# The Number Strand: Outcome N4.1

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| **Outcome** | **Indicators** |
| N4.1 Demonstrate an understanding of whole numbers to 10 000 (pictorially, physically, symbolically) by:* representing
* describing
* comparing two numbers
* ordering three or more numbers.

[C, R, V]*In support of the K-12 Mathematics goals of Number Sense, Logical Thinking and Mathematical Attitude.* | 1. Read a four digit numeral without using the word “and” (e.g., 5321 is five thousand three hundred twenty one, NOT five thousand three hundred AND twenty one).
2. Write a numeral using proper spacing without commas (e.g., 4567 or 4 567, 10 000).
3. Write a numeral (0 - 10 000) in words.
4. Represent a numeral using a place value chart or diagrams.
5. Explain the meaning of each digit in a numeral.
6. Express a numeral in expanded notation (e.g., 321 = 300 + 20 + 1).
7. Write the numeral represented by an expanded notation expression.
8. Explain and show the meaning of each digit in a given 4-digit numeral with all digits the same (e.g., for the numeral 2222, the first digit represents two thousands, the second digit two hundreds, the third digit two tens, and the fourth digit two ones).
9. Explain the meaning of each digit in a 4-digit number representing a particular quantity.
10. Order a set of numbers in ascending or descending order, and explain the order by making references to place value.
11. Create and order three different 4-digit numerals.
12. Identify the missing numbers in an ordered sequence or on a number line.
13. Identify incorrectly placed numbers in an ordered sequence or on a number line.
14. Decompose and represent a 4-digit number at least three different ways.
15. Explain why two or more number compositions represent the same quantity.
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| **Learning Space:** |
| This outcome is a natural progression from the grade 3 study of whole numbers to 1000. By grade 4, the students should be well into understanding the patterning of the place value system from numbers. Emphasis in their learning activities should be on making sense of numbers and their composition and decomposition based upon the place value of each of the digits in a given whole number. It is important that this learning take place through a variety of representation strategies – visual images, physical movement (such as total number of steps in physical education), drama and literature explorations of number, quantity and place value as well as in symbolic numerals and expanded forms. As a strong foundation of understanding for addition of whole numbers, students should be encouraged to “play” with the decomposition of a number according to place value and to look for patterns that result. For example, a student might write 2314 as 2 x 1000 + 3 x 100 + 1 x 10 + 4 and then use their understanding of place value to come up with a variety of different representations: e.g., 1x 1000 + 3 x 100 + 101 x10 + 4. Discussion and sharing of strategies is key to this learning process. Students need to be challenged to describe their thinking, and to reflect upon the thinking of others in order to internalize and deepen their understanding of whole numbers and the base ten number system.By considering numbers up to 10 000, there are many possibilities to integrate and show connections with other subject areas. For example, in social studies students might consider different populations of rural communities and analyze trends within those populations.Much of the students’ learnings about whole numbers to 10 000 will occur as they engage in rich learning experiences related to adding and subtracting of these numbers, as well as analyzing and graphing data including a large range of whole numbers. Assessment of student achievement for this outcome should occur throughout the year as they experience new contexts and interpretations for the larger numbers. |
| **What Students Should…**  [**Top**](#top) |
| **Know*** the place value position names up to 10 000 in increasing and decreasing order (10 000 is new)
* the word AND is not used when saying or writing a whole number
* commas are not used in recording whole numbers in Canada.
 | **Understand*** positioning of a number on a number line is related to the quantity the number relates to
* each digit in a number contributes a different amount to the total quantity represented by the entire number
* different compositions for the same number (or decompositions of the same number) can be created by applying knowledge of place value
* whole numbers to 10 000 have many connections both within mathematics and in other areas of life.
 | **Be Able to Do*** express a quantity in words, as a numeral, and in expanded form
* change representations of a quantity among words, digits, and expanded form
* express each digit in a whole number as a particular quantity based upon the place value of that digit
* compare and order whole numbers, representing them as symbols or on a number line
* create larger and/or smaller numbers to a given number by changing the order of the digits
* create and verify alternate decompositions for a given number.
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| **Key Questions:**  [**Top**](#top) |
| * Why is place value important?
* What is the relationship between place value and size or quantity represented by a number?
* How can you use place value to decompose a number in different ways?
* Why can you write the equal sign between two different decompositions for the same number? What does it mean for a number to be larger or smaller than another number?
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| **Suggestions for assessment**  [**Top**](#top) |
| **Big Idea:**Composing and decomposing whole numbers.* *Note: because of the large size of the numbers, concrete representations using base ten materials and similar manipulatives should be limited.*

**Suggestions of assessment tasks:**1. Students could be asked to create different representations of a given whole number.
	1. Represent 3024 in three different ways and explain why they show the same quantity.
	2. Represent 5555 and explain what that representation tells you about each digit in the number.
2. Students could be given a representation of a whole number and be asked to identify the number represented, or to create alternative representations.
	1. What whole number does 3x 100 + 8 x 1 represent? How do you know? How else could you represent this number?
	2. Where might you use the number 9000 and how would it be represented?

**What to look for:*** [*Decomposition and Composition of Whole Numbers* Rubric](http://curriculum.nesd.ca/files/u7/Decomp%20Comp%20of%20Whole%20Numbers%20Rubric.doc)

**Big Idea:**Saying and writing whole numbers.* *Note: this big idea is directly connected to the students understanding of place value. It cannot be assessed or taught in isolation from that idea.*

**Suggestions of assessment tasks:**1. Assess this during activities related to place value and the composition and decomposition of whole numbers. The assessments can be done orally, through recordings, peer activities, homework activities, and in writing.
2. As a homework activity, have the students record five numbers between 1000 and 10 000 that they read or hear over the weekend as numerals, record the context the number was in, and write the number in words. Students can also be asked to say the numbers to their parents, and have the parents observe whether the student avoid using the word “and”.
3. As a homework activity, have the students keep a journal entry of places and contexts in which they heard numbers being said incorrectly (using the word “and”) or where they have seen numbers written incorrectly (using commas).
4. Students can be asked to engage in self- and class-monitoring (including of the teacher) for correct reading and writing of numbers.

**What to look for:*** [*Saying and Writing Whole Numbers* Rubric](http://curriculum.nesd.ca/files/u7/Saying%20Writing%20Whole%20Numbers%20Rubric.doc)
* focus should be on relationship of naming whole numbers to place value, and the use of proper language and notation.

**Big Idea:**Comparing quantity and ordering whole numbers.**Suggestions for assessment tasks:**1. Order a set of whole numbers made from the same digits (not including zero and then including zero).
2. Pick four digits (no repeats). Write the numerals for as many four-digit whole numbers as you can using those digits. From your list of numerals, write the largest three numbers in decreasing order and explain your reasoning.
3. Roll a ten-sided die (using 0 for 10) four times. Write the numeral that represents the four rolls in order of rolling (e.g., if you roll 0, 5, 8 and 7 in that order you would write 0587). Using those same numbers write either the smallest or largest whole number possible and explain how you know it is the smallest or largest.
4. Given a set of whole numbers, record them on a number line and provide justification for the ordering of the numbers on a number line.
5. Compare whole numbers from self-generated or class-generated data and draw a conclusion from the comparison.
6. Roll a die for 30 seconds and record the number for each roll. Find the total amount rolled. Compare your total to that of a classmate and write a statement of comparison.

**What to look for:*** Are the students connecting their reasoning to place value?
* Rubrics: [*Decomposition and Composition of Whole Numbers*](http://curriculum.nesd.ca/files/u7/Decomp%20Comp%20of%20Whole%20Numbers%20Rubric.doc) and [*Saying and Writing Whole Numbers*](http://curriculum.nesd.ca/files/u7/Saying%20Writing%20Whole%20Numbers%20Rubric.doc)for suggestions).
* Are the students associating the ordering of numbers to quantity and position on a number line?
* Are the students able to make sense of the comparison and ordering of numbers in everyday situations?
* *The above three questions could be used in an observation checklist or anecdotal notes could be kept.*
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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**Comparing quantity and ordering numbers. (As well as composing and decomposing whole numbers)**Suggestions for instruction:**1. Have the students start a discussion with a question like “Is it possible to have more than 999?” Probe for ideas and connections through related questions as they are appropriate to the discussion. For example:
2. *What does a number represent*? *(quantity, how many?)* This could lead to the question *Can there ever be a largest number*?
3. *What do you think the number one larger than 999 would look like?* If they know that it will have to have a new place value, ask them where it belongs and why. Also ask how the new place value would be related to the previous ones. Introduction of the word “thousand” should be done when the students have demonstrated that they understand such a number must exist.
4. *What does 999 look like? What would 1 000 look like? Can you construct it with the base ten blocks? If you were to make a base ten block that could represent 1 000, what would you make it look like and why? If you had ten of those base ten blocks, how many in total would you have? How would you write that as a numeral? If you could create a new base ten block that would represent 10 000, what would it look like and why?* Introduction of the words “thousand” and “ten thousand” should be done when the students have demonstrated that they understand such a number must exist.
5. Have the students write a number greater than 999 and have them work in pairs to find ways to describe its relationship to 999, and also to represent it either concretely or pictorially as well as the composition of different numbers (including place value). Have the students share, discuss and critique their representations as a class.
6. As the students are exploring these concepts about whole numbers greater than 999, model the correct writing and saying of the number names.
7. Give students a whole number and ask them what number(s) they would use as an estimate for their quantity.
8. Ask the students what contexts they can think of for numbers larger than 999.

**Big Idea:**Saying and writing whole number names.**Suggestions for Instruction** 1. Direct instruct on the conventions of saying and writing the number names. Discuss the use of “and” in colloquial speech, and the use of the comma in the U.S. Explain the reasons for Canada opting out of using the comma and the purpose of the space in writing numbers. Within this direct instruction, do expect the students to help explain or reason out how the use of the place value words impacts the naming of whole numbers.
2. Continue to emphasize these ideas and the skills throughout the students study and use of whole numbers.

**Big Idea:**Composing and decomposing whole numbers.**Suggestions for Instruction**1. Provide the students with four different digits and ask the students to create as many whole numbers as possible from those digits. Next, have the students share their list of numbers with a partner. Instruct the students that if they have a number that their partner doesn’t have they need to convince their partner that it should be included in their combined list. This activity can have at least three levels to it, and the teacher needs to decide whether the entire class or some pairings of students need to be given differentiated instructions. The first level would have the students just explore the numbers possible if they use all the digits only once in each number that they create. The second level would be allowing the students to use some or all of the digits only once in each number they create. The third level would allow the students to repeat any digit up to three times while also allowing for numbers contain up to three digits. For example, if the digits the students are given are 1, 2, 3 the possible numbers for each level are:
* Level 1: 123, 132, 312, 213, 231, 231
* Level 2: 1, 2, 3, 12, 13, 21, 31, 23, 32, 123, 132, 312, 213, 231, 231
* Level 3: 1, 2, 3, 12, 13, 21, 31, 23, 32, 123, 132, 312, 213, 231, 231, 11, 111, 22, 222, 33, 333, 112, 121, 211, 113, 131, 311, 221, 212, 122, 223, 232, 322, 331, 313, 133, 332, 323, 233

This activity, at any of the levels, not only engages the students in thinking about place value, but also about patterns and mathematical reasoning. The activity can be repeated any number of times, with and without repeating digits being given and the lists can then be used to have the students develop strategies for ordering sets of numbers and locating them on a number line. The students may also choose to “define the rules” in terms of how many digits that are allowed in the numbers or whether they are allowed to repeat digits. Assessment of student understanding of how to read numbers out loud can be interjected throughout the activity by asking students to read their largest or smallest number, the first number they wrote, a number that they had that their partner didn’t and so on. Within their pairs, the students can also peer assess on the linguistic conventions of reading the number names as they share their numbers with each other.1. Students have previously learned about writing numbers in expanded form and writing different decompositions for a number. As a homework task, students could be asked to write a three digit number and a four digit number and then write both in words and expanded form. The purpose of this homework task is three-fold: to activate the students prior knowledge, to have them critically and creatively reflect upon that prior learning to solve the new problem of expanding and decomposing four digit whole numbers (whole numbers between 999 and 10 000), and to have the students better prepared to engage in a learning discussion and construction of understanding as a whole group during the next class. The homework is not intended to “be for marks”, nor should it be categorized as “right or wrong”. In order to build a disposition for learning, one of the foundations is for students to realize that errors lead to better understanding and that they are capable of hypothesizing and generalizing mathematically. In the next class, the students would be asked to share, compare, and analyze their homework and through a whole group discussion generalize strategies for decomposing whole numbers to 10 000 in a variety of ways, including the expanded form. In both the homework and in the group discussion and generalization of strategies, alternate methods and representations should be honoured and connections need to be made between all valid strategies. Proposed strategies cannot be discarded as wrong without analysis, and students should be given the opportunity to modify their strategies at any time throughout the process. Students need to experience learning as an opportunity to reflect and change.
2. As a homework task or an exit slip would be to challenge students to come up with the “trickiest” decomposition of a four digit number possible and to explain how they came up with the decomposition. This small task could be expanded to a project in which each student could be provided a different number, and the students could be asked to present their decomposition using any type of representation that could be displayed and/or shared. This would provide students who excel in other subject areas an opportunity to explain their mathematical reasoning through different avenues (dance, drama, poetry, music, physical movement…). If the task is expanded to include possible subject area integrations, the class could develop an assessment rubric that looks at mathematical correctness, clarity of presentation/explanation, and level of “trickiness” for the completed projects.
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