**The Number Strand: Outcome N4.7**

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| **Outcome** | **Indicators** | | |
| N4.7 Demonstrate an understanding of decimal numbers in tenths and hundredths (pictorially, orally, in writing, and symbolically) by:   * describing * representing * relating to fractions.   [C, CN, V]  *In support of the K-12 Mathematics goals of Number Sense, Logical Thinking, Mathematical Attitude and Spatial Sense.* | 1. Write the decimal for a concrete or pictorial representation of part of a set, part of a region, or part of a unit of measure. 2. Represent a decimal concretely or pictorially. 3. Explain the meaning of each digit in a given decimal with all digits the same. 4. Represent a decimal using money (dimes and pennies). 5. Record a money value using decimals. 6. Provide examples of everyday contexts in which tenths and hundredths are used. 7. Model, using manipulatives or pictures, that a tenth can be expressed as hundredths (e.g., 0.9 is equivalent to 0.90 or 9 dimes is equivalent to 90 pennies). 8. Read and write decimals as fractions (e.g., 0.5 is zero and five tenths). 9. Express orally and in symbolic form a decimal in fractional form. 10. Express orally and in symbolic form a fraction with a denominator of 10 or 100 as a decimal. 11. Express a pictorial or concrete representation as a fraction or decimal (e.g., 15 shaded squares on a hundred grid can be expressed as 0.15 or ). 12. Express orally and in written form the decimal equivalent for a fraction (e.g., can be expressed as 0.50). | | |
| **Learning Space:** [**Top**](#top) | | | |
| This is the students’ first encounter with decimals, although they may have seen or heard decimal values outside of the mathematics classroom, including in the context of money and to a lesser extent they may know “point five” as being “one half”. This knowledge will likely not be at a deep level of understanding, and it is important to explore the students’ notions of decimals both for true understandings and for misconceptions.  As always, the students need a wide variety of experiences in range of contexts using different concrete and pictorial representations. Two of the most tangible types of representations when starting to look at decimals are money and length measurement. It is important for the students to realize that decimal notation allows them to not have to use two different units of measurement while also not having to describe the quantity in terms of the smaller sized measurement. That is to say, instead of writing $1 and 45 cents, or 145 cents, they can now write $1.45.  The use of place value models becomes important so students don’t believe 1 minute and 23 seconds is 1.23 minutes. In addition, the use of grids can also help the students recognize decimals can also be represented using fractions with a base of 10 or 100. Because of where the students are in their understanding of fractions, it is important to remember that the students should not be simplifying these fractions. Moreover, when students are writing and representing the decimal equivalents for given fractions, the fractions must be given in tenths or hundredths.  The sharing and discussion of ideas and strategies for representing and making sense of decimals is again very important both for student understanding and the teacher’s insights into that understanding.  The oral reading of the decimal numbers is also key for the development of deep understanding. It is important to avoid saying the word “point” for the decimal point as the word “and” should be used. As well, the decimal values need to be read using their place value designation so that students develop a clear understanding of the value of digit positions in decimals. For example, 0.03 should be read “zero and three hundredths” and not as “point zero three”. Students may be familiar with the second variation, but they need to be encouraged to use the correct structure and language. Although “point zero three” may seem easier to record in symbolic decimal form, it does not help the students understand how place vale is designated and ordered in decimals, nor does it reinforce the relationship between decimals and fractions.  Wherever students encounter fractional amounts, money, or linear measurements in other subject areas there are opportunities to strengthen their understanding of decimals and how decimals are related to fractions. Topics of interest from the other subject areas can also be brought into the mathematics classroom as contexts for exploring and refining ideas about decimals and fractions.  When studying patterns in tables, the students can explore problems that involve decimal values. As well, students can use decimal data in their creation of bar graphs. | | | |
| **What Students Should…** [**Top**](#top) | | | |
| **Know**   * “.” signifies the start of the decimal portion in a number or quantity, is called the decimal point, and is read as “and” when reading out a decimal number * that decimals in a number represent part of a whole (1) | | **Understand**   * a digit in the tenths position tells how many entire pieces out of 10 there are in the quantity * a digit in the hundredths position tells how many entire pieces out of 100 there are in the quantity that are not accounted for in the tenths. * decimals are another way of representing parts of a whole | **Be Able to Do**   * model decimal amounts using concrete and visual representations * write a decimal in symbolic form for a given concrete or pictorial model * identify the value of each digit in a decimal number by relating the digit to it’s place value * writing decimals as fractions |

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| * the first position to the right of the decimal point is called the tenths position, and the next position is called the hundredths position. | * a decimal can be represented as a fraction. * fractions out of 10 or 100 can be represented as decimals. * tenths represent a larger quantity or part of the whole than hundredths. * in money and measurement, there are other names for the decimals ,e.g., 45 hundredths of a dollar is also 45 cents, 2 tenths of a meter is also 20 centimetres. * any decimal number can be represented with an additional zero on the end (or any number of zeros) and the quantity represented remains the same. | * write fractions with denominators of 10 or 100 as decimals. * identify everyday contexts in which decimals occur, writing a decimal for a context, andexplaining what it means in that context. * read a decimal number orally. * compare, with justification, two decimal numbers. * show how two decimals numbers, such as 0.3 and 0.30, represent the same quantity and explain why the zero in the hundredths position does not change the value of the decimal. * write the words for the name of a given decimal. * select a benchmark (0, 0.5 or 0.50, 1) for a given decimal and explain the reasoning. |
| **Key Questions:** [**Top**](#top) | | |
| * What does the zero before the decimal point in a decimal number tell you? * How are fractions and decimals alike/related? * Why does adding a zero to the end of a decimal number not change the quantity represented by the decimal? * Can zero be added to the end of a whole number without changing the quantity it represents? Explain? Is there some place in a whole number where a zero can be added to not change the quantity represented by the whole number? | | |

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| **Suggestions for assessment:** [**Top**](#top) |
| **Big Idea:**  Decimals as signifying quantity.  **Suggestions for assessment tasks:**   1. Give the students an example of a decimal within a context and ask them to explain what the decimal tells them about that context. 2. Show students a representation of a quantity and ask them to write the symbolic notation for the decimal represented. 3. Give the students a decimal and ask them to represent it concretely or pictorially. 4. Give the students a decimal number and ask them to write it as a fraction. 5. Give the students a fraction with a denominator of 10 or 100 and ask them to write it as a decimal.   **What to look for:**   * See [*Decimals as Quantity Rubric*](file:///C:\Users\ru593\AppData\Local\Temp\Decimals%20as%20Quantity%20Rubric.doc)   *.*  **Big Idea:**  Comparing decimals.  **Suggestions for assessment tasks:**   1. Give the students a set of decimals in random order and ask them to arrange the decimals in order from smallest to largest and to explain their reasoning. 2. Give the student two decimals and ask them to tell you a decimal that would be between them on the number line. Have the student explain their reasoning. 3. Give the students a set of decimals and fractions with denominators of 10 and 100 that they sort in descending order, or place on a number line. Have the students justify the order they give. Include in the set of numbers equivalent decimals such as 0.3 and 0.30 and decimals that involve the same digits but are not equivalent such as 0.50 and 0.05.   **What to look for:**   * See [*Comparing Decimals Rubric*](file:///C:\Users\ru593\AppData\Local\Temp\Comparing%20Fractions%20Rubric.doc)*.* |

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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**  Decimals as signifying quantity.  **Suggestions for instructional activities:**   1. Provide the students with base ten blocks. Tell the students that for this activity, the hundreds flat is going to equal 1 (a whole). This may at first be confusing for the students, as they are used to thinking of a flat as 100. At first relate this to their study of fractions in that 1 whole can be represented using any of the base ten blocks, not just the unit piece. Begin by asking the students what the large cube would equal if the flat is 1. (It is equal to 10 flats, so it equals ten). Introduce the decimal place onto the symbolic notation of both 1 and 10 (so 1.0 and 10.0) and talk about how that shows the flat represents 1 and 0 parts of one more, and that the cube represents 10 and 0 parts of 1 more. Be sure to connect these ideas back to their notions of fractions as being part of a whole (or of 1). Tell the students this form of symbolic notation is the reason why we do not say the word “and” in the whole number names (because we say the *and* before we say and 0 parts of 1 more). Next, ask the students what the rod would represent. Have the students discuss how many rods it takes to make the flat (10) and if a flat is 1, or a whole, what would a rod represent? If the students have studied fractions already, or begun them, this should be an easy question for the students – 1out of 10 or 1 tenth. Ask the students how they would write that symbolically. Tell the students that the first position to the right of the decimal point is call the tenths position. Have the students how they think they could write one tenth using decimal notation. They may need to explore how they would write 1 ten or 1 one or 1 thousand to get the idea that the position of tenths is where the 1 for the one tenth would go. A discussion of what happens before the decimal place will have to occur too. Bring the students to this discussion by asking them how much the rod represents in terms of whole numbers – zero – and ask them how they could show that the rod represents zero ones (and tens, hundreds, thousands…) and one tenth. Some students may find a place value mat with columns for units and tenths may help them in figuring out the symbolic notation, but be sure to make sure their understanding is grounded in relationship to actual quantity. The students should also explore other representations of decimals to tenths, such as using grid paper. 2. Continue the same approach as above but moving into hundredths. As they become confident with writing the decimals in both tenths and hundredths, ask the students how many hundredths there are in 1 tenth (2 tenths, 3 tenths,…). Have the students confirm their ideas by creating concrete and/or pictorial representations of the number in tenths and hundredths to show that they do represent the same quantity (i.e., 0.2 is the same as 0.20) Also introduce metre sticks and rulers as contexts for decimal numbers. 3. Having the understanding that fractions and decimals serve the same purpose – to represent part of a whole (or unit), have the students brainstorm where they have heard or seen fractions and decimals. The key is for the students to realize that in some contexts we tend to favour one format over the other, although either format could be used. For example, we tend to describe pizza in fractions, but long jump measurements in decimals. 4. Have the students practice representing decimals in different ways, including as fractions and writing fractions with denominators of 10 or 100 as decimals.   **Big Idea:**  Comparing decimals.  **Suggestions for instructional activities:**   1. Give pairs of students two decimals (both in tenths or hundredths) and have the students explore ways to compare the size of the two decimals. Provide the students with other pairs of numbers, gradually making them more involved (one tenth and one hundredth, two equivalent decimals, and two decimals that involve the same digits in different orders). Have the pairs share their strategies with another pair of students and the discuss all of the strategies that the students have come up with as a class. Encourage the students to try to make connections between the strategies as well as connections to their understanding of fractions.   2. Draw a number line on the board with 0, 0.5 and 1 labelled. Tell the students another decimal and ask them where they would show it on the number line. Keep adding decimals, allowing the students to debate the positioning of the decimals. Gradually add equivalent decimals and fractions for the students to place on the number line.  3. Have the students work in pairs and give each pair two 10-sided die. Tell the students to roll the die twice and record a decimal by using the first roll as the digit for the tenths position and the second roll as the digit for the hundredths position. After the students have generated 6 decimals, ask the students to individually order the decimals from least to greatest. Then, have the partners compare their results. If there are disagreements, the partners are to explore different representations of the decimals and come to agreement on the correct ordering. Have the students write about this activity, any problems they encountered, and strategies they used in their journals. |