Number Concepts
Grade 4

**Western and Northern Canadian
Protocol (WNCP) Edition**

hands-on
mathematics
Grade 4

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Printed and bound in Canada by Prolific Group

ISBN 978-1-55379-144-7

Contents

Introduction

At the grade-four level, the focus of the number concepts module is on number manipulation as well as place-value recognition for numbers to 10 000. Lessons in this module engage students in hands-on activities building groups or sets of items to 10 000. Students also learn to differentiate between the place value and the face value of a digit.

Students are presented with various opportunities to compare and order whole and rational numbers (fractions and decimals), expressing numbers in both standard and expanded notation. They also perform activities that lead to an understanding of *numerator* and *denominator* as well as the importance of one-half—a benchmark fraction that will help students build understanding of other fractions such as one-third, one-fourth, and so on.

Most of the lessons in this module involve numerous steps and should be completed over the course of several days. Lessons provide opportunities for students of all aptitudes to contribute and to be challenged, including multiple points of entry to engage all learners.

The opportunity to reflect on what they are learning, to record their experiences, and to communicate their understanding through writing are all important components of learning for students. A math journal is an excellent medium for this type of learning.

Depending on your students' writing skills, also consider having them begin mathematics logbooks or journals for recording

- new math vocabulary
- strategies
- reflections about their learning

Note that there are two acceptable methods of writing a four-digit numeral: either with a space between the hundreds digit and the thousands digit (1 234) or with no space (1234).

The International System of Units (SI) does *not* use commas. For a numeral with five or more digits, a space *must* be placed between the thousands digit and the hundreds digit (12 345; not 12345 or 12,345). When reading a numeral over 100 (for example, 112), the word *and* is not used; it is correct to say "one hundred twelve," *not* "one hundred *and* twelve." The word *and* should be used only with reference to decimals.

Note: Lessons related to the addition and subtraction of decimals are found in the Number Operations module of ***Hands-On Mathematics Grade 4***.

Mathematics Vocabulary

In ***Hands-On Mathematics*** books, we use the term *number* to signify an amount or a quantity of things; how many of an item there are. We use the term *numeral* to signify a symbol (or group of symbols) that represents a number. That is, a numeral is a written representation of a number. A *digit* is simply a single numeral, namely: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 (the term *digit* can also be used to modify *number*, as in three-digit number). For example: Claire told Angie that her favourite number is twelve. Pointing to the numeral 12 she had recorded, she added, "The numeral 12 is made up of two digits: a 1 and a 2."

Continue to use your classroom math word wall to display new vocabulary as it is introduced. Throughout this module, teachers should use, and encourage students to use, vocabulary such as:

- **Numeral**: a symbol (or group of symbols) that represents a number. Numerals differ from numbers in the same way that words differ from the things to which they refer. The symbols "11," "eleven," and "XI" are all numerals representing the number that is one less than a dozen.

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- **Digit**: a single numeral. The numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are all digits. The numeral 217 is made up of three digits: 2, 1, and 7.

- **Digital root**: the sum of all the digits of a whole number, continuing with the addition until there is only one digit remaining. For example, the digital root of 15 is 6 (1 + 5 = 6); the digital root of 457 is 7 (4 + 5 + 7 = 16; 1 + 6 = 7); the digital root of 39 is 3 (3 + 9 = 12; 1 + 2 = 3).

- **Digit value**: the value of a digit, which is determined by the place it holds. For example, in the number 2 174, the 2 is in the thousands place and thus has a *digit value* of 2 000; the 1 is in the hundreds place and has a *digit value* of 100; the 7 is in the tens place and has a *digit value* of 70; and the 4 is in the ones place and has a *digit value* of 4.

- **Place value**: a digit's *place value* is determined by its location within a number. For example, in the number 2 174, the 2 is in the *thousands place* so its place value is *thousands*; the 1 is in the *hundreds place* so its place value is *hundreds*; the 7 is in the *tens place* so its place value is *tens*; and the 4 is in the *ones place* so its place value is *ones*.

- **Additive identity**: a number's *additive identity* is the sum of that number and zero, which equals the number. For example, 2 174 + 0 = 2 174.

- **Multiplicative identity**: a number's *multiplicative identity* is the product of any number multiplied by zero, which equals zero. For example, 2 174 x 0 = 0.

- **Standard notation/form**: the way of representing a number that we see on a daily basis. For example, in *standard notation*, the number two thousand, one hundred, seventy-four is 2 174.

- **Expanded notation/form**: the way of representing a number whereby it is written as the sum of two or more parts. For example, in *expanded notation*, the number two thousand, one hundred, seventy-four is 2 000 + 100 + 70 + 4.

- **Fractions**: numbers that represent parts of a whole. A fraction can be represented either as a region or as a group or set, as in the following diagrams:
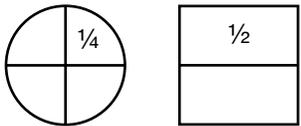

group or set
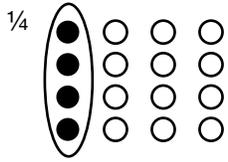
- **Denominator**: the numeral that is below the line in a fraction.

- **Numerator**: the numeral that is above the line in a fraction.

- **Decimal**: a number that represents a fractional amount and is written using place value. For example, 0.1 (read as zero and one tenth); 2.13 (read as two and thirteen hundredths).

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■ **Empty number line**: a number line that has no calibrated markings or numbered measures on it, and does not require the same spatial distance between jumps and marks as a standard number line does, as in the following diagram:

25 + 34
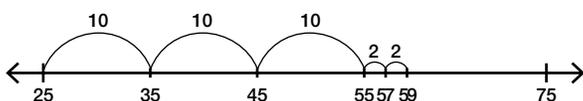
Use, and encourage students to use, this vocabulary both orally and in writing, and continue to review all vocabulary previously introduced.

A mathematics word wall for displaying new vocabulary is a valuable reference for students. Dedicate a classroom bulletin board to your math word wall, and display the letters of the alphabet along the top. Use index cards to record math vocabulary introduced in each lesson, attaching these to the board under the appropriate letter. Encourage students to refer to the math word wall during classroom activities and assignments.

1 | Introducing Thousands

Background Information for Teachers

This lesson uses concrete and pictorial representations to introduce students to the concept of *thousands*. In this lesson, the following terms are used when working with Dienes blocks (or pictorial representations of them):

■ *Unit cube*: the smallest unit, representing one
■ *Ten rod*: a ten-unit rod that represents ten
■ *Hundred flat*: a hundred-unit piece that represents one hundred
■ *Thousand block*: a thousand unit block that represents one thousand

It is also appropriate to refer to the place value of the block(s) only, using the terms *ones*, *tens*, *hundreds*, and *thousands*, without using the terms *units* or *cubes*, *rods*, *flats*, or *blocks*.

With Digi-Blocks, the terms *single (one), block-of-ten, 100-block*, and *1 000-block* are used.

Materials

■ place-value manipulatives such as Dienes blocks or Digi-Blocks (one set for each working group of students)
■ chart paper
■ markers
■ centimetre graph paper (included. Make several copies for each student.) (4.1.1)
■ glue
■ tagboard
■ scissors
■ small, resealable sandwich bags
■ paper clips

Activity: Part One

Divide the class into working groups of students, and provide each group with a set of place value manipulatives. Have students identify the blocks that represent a one, a ten, and a hundred. For example, with Diene's blocks, have students identify the *unit*, the *rod*, and the *flat*. Ask:

■ How many units make up a ten rod? (ten)
■ How many rods make up a hundred flat? (ten)

Now, have students identify the thousand cube. Ask:

■ How many flats make up a thousand cube? (ten)

Have each group stack ten flats to show that they are equal to one thousand. Ask:

■ How many rods (or tens) are in a thousand cube? (100)
■ How many units are in a thousand cube? (1 000)

On chart paper, record various four-digit numbers, and have the groups use their place-value manipulatives to build the numbers.

Assessment for Learning

Observe as students construct numbers with the manipulatives. Look specifically for their ability to identify place value. It is essential that students have a solid foundation in this concept in order to master subsequent related skills.

Distribute Activity Sheet A (4.1.2), and have students record the numbers for each picture and then answer the questions.

Activity Sheet A

Directions to students:

Record the numbers for each picture, and then answer the questions (4.1.2).

Activity: Part Two

Distribute, to each student, pieces of centimetre graph paper (4.1.1), a piece of chart paper, scissors, and glue. Also have sets of Dienes

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blocks available for students to trace. Have students use the graph paper to construct their own place-value manipulatives. Tell students to trace, onto centimetre graph paper, and cut out:

- ten 1-centimetre units
- ten rods (each one 10 centimetres in length)
- ten flats (10 x 10 centimetre grids)
- ten additional flats (have students glue these onto chart paper in a 5 by 2 grid of flats to provide representation for one thousand)

Then, distribute tagboard to students, and have them mount all their place-value pieces onto the tagboard and cut them out again. Each student can keep the smaller pieces in a sealed, plastic bag that is paper clipped to the thousand piece, for use throughout the module for building numbers.

Note: These manipulatives will also be useful to students with the Number Operations module as they add, subtract, multiply, and divide with larger numbers.

Problem Solving

- How many different ways can you use concrete materials to show the number 1 000?

- How many different ways can you use pictures or diagrams to show the number 1 000?

- How many different addition number sentences can you make with a sum of 1 000?

Create a chart to record your answers.

Note: Reproducible masters for these problems can be found on page 283.

Activity Centre

Place base ten cards (included in the ***Hands-On Mathematics*** *Mental Math Activities* module), a number cube, a small white board, and an erasable marker at an activity centre. Have students use the base ten cards to construct numbers from 100 to 10 000. Tell students to begin by rolling the number cube four times to determine the four digits of a number and then record these digits on the white board. Then, ask them to use the base ten cards to build the number. Students can work in groups or pairs, with one student rolling the number cube and another student building the number.

Note: It may also help students to use concrete place value manipulatives such as Dienes blocks or Digi-Blocks to complete this activity.

Extension

- Extend the preceding problem solving questions by replacing the number 1 000 with 2 000, 3 000, and so on.

- Challenge students to organize several classroom activities related to the question. How much is 1 000? For example, have the class read 1 000 books, collect 1 000 pennies for charity, display 1 000 photographs of Canada, and so on.
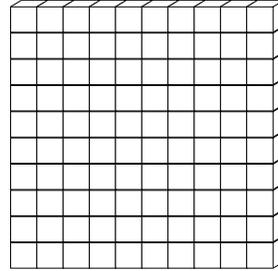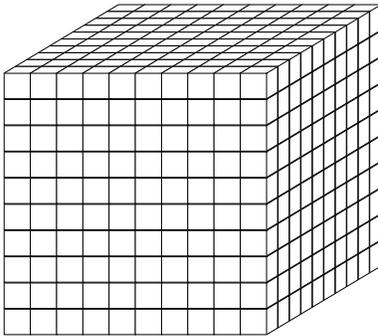
Centimetre Graph Paper

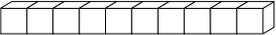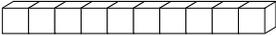**Date:** _____   **Name:** _____

How Many?

1.

_____

2.

_____

3.

_____

4.

_____

Date: _____   **Name:** _____
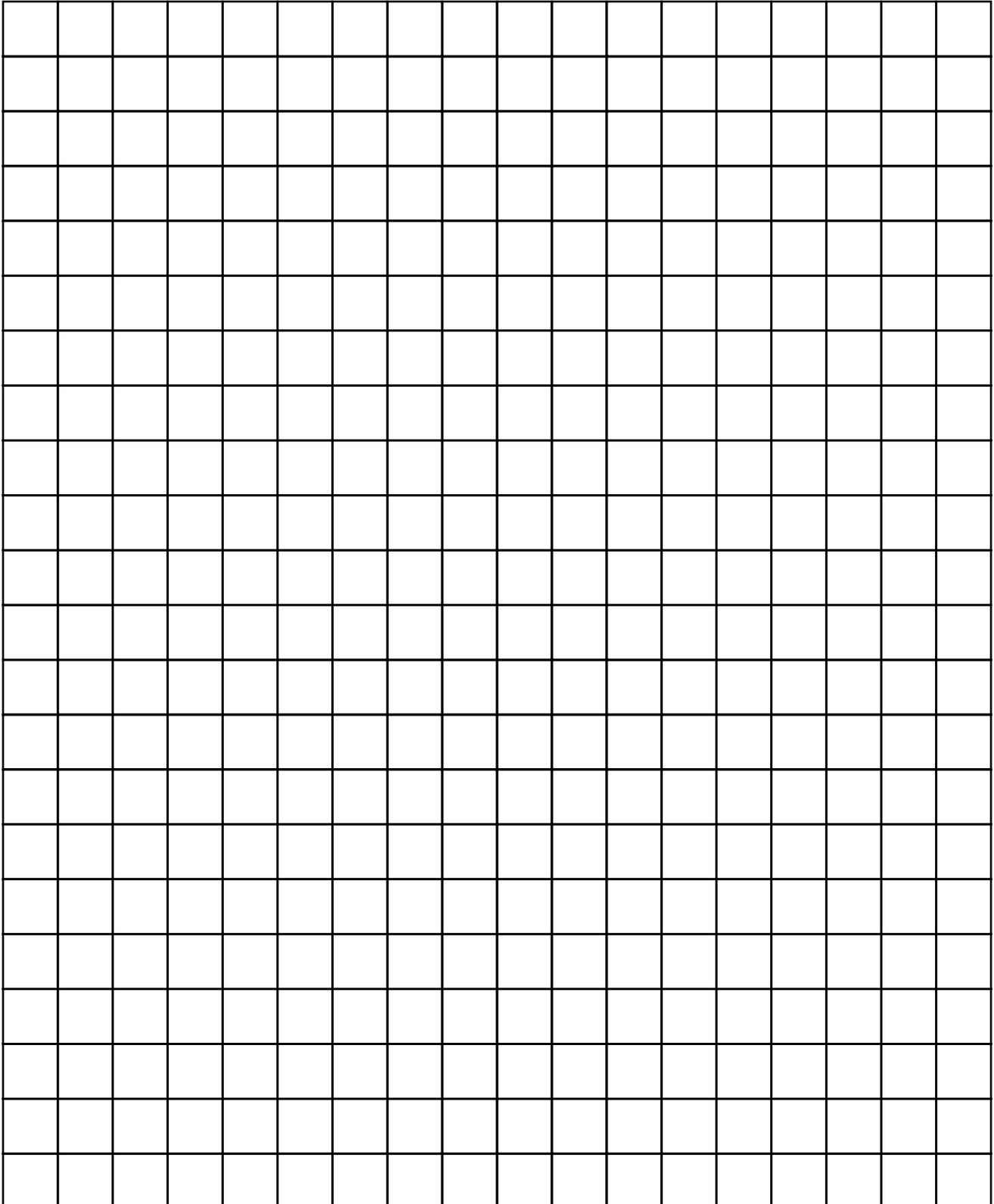
5. How many ▢ in ▱▱▱▱▱▱▱▱▱ ? _____

6. How many ▱▱▱▱▱▱▱▱▱ in [grid] ? _____
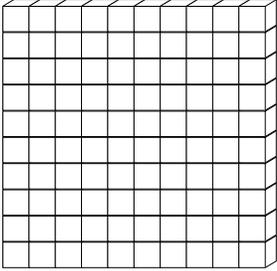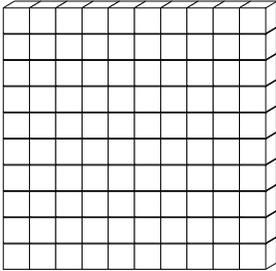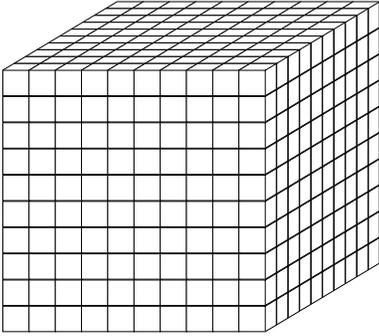
7. How many [flat] in [cube] ?_____

8. How many tens in one thousand? _____

9. How many ones in one thousand? _____