INTRODUCTION

In Grade 6 mathematics, students continue to build on what they have already learned and are introduced to several new concepts. While working through the different topics, it is important that the students work on their **Social and Emotional Learning**, using applications and activities from each content area.

CONTENT

The mathematical content in Grade 6 builds on what was learned in Grade 5. Previous content is covered in greater depth with wider applications. New topics are added in some areas.

Number Concepts

Students work with numbers up to 1 000 000. In number sense, they work with factors and multiples, as well as improper fractions and mixed numbers. The number system is expanded to include integers with negative numbers.

Number Operations

This topic includes addition, subtraction, multiplication, and division with whole numbers, fractions, and decimals. Concepts of ratio, rate, and percent are included. The order of operations is also introduced at this grade level.

Financial Literacy

In this chapter**,** money transactions, financial goals, and percent applications, including discounts, are introduced. There is a focus on how these concepts are applied in everyday life.

Variables, Equations, and Inequalities

Work in this area includes applications of patterns in tables and charts. Variables, equations, and inequalities are introduced, and a problem-solving approach is used.

Measurement

This chapter includes perimeter, area, measuring angles, triangles, and capacity.

Geometric and Spatial Sense

Students will work with triangles, polygons, 3-dimensional solids, and transformations of shapes in this chapter.

Data and Probability

The chapter provides an introduction to samples and populations, and includes ways of displaying and interpreting data. It includes applications of probability in business and everyday life through the use of experimental and theoretical 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 in the chapter. Each chapter ends with a chapter test. Answers to all exercises and chapter tests are provided.

SOCIAL EMOTIONAL LEARNING

Social emotional skills (SES) are important when working with mathematics. Using these skills help you to think about how to solve problems. These skills are enhanced by developing problem-solving skills and selecting the best tools and strategies to approach a problem.

Chapter 9 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 the process of expressing mathematical ideas and understandings orally, visually, and in writing. This is done by using numbers, symbols, pictures, graphs, diagrams, and words. It is important that you are able to **communicate** to express, describe, explain, and apply mathematical ideas in several different ways. Using this as a tool should help you in describing, creating, and interpreting relationships.

Representing

We **represent** mathematical relationships with the use of drawings, physical models, equations, charts, and graphs. Being able to represent mathematical ideas in different ways and making connections among them to solve problems are important skills.

Connecting and Relating

Connecting involves **relating** mathematical concepts to each other. It also involves making mathematical connections to the real world.

Reasoning and Proving

The ability to understand the relationships that apply to numbers, shapes, or operations is called mathematical **reasoning**. Steps involved in this process include defining the relationship, analyzing why it is true, and determining if it can be applied to numbers, shapes, or operations.

CODING

Learning how computers follow instructions is an important part of **coding** in mathematics. It involves writing a set of instructions that a computer understands. Chapter 10 will help to strengthen the coding knowledge that students already have. It will build on the use of control structures to simplify code.

CHAPTER 1
NUMBER CONCEPTS

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

1.1 Place Value

Numbers up to 1 000 000

When numbers are written with digits, they are called numerals (320 000). When we read these numbers using words, they are called number words (three hundred twenty thousand).

To gain a better understanding of numbers, it is important to know what the value of each digit is. We do this with place value, which you have used.

Example: The number **538 094** is shown with the place value for each of its digits.

5	**3**	**8**	**0**	**9**	**4**
↑	↑	↑	↑	↑	↑
hundred thousands	ten thousands	thousands	hundreds	tens	ones
five hundred thirty-eight thousand			zero hundreds	ninety-four	

The above numeral (number) has 5 hundred thousands, 3 ten thousands, 8 thousands, 0 hundreds, 9 tens, and 4 ones. When we describe the numeral with a number word, we usually combine the thousands, and the tens and ones. The **number word** is five hundred thirty-eight thousand ninety-four.

Examples with Solutions

1. Which digit is located in each of the following place-values for the numeral **729 438**?

a. hundred thousands	7, which represents 7 hundred thousand.
b. ten thousands	2, which represents 20 thousand.
c. thousands	9, which represents 9 thousand.
d. hundreds	4, which represents 4 hundreds.
e. tens	3, which represents 3 tens.
f. ones	8, which represents 8 ones.

2. Write number words for the following numerals.

a. 235 608

235 608
There are 235 thousands (2 hundred thousands, 3 ten thousands, and 5 one thousands), 6 hundreds, and 8 ones. The number word is two hundred thirty-five thousand six hundred eight.

b. 365 240

365 240
There are 365 thousands (3 hundred thousands, 6 ten thousands, and 5 one thousands), two hundreds, and 4 tens (or forty). The number word is three hundred sixty-five thousand two hundred forty.

c. 560 032

560 032
There are 560 thousands, 3 tens and 2 ones (or thirty-two). The number word is five hundred sixty thousand thirty-two.

3. Write the following number words as numerals.

a. eight hundred thirty thousand eight hundred forty-seven	830 847
b. seventy thousand fifteen	70 015
c. one hundred twenty thousand two hundred six	120 206
d. seven hundred five thousand thirty-four	705 034

When we write numbers with more than 4 digits, we use a space instead of a comma to separate groups of three. This is done because Canada has adopted the metric system and in many other countries a comma is used as a decimal point.

Examples:

1. 27 500 instead of 27,500
2. 345 420 instead of 345,420
3. 3540 instead of 3,540 (We don't leave a space if there are only 4 digits.)

Exercises 1.1a

1. What is the value of the digit asked for in each of the following numbers?

a. 405 632 digit 6

b. 140 670 digit 7

c. 840 035 digit 8

d. 302 670 digit 2

e. 86 075 digit 8

2. Write the numeral for each number word.

a. three hundred ten thousand thirty

b. five hundred three thousand four hundred twenty-one

c. seventy thousand seventy

d. five hundred thousand five

e. six thousand six

f. forty thousand fifteen

g. twenty thousand three hundred

h. one hundred thousand one hundred one

3. Write the number word for each numeral.

a. 506 320

b. 35 028

c. 60 060

d. 505 055

e. 10 001

f. 33

g. 1001

h. 77 007

4. The distance from the earth to the moon is about 384 403 km. Write this numeral as a number word.

5. A provincial park has about two hundred twenty-three thousand six hundred trees in it. Write this number word as a numeral.

Exciting Extras

Who Am I?

6. I am a number with 6 digits. My ones digit is 6 and my tens digit is one less. My other four digits are all one less than my tens digit.

7. I have 6 digits. All of my digits are the same and their sum is 12.

8. I have 6 digits. Both my hundred-thousands digit and my ones digit are equal to 5. Each of the digits in between are two less than five.

9. I have six digits, each of which is equal. My digits sum to 18.

10. I am greater than one hundred thousand but less than one hundred thousand one hundred. I have a total of six digits and all of them are either zeros or ones. My digits sum to 2. What possible numbers am I?

11. I have 6 digits. My hundred-thousands digit is 3 and all other digits to the right of it are one more than the digit on its left. What number am I?

12. There are five digits in my number. The first and the last are 1. The second is twice the sum of the first and last, the third is half the second and the fourth is one more than the third. What number am I?

Working with Thousandths

The Decimal Point

In our decimal system of numbers, digits can be placed to the left or to the right of a **decimal point**. Numbers to the left are equal to or greater than one, and numbers to the right are less than one.

Place Value and the Decimal Point

To the **right** of the ones column is a decimal point, followed by the columns corresponding to place values of tenths, hundredths, and thousandths.

Example: The number 725.135 is shown with the place value for each of its digits below.

7	**2**	**5**	**.**	**1**	**3**	**5**
↑	↑	↑	↑	↑	↑	↑
hundreds	tens	ones	decimal point	tenths	hundredths	thousandths
seven hundred	twenty-five		and	one hundred thirty-five thousandths		

The above **numeral** (number) has 7 hundreds, 2 tens, 5 ones, 1 tenth, 3 hundredths, and 5 thousandths. The **number word** is seven hundred twenty-five **and** one hundred thirty-five thousandths.

Writing Decimal Numerals and Decimal Number Words

We use the word "**and**" to represent the decimal point.

Example: Write each of the following numerals as a number word.

Numeral	Number word
7.9	seven **and** nine tenths
81.04	eighty-one **and** four hundredths
357.019	three hundred fifty-seven **and** nineteen thousandths
105.21	one hundred five **and** twenty-one hundredths
261.011	two hundred sixty-one **and** eleven thousandths
500.007	five hundred **and** seven thousandths
205 000.04	two hundred five thousand **and** four hundredths

Examples with Solutions

1. Which digit is located in each of the following place values for the numeral **3005.267**?

a. thousands 3, which represents 3 thousands.

b. hundreds	0, which represents zero hundreds.
c. tens	0, which represents zero tens.
d. ones	5, which represents 5 ones.
e. tenths	2, which represents 2 tenths.
f. hundredths	6, which represents 6 hundredths.
g. thousandths	7, which represents 7 thousandths.

2. Write number words for the following numerals.

a. 30.501	30.501 The number is thirty and five hundred one thousandths.
b. 9.05	9.05 The number is nine and five hundredths.
c. 1033.054	1033.054 The number is one thousand thirty-three and fifty-four thousandths.
d. 23 006.03	23 006.03 The number is twenty-three thousand six and three hundredths.

Exercises 1.1b

1. What is the value of each of the following digits in the number **23.468?**

   a. 2

   b. 4

   c. 6

   d. 8

   e. 3

2. Write each of the following numerals as number words.

   a. 25.015

   b. 250.006

c. 45.111

d. 2300.508

e. 250.013

f. 3030.03

g. 1003.003

h. 7000.077

i. 205 000.29

j. 310 005.6

3. Write each of the following number words as numerals.

a. three hundred fifty and twenty-nine thousandths

b. forty-five and forty-five thousandths

c. two hundred five and two hundredths

d. seven thousand five hundred and seventy-five thousandths

e. one hundred thousand ten and one tenth

f. six hundred thousand six and six hundredths

g. one hundred thousand one hundred one
and one hundredth

Exciting Extras

4. Find each of the following numbers based on their descriptions.

a. My thousandths digit is 8. My hundredths digit is half my thousandths, my tenths digit is half my hundredths, and my ones digit is half my tenths digit. I have four digits altogether. Who am I?

b. I have 4 digits altogether. My thousandths digit is the same as my tenths and my ones digits. My hundredths digit is zero. All of my digits sum up to twenty-one. Who am I?

c. I have a total of 5 digits. My ones digit is 3. My tens digit, which is one more than my ones, is twice my tenths digit. My hundreds digit, which is two more than my tens digit, is six times my hundredths digit. Who am I?

1.2 Rounding Numbers

Estimating Answers

Estimation is used in many situations where we don't need an exact answer. For example, we may want to estimate how much money to bring to the grocery store in order to buy groceries, how much lawn seed is needed for a lawn, or how much paint is needed to paint the house.

Rounding Numbers

It is often helpful to **round** numbers before we estimate. For example, if we estimate how much the groceries in our grocery cart will cost, we may want to round each item to the nearest dollar first and then find the sum.

Rules for Rounding

Rounding involves place value. Use the following steps to round numbers.

1. Go to the column immediately to the right of the digit in the location of the place value asked for.
2. Round up if that digit is 5 or greater (5 to 9) or leave it the same if it is less than 5 (0 to 4).
3. Replace digits to the right of the place value asked for with zero.

Example: Round 234.637 to

hundreds	tens	ones	decimal	tenths	hundredths	thousandths
3	8	2	.	6	3	7

	Process	Answer
a. the nearest ten	Go to the ones column. It is 4, so leave the tens digit the same and replace digits to the right with zero.	230.000 or 230
b. the nearest one	Go to the tenths column. It is 6, so round the ones digit up to 5 and replace digits to the right with zero.	235.000 or 235
c. the nearest tenth	Go to the hundredths column. It is 3, so leave the tenth digit the same and replace digits to the right with zero.	234.600 or 234.6
d. the nearest hundredth	Go to the thousandths column. It is 7, so round the hundredths column up to 4 and replace digits to the right with zero.	234.640 or 234.64

Examples with Solutions

1. Round 353.681 as follows:

a. to the nearest one	Go to the tenths column (it is 6). Round the ones column up to 4. The answer becomes 354.
b. to the nearest tenth	Go to the hundredths column (it is 8). Round the tenths column up to 7. The answer becomes 353.7.
c. to the nearest hundredth	Go to the thousandths column (it is 1). Leave the hundredths the same and replace digits to the right with zero. The answer becomes 353.680 or 353.68.

2. Round 709.163 as follows:

a. to the nearest one	Go to the tenths column (it is 1). Leave the ones the same and replace digits to the right with zero. The answer becomes 709.000 or 709.
b. to the nearest tenth	Go to the hundredths column (it is 6). Round the tenths column up to 2. The answer becomes 709.2.
c. to the nearest hundredth	Go to the thousandths column (it is 3). Leave the hundredths the same and replace digits to the right with zero. The answer becomes 709.160 or 709.16.

Exercises 1.2

1. Round 53.458 as follows

a. to the nearest one

b. to the nearest tenth

c. to the nearest hundredth

CHAPTER 10
CODING

Coding at the Grade 6 Level

In Grade 6, we continue to build on your knowledge of coding while focussing on creating efficient code.

The examples and exercises in this chapter will rely on your knowledge of topics that we explored in previous chapters. We recommend that you complete those chapters before doing this chapter on coding.

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)

10.1 The Structure of Coding

Do you know what a recipe book and video game have in common? They are both made up of algorithms. An **algorithm** is a set of instructions that will produce a specific result. The recipe to make chocolate chip cookies is an algorithm, as are the many lines of instructions that make up a video game. The only difference is that the recipe is written in language that people can easily understand. The algorithms that make up a video game are written in a very specific computer language called **code**.

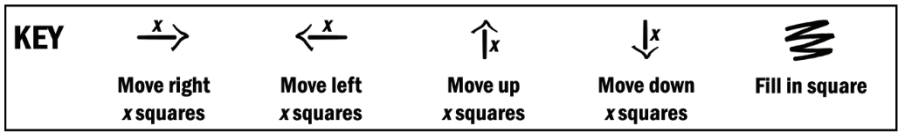
When we are **coding**, we are writing a set of instructions that a computer can understand. We need to be very specific in our instructions because a computer can't think for itself. Whatever you tell a computer to do, it will do it exactly as it is written.

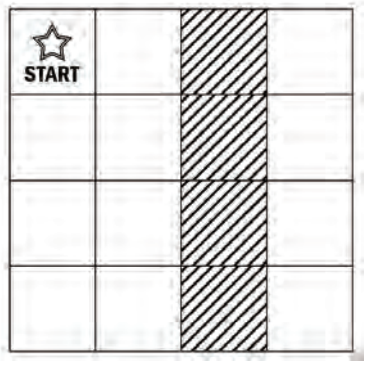
Computer programs are everywhere. They are in the smallest of microchips and the largest of supercomputers. They are in your electric toothbrush, your fridge, your headphones, and many other items you use on a daily basis. Regardless of whether it is a simple algorithm or a complex network of algorithms, they all need to be as efficient as possible.

We create efficient programs by simplifying the code by removing unnecessary extra steps, and by using control structures such as loops and conditional statements to reduce the amount of code the computer needs to process.

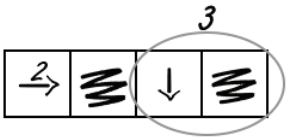
The goal is to create the most efficient code, but don't let this get in the way of your creativity. You can always go back over your code and look for areas where you can simplify the code to make it more efficient.

Example: Can you create an algorithm that produces the pattern below using only four symbols? You can place 1 symbol in each box. To create a loop, circle the boxes and state the number of times to repeat them.





Solution:



ANSWERS TO EXERCISES AND CHAPTER TESTS

CHAPTER 1

Exercises 1.1a (page 3)
1. a) 600 **b)** 70 **c)** 800 000 **d)** 2000 **e)** 80 000 **2. a)** 310 030 **b)** 503 421 **c)** 70 070 **d)** 500 005 **e)** 6006 **f)** 40 015 **g)** 20 300 **h)** 100 101 **3. a)** five hundred six thousand three hundred twenty **b)** thirty-five thousand twenty-eight **c)** sixty thousand sixty **d)** five hundred five thousand fifty-five **e)** ten thousand one **f)** thirty-three **g)** one thousand one **h)** seventy-seven thousand seven **4.** three hundred eighty-four thousand four hundred three **5.** 223 600 **6.** 444 456 **7.** 222 222 **8.** 533 335 **9.** 333 333 **10.** 100 010 or 100 001 **11.** 345 678 **12.** 14 231

Exercises 1.1b (page 8)
1. a) 20 **b)** $\frac{4}{10}$ or 0.4 **c)** $\frac{6}{100}$ or 0.06 **d)** $\frac{8}{1000}$ or 0.008 **e)** 3 **2. a)** twenty-five and fifteen thousandths **b)** two hundred fifty and six thousandths **c)** forty-five and one hundred eleven thousandths **d)** two thousand three hundred and five hundred eight thousandths **e)** two hundred fifty and thirteen thousandths **f)** three thousand thirty and three hundredths **g)** one thousand three and three thousandths **h)** seven thousand and seventy-seven thousandths **i)** two hundred five thousand and twenty-nine hundredths **j)** three hundred ten thousand five and six tenths **3. a)** 350.029 **b)** 45.045 **c)** 205.02 **d)** 7500.075 **e)** 100 010.1 **f)** 600 006.06 **g)** 100 101.01 **4. a)** 1.248 **b)** 7.707 **c)** 643.21

Exercises 1.2 (page 12)
1. a) 53 **b)** 53.5 **c)** 53.46 **2. a)** 600 **b)** 610 **c)** 607 **d)** 607.1 **e)** 607.05 **3.** 130 **4.** 1900 **5.** $123.30 **6.** 35.81 **7.** 5, 6, 7, 8 or 9 **8.** 0, 1, 2, 3 or 4 **9.** 5, 6, 7, 8 or 9 **10.** 0, 1, 2, 3 or 4

Exercises 1.3 (page 15)
1. 3000 **2.** $40 000 **3.** 89 000 **4.** 960 000 **5.** About 721 000 **6.** $426 000

Exercises 1.4 (page 22)
1. a) 5, 71 **b)** 7, 29 **c)** 3, 73 **d)** 11, 31 **e)** 13, 23, 43, 53 **f)** 5 **2. a)** 1, 2, 4, 5, 8, 10, 20, 40; 2, 5 **b)** 1, 5, 11, 55; 5, 11 **c)** 1, 2, 5, 7, 10, 14, 35, 70; 2, 5, 7 **d)** 1, 2, 4, 5, 10, 20, 25, 50, 100; 2, 5 **e)** 1, 3, 5, 15, 25, 75; 3, 5 **3. a)** 40 = 2 × 2 × 2 × 5 **b)** 55 = 5 × 11 **c)** 70 = 2 × 5 × 7 **d)** 100 = 2 × 2 × 5 × 5 **e)** 75 = 3 × 5 × 5 **4.** a) and c) show multiples of the first number. All of the numbers in the pattern are evenly divisible by the first number. **5. a)** 36, 42, 48; The numbers are multiples of 6. **b)** 42, 49, 56; The numbers are multiples of 7. **6. a)** prime **b)** composite **c)** prime **d)** composite **e)** composite **f)** composite **7.** 2, 3, 5, 7, 11, 13, 17, 19 **8. a)** 1, 5, 25 **b)** 1, 3 **9. a)** 35, 70 **b)** 24, 48, 72, 96 **10.** 1, 2, 4 **11.** 1, 6 **12.** 30, 60, 90 **13.** 2 **14.** 66, 72, 78, 84, 90, 96 **15.** 210

Exercises 1.5 (page 27)
1. GCF = 4, LCM = 224 **2.** GCF = 4, LCM = 240 **3.** LCM = 60 **4.** GCF = 14 **5.** GCF = 15, LCM = 1050 **6.** GCF = 3, LCM = 420 **7.** 60 minutes **8.** 35 or 105 **9.** 7 **10.** 5 **11.** 10, 20, 40 **12.** 15 and 30 **13. a)** 9:00 am **b)** Bus A will have completed 3 trips. **c)** Bus B will have completed 2 trips.

Exercises 1.6 (page 31)
1. a) proper **b)** improper **c)** proper **d)** improper **e)** improper **f)** proper **g)** improper **h)** proper **i)** improper **j)** proper **k)** improper **l)** improper **m)** improper **n)** proper **2. a)** $\frac{5}{2}$ **b)** $\frac{11}{3}$ **c)** $\frac{41}{8}$ **d)** $\frac{21}{5}$ **e)** $\frac{101}{10}$ **f)** $\frac{101}{5}$ **g)** $\frac{33}{5}$ **h)** $\frac{103}{20}$ **i)** $\frac{1003}{10}$ **j)** $\frac{85}{4}$ **k)** $\frac{63}{4}$ **l)** $\frac{69}{8}$ **m)** $\frac{12}{11}$ **n)** $\frac{601}{20}$ **3. a)** $1\frac{1}{3}$ **b)** $1\frac{2}{3}$ **c)** $1\frac{1}{8}$ **d)** $1\frac{4}{7}$ **e)** $1\frac{2}{7}$ **f)** $4\frac{1}{2}$ **g)** $2\frac{1}{3}$ **h)** $4\frac{1}{3}$ **i)** $2\frac{2}{3}$ **j)** $3\frac{1}{10}$ k) $3\frac{1}{7}$ **l)** $2\frac{3}{13}$ **m)** $5\frac{5}{9}$ **n)** $1\frac{1}{999}$ **4.** $\frac{8}{6}$ or $\frac{9}{7}$ **5.** $\frac{5}{2}, \frac{7}{4}, \frac{8}{5}, \frac{9}{6}$ **6.** $1\frac{1}{2}$ **7.** $3\frac{1}{4}$ **8.** $7\frac{3}{4}$

Special Project (page 34)
1. $\frac{7}{8}$ **2.** $\frac{1}{15}$ **3.** $\frac{15}{2}$ **4.** $\frac{8}{7}$ **5.** $15\frac{7}{8}$ **6.** $1\frac{2}{15}$