid.

There is also a chapter on **Data and Probability** that covers data collection, organizing and displaying data, analyzing data and an introduction to the concept of probability.

The section covering each content area begins with a description of the concept, followed by examples with clear step-by-step solutions. Students are then provided with questions that range from easy to difficult. Each chapter contains a set of extra practice questions on key concepts from each section within the chapter. Each chapter ends with a test. Answers to all exercises and chapter tests are provided.

SOCIAL EMOTIONAL LEARNING

Social and emotional skills are important when working with mathematics. If you use these skills, it will help you think about how to solve a problem.

In teaching this content, teachers are encouraged to use techniques to develop communication, representation, connection, and reasoning skills. A brief description of each follows. Activities and questions connected with each skill should be included when teaching the different content areas.

Chapter 10 goes into more details on these skills and includes examples with answers or explanations. Each set of examples is followed by a set of exercises.

Communicating

Communicating is being able to express mathematical ideas and your understanding of them. To communicate, you use numbers, symbols, pictures, graphs, diagrams, and words to show that you know what is being said or asked. You are expected to be able to show that you can express, describe, explain, and apply mathematical ideas in several different ways.

Representing

Representing involves different ways of showing mathematical ideas. To represent, you can use physical models, pictures, figures, numbers, and other methods to help make things clearer so that you can answer questions and find the solutions to problems.

Connecting and Relating

Connecting is being able to see and describe mathematical ideas. You should be able to connect mathematical ideas to each other and understand how they build on each other.

Reasoning and Proving

Reasoning and proving involve understanding the relationships that apply to numbers, shapes, or operations. To reason, you have to think about why something is true and whether it applies to a group of numbers, shapes, or operations.

CODING

Learning how to understand how computers follow instructions is an important part of coding in mathematics. It involves writing a set of instructions that a computer understands. Chapter 11 will help to strengthen the coding knowledge that students already have. It will also introduce the idea of using loops and nested events.

CHAPTER 1

NUMBER SENSE

1.1 Representing and Describing Whole Numbers

1.2 Comparing and Ordering Numbers

1.3 Representing and Classifying Numbers

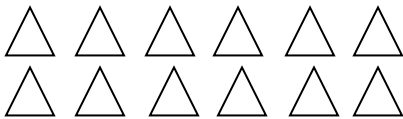
If you need additional help, there are more resources available at **dynamicmath.ca**.

1.1 Representing and Describing Whole Numbers

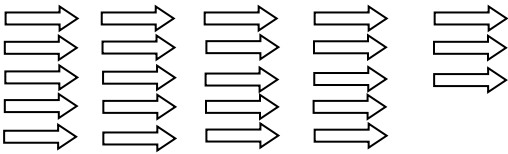
Whole Numbers

Whole numbers can be used to represent how many objects are in a set, beginning with none and going to any number of objects.

Example: Count the objects below and describe them with a whole number.



The number of triangles shown on the left is **12**.



The number of arrows shown on the left is **23**.

Whole numbers can be thought of as the numbers used for counting plus the number zero.

The set of whole numbers: **0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, ...**

Each number can be written in two ways: as a **numeral** and as a **word number**.

Note: We do not include the word “and” with word numbers for whole numbers. The word “and” will be used later with decimal numbers.

Examples:

12 is a numeral and **twelve** is its word number.

145 is a numeral and **one hundred forty-five** is its word number (not one hundred *and* forty-five).

5125 is a numeral and **five thousand one hundred twenty-five** is its word number.

Numerals are made up of **digits**. For example, the numeral 435 is made up of the digits **4, 3,** and **5**. Each of these digits represents a certain value. To better understand the value of each digit, we need to understand **place value**, which we will discuss in the next section.

Example: 3417 consists of the **digits 3, 4, 1,** and **7**. Each of these digits have different values.

Examples with Solutions

1. Write the numerals for each of the following word numbers.

Eighty-five	85
One hundred twenty-five	125
Four hundred three	403
Five thousand two hundred fifty	5250
Nine thousand twenty	9020
Eight thousand seven	8007

2. Write the word number for each of the following numerals.

655	six hundred fifty-five
1943	one thousand nine hundred forty-three
508	five hundred eight
2030	two thousand thirty
9007	nine thousand seven

3. Write all possible two-digit numerals that can be made from the following two digits.

7, 9	97 – ninety-seven
	79 – seventy-nine

4. Write all possible three-digit numerals that can be made from the following three digits.

4, 3, 1	431 – four hundred thirty-one
	413 – four hundred thirteen
	341 – three hundred forty-one
	314 – three hundred fourteen
	143 – one hundred forty-three
	134 – one hundred thirty-four

Numerals, Digits, and Values

The **numeral** 427 contains 3 **digits**: 4, 2, and 7. The **value** of each digit depends on its location or **place** in the numeral.

In the numeral 427, the digit 4 has a value of 400 because it is in the hundreds place. The digit 2 has a value of 20 because it is in the tens place. The digit 7 has a value of 7 because it is in the ones place.

Place Value (ones, tens, hundreds, thousands)

When we write numerals from 0 to 9, they involve only the “**ones**” digits.

Examples:

1. 6 is equal to six ones.
2. 2 is equal to two ones.

When we write numerals from 10 to 99, they involve both “**tens**” and “**ones**” digits.

Examples:

1. 20 is equal to 2 tens and 0 ones.
2. 38 is equal to 3 tens and 8 ones.
3. 97 is equal to 9 tens and 7 ones.

When we write numerals between 100 and 999, they involve **hundreds**, **tens**, and **ones** digits.

Examples:

1. 639 is equal to 6 hundreds, 3 tens, and 9 ones.
2. 485 is equal to 4 hundreds, 8 tens, and 5 ones.

Numerals between 1000 and 9999 include the “**thousands**, **hundreds**, **tens**, and **ones**” digits. Below, the number 5628 is shown with the place value for each digit.

5	6	2	8
↑	↑	↑	↑
thousands	hundreds	tens	ones

5628 has 5 thousands, 6 hundreds, 2 tens, and 8 ones.

Writing Numerals Using Proper Spacing

In Canada, we do not use commas with whole numbers. When a numeral has more than 4 digits, we leave a space instead of a comma between every three digits, working from right to left. We do **not** use a comma or leave a space if there are only four digits.

Examples:

1. Write as 11 250 instead of 11,250.
2. Write as 33 066 instead of 33,066.
3. Write as 5268 instead of 5,268.

Expressing a Numeral in Expanded Form

We can show a numeral as a sum of the values of its digits. This is called writing the numeral in expanded form. For example, 328 is equal to $300 + 20 + 8$. Keep in mind the place values of the digits.

Examples:

1. $62 = 6 \times 10 + 2 \times 1 = 60 + 2$
2. $549 = 5 \times 100 + 4 \times 10 + 9 \times 1 = 500 + 40 + 9$
3. $7604 = 7 \times 1000 + 6 \times 100 + 0 \times 10 + 4 \times 1 = 7000 + 600 + 4$

Examples with Solutions

1. Write the numeral that has 2 thousands, 5 hundreds, 0 tens, and 7 ones.

$$\underline{2} \times 1000 + \underline{5} \times 100 + \underline{0} \times 10 + \underline{7} \times 1$$
$$2000 + 500 + 0 + 7 = 2507$$

2. Write the word number for the numeral below.

6512

The numeral has 6 thousands, 5 hundreds, 1 ten, and 2 ones.

The word number is **six thousand five hundred twelve**.

3. Write 4084 in words.

The numeral has 4 thousands, 0 hundreds, 8 tens, and 4 ones.

The number is **four thousand eighty-four**.

4. Write three thousand six hundred twenty as a numeral. There are 3 thousands, 6 hundreds, and 2 tens. The numeral is **3620**.
5. Look at the numeral 6513.
- a. What is the value of the 5? The 5 is in the hundreds column, so its value is $5 \times 100 = 500$.
- b. What is the value of the 1? The one is in the tens column, so its value is $1 \times 10 = 10$.
- c. What is the value of the 6? The 6 is in the thousands column, so its value is $6 \times 1000 = 6000$.
6. Express 759 in expanded form. There are 7 hundreds, 5 tens, and 9 ones.
 $759 = 7 \times 100 + 5 \times 10 + 9 \times 1$
 $= 700 + 50 + 9$
7. Write a numeral for the number that has 3 thousands, 3 hundreds, 3 tens, and 3 ones. 3 thousands, 3 hundreds, 3 tens, and 3 ones is equal to $3 \times 1000 + 3 \times 100 + 3 \times 10 + 3 \times 1$. This is equal to $3000 + 300 + 30 + 3 = 3333$.

Exercises 1.1

1. Fill in each blank in the table below.

	thousands	hundreds	tens	ones
a. 9052				
b. 206				
c. 6300				
d. 5106				
e. 310				
f. 42				
g. 7007				

2. Write each of the following numerals in expanded form. The first one is done for you.

a. 3257 $3000 + 200 + 50 + 7$

b. 4433

c. 8056

d. 8506

e. 9990

3. Write the numeral for each description below.

a. 2 thousands, 9 hundreds, 7 tens,
and 5 ones

b. 2 hundreds, 5 tens, and 6 ones

c. 8 hundreds and 5 ones

d. 9 thousands, 9 hundreds, 9 tens, and 9 ones

e. 2 thousands, 7 hundreds, and
3 ones

f. 6 thousands and 5 tens

g. 4 thousands, 5 tens and 4 ones

h. 3 thousands and 3 ones

i. 27 thousands and 8 ones

j. 38 hundreds and 20 ones

4. The word numbers below combine some of the place values. Three examples are done for you. Write the correct numeral for each of those that follow.

- (i) five hundred twenty-seven 527
(ii) twelve hundred sixty-five 1265
(iii) twenty-six hundred eight 2608

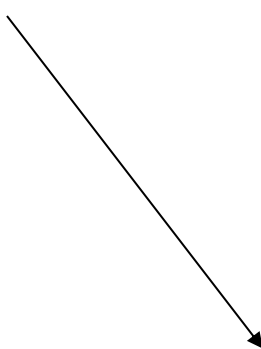
- a. eight hundred twelve b. six hundred twenty-one
c. eighteen hundred seven d. eleven hundred sixty-eight
e. twenty-five hundred forty-two f. one thousand two hundred five
g. twenty-nine hundred six h. nine thousand twenty
i. ten thousand six

5. Write the word number for each numeral listed below.

- a. 106 b. 67
c. 235 d. 610
e. 501 f. 1034
g. 1528 h. 5202

6. Match the word number in the left column with the numeral in the right column by drawing an arrow between them. The first one is done for you.

a. six hundred seventy	10 010
b. twenty-three hundred two	2320
c. forty-two thousand sixty-five	11 101
d. ten thousand ten	607
e. twenty-three hundred twenty	670
f. eleven thousand eleven	42 605
g. ten thousand one hundred one	42 065
h. forty-two thousand six hundred five	2302
i. six hundred seven	11 011
j. eleven thousand one hundred one	10 101



7. Use numerals to write each of the following numbers.

- | | |
|---|---|
| a. two hundred greater than twenty-one | b. one thousand greater than five hundred nine |
| c. two hundred less than one thousand three hundred | d. three hundred less than twenty-five hundred |
| e. one hundred seventy-two more than seven hundred | f. twelve hundred less than twenty-five hundred |
| g. seventeen more than fifteen hundred | h. five hundred less than seventeen hundred |

8. Use words to write each of the following numbers.

a. 28 more than 500

b. 200 more than 750

c. 300 less than 2575

d. 100 more than 890

e. 1250 more than 1005

f. 210 more than 530

g. 1400 less than 1750

Exciting Extras

For questions 9 to 16, write the number that makes the statement true.

9. I have 6 thousands, no hundreds, 2 tens, and 3 ones.

10. I have 3 hundreds, twice as many tens as hundreds, and no ones.

11. I have 11 ones and 2 tens.

12. I have 12 tens and 3 ones.

13. I have 13 hundreds, 5 tens and 15 ones.

14. I have twice as many hundreds as tens, twice as many tens as ones, and 2 less than 3 ones.

15. I have 8 thousands, half as many tens as thousands, and one more ones than tens.

16. I have the same number of thousands, hundreds, tens and ones. My number of ones is two more than three.

ANSWERS TO EXERCISES AND CHAPTER TESTS

CHAPTER 1

Exercises 1.1 (page 6)

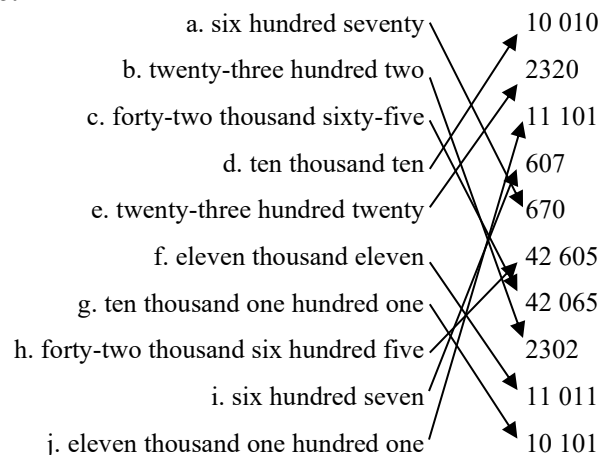
1.

- a) 9052
- b) 206
- c) 6300
- d) 5106
- e) 310
- f) 42
- g) 7007

	Thousands	Hundreds	Tens	Ones
a)	9	0	5	2
b)	0	2	0	6
c)	6	3	0	0
d)	5	1	0	6
e)	0	3	1	0
f)	0	0	4	2
g)	7	0	0	7

- 2. a) $3000 + 200 + 50 + 7$
- b) $4000 + 400 + 30 + 3$ c) $8000 + 50 + 6$
- d) $8000 + 500 + 6$ e) $9000 + 900 + 90$
- 3. a) 2975 b) 256 c) 805 d) 9999 e) 2703
- f) 6050 g) 4054 h) 3003 i) 27 008 j) 3820
- 4. a) 812 b) 621 c) 1807 d) 1168 e) 2542
- f) 1205 g) 2906 h) 9020 i) 10 006
- 5. a) one hundred six b) sixty-seven
- c) two hundred thirty-five d) six hundred ten
- e) five hundred one f) one thousand thirty-four
- g) one thousand five hundred twenty-eight
- h) five thousand two hundred two

6.



- 7. a) 221 b) 1509 c) 1100 d) 2200 e) 872
- f) 1300 g) 1517 h) 1200 8. a) five hundred twenty-eight b) nine hundred fifty c) two thousand two hundred seventy-five d) nine hundred ninety e) two thousand two hundred fifty-five f) seven hundred forty g) three hundred fifty 9. 6023 10. 360 11. 31 12. 123 13. 1365 14. 421 15. 8045 16. 5555

Exercises 1.2 (page 15)

- 1. a) 540 b) 2110 c) 4810 d) 5110 2. a) 318 b) 1028 c) 3389 d) 1009
- 3. a) 210, 207, 165, 156 b) 3165, 3155, 3090, 3033 c) 8100, 8099, 947, 895 d) 5010, 5005, 4990, 4988 e) 4532, 4529, 4444, 4399
- 4. a) 139, 159, 165, 240, 268 b) 1009, 1029, 1034, 1040 c) 4408, 4499, 4500, 4510 d) 890, 908, 7009, 7010
- 5. 839, 893, 389, 398, 938, 983
- 6. 542, 245, 524, 254, 425, 452
- 7. 7, 8, 9 8. 0, 1, 2 9. 0, 1, 2, 3
- 10. 0, 1, 2, 3, 4, 5, 6, 7, 8 11. 9999

Exercises 1.3 (page 19)

- 1. a) 8, 9 b) 0, 1, 2, 3, 4 c) 7 d) 0 e) 5
- f) 4, 5, 6, 7, 8, 9 g) 0, 1, 2, 3 h) 0 2. 6, 7
- 3. 22, 24, 26, 28 4. 10, 20 5. 12, 24 6. 21, 63

Extra Practice – Chapter 1 (page 20)

- 1. a) 202 b) 3333 c) 3300 d) 3330 e) 3030 f) 3003 2. a) two thousand four hundred ten b) two thousand ten c) two thousand four d) nine thousand one hundred five
- 3. 2, 4, 42, 24 4. 758, 587, 857, 785, 578, 875
- 5. a) $400 + 50 + 6$ b) $9000 + 800 + 2$ c) $7000 + 60 + 7$ 6. 963 7. 2222 8. 5555
- 9. a) 1210 b) 5011 c) 8114 10. a) 3302 b) 7389 11. 898, 899, 908, 910
- 12. 2110, 2101, 2011 13. 8, 9
- 14. 0, 1, 2, 3, 4, 5, 6, 7, 8 15. a) 15, 16, 17 b) 18, 19 c) 15, 18 16. a) 5, 10, 15 b) 12, 18 17. a) $200 + 30 + 4$ b) $400 + 2$ c) $2000 + 900 + 30 + 9$ 18. a) 423 b) 965 c) 5270

Chapter 1 Test (page 24)

- 1. a) 45 b) 57 c) 2210 2. a) 400 b) 5000 c) 80 3. a) 2612 b) 3047 c) 205 d) 30 200
- 4. a) four thousand fifteen b) six thousand seven 5. 2020 6. 2200
- 7. 7777 8. 29, 30, 31 9. 468, 648, 846, 486, 684, 864 10. a) $400 + 30 + 8$

CHAPTER 11

CODING

11.1 The Structure of Coding

11.2 Simplifying the Code

11.3 Code Blocks

11.4 Loops and Nested Events

11.5 Writing Code

Coding at the Grade 4 Level

This chapter will help strengthen the coding knowledge you already have and will introduce new concepts that will teach you how to take a repeating section of code and simplify it by using a **loop**. We will then explore more complex situations involving **nested events**, or loops inside other loops.

We will be relying on your knowledge of the content found in chapters 5 and 8. You should complete those chapters before doing this chapter on coding. We will be exploring coding examples that require your understanding of the following topics:

- Geometry of squares and rectangles, and figures created from the combination of these shapes
- Determining if angles are right, acute, or obtuse
- Compass directions (north, east, south, west) and translations on a grid
- Parallel and perpendicular lines

The best way for students to understand how coding works is for them to write some code and see the outcome.

This chapter provides explanations, examples, and practice questions that do not require the use of a computer or other technology. It also includes references to some optional online resources and tools that you can use to practice writing your own code using a free coding platform. Internet access will be needed to participate in the optional online part of this chapter.

The free coding platform that is used is called *Scratch*. This program makes use of coding blocks that you can drag and drop to create your own code and execute it on the screen. We use screenshots of these coding blocks in this chapter.

It is okay if access to the Internet is not possible, as all the topics are covered directly in this book. You will probably enjoy this unit more if you are able to create your own code and test it online.

Scratch is part of the MIT Media Lab and is free to use. (<https://scratch.mit.edu>)

11.1 The Structure of Coding

What Is Coding?

Coding is writing a set of instructions that a computer can understand so that the computer can complete a specific task. If you want a computer to do something, like draw a rectangle, then you need to give it a set of instructions that it can understand and follow.

We can look at an example of something that we do every day to understand how code is created. If you were to go outside, you would probably have to put on your socks and shoes. Think about the steps that are needed to put them on.

1. Put your socks on your feet.
2. Put your shoes on your feet.
3. Tie your shoelaces.

Those steps must be done in that order to get the result you want. You can't put on your shoes first, otherwise your socks won't fit.

Understanding the Structure of Code

A set of instructions is called an **algorithm**. Algorithms are used all the time when coding. We need to make sure that the algorithm is written in a way that a computer can understand. This is referred to as **code**. When the computer follows a set of instructions, it is **executing** the code.

It is not only important to have the correct steps. It is also important that the steps are in the correct order. Computers will only do exactly what they are told, in the order that they are told to do it. Putting your instructions in the correct order is the only way that you can get the **outcome** (or result) that you want.

Instructions that follow each other are called **sequential events**. Using the example above, the sequential events would be to put on your socks, then put on your shoes, and finally to tie your laces.

Instructions that happen at the same time are called **concurrent events**. An example of this would be to smile and wave at a friend.