Grade 7 Mathematics

Unit 3

Fractions, Decimals, and Percents

Estimated Time: 23 Hours

[C]	Communication	**[PS]**	Problem Solving
[CN]	Connections	**[R]**	Reasoning
[ME]	Mental Mathematics and Estimation	**[T]**	Technology
		[V]	Visualization

Unit 3 Overview

Introduction

Students will focus on understanding that fractions, decimals and percents are just three ways to refer to the same thing. Students will learn algorithms enabling them to perform calculations with all three forms. It is very important that students develop number sense by estimating first and then calculating; a "sense" of whether or not an answer is correct will be critical to problem solving. The big ideas in this unit are:

- Fractions, decimals, and percents are alternate forms of the same thing. Understanding the relationships between the three is critical.
- Percents mean *per hundred.* One percent is one-hundredth and so on.
- When working with decimals it is imperative that the student understand place value. Comparing, ordering, and operating will all rely on this knowledge.
- Estimating a reasonable answer prior to calculating is very important for developing number sense.
- The algorithms for multiplication and division of whole numbers and decimals are the same. The placement of the decimal can be determined through the use of good estimation skills.

Context

Patterns will be useful once again when used to convert between fractions and decimals. Several of the tools and ideas used to compare and order fractions will be benchmarks, number lines, place value, equivalent fractions and manipulatives such as fraction pieces and fraction strips.
The use of manipulatives, technology, and pencil & paper will be encouraged while performing operations with fractions, decimals and percents. Operations with decimals will be subject to the order of operations but exponents will not be introduced. During this unit students will examine the connections between fractions, decimals and percents and learn to recognize and express them in all three forms. Percent problems will be limited to values no greater than 100%.

Why are these concepts important?

Developing a good understanding of fractions, decimals and percents will permit students to:

- Deal with these ideas when they occur in everyday life; as they often do.
- Prepare students to be informed consumers and contributing workers in the technological era that is the Information Age.
- Better help students to answer for themselves the perennial question "Why do I need to learn this?"
- Build a greater facility for working with numbers and enhance knowledge of basic facts.
- Prepare students for future math learning that focuses on rational numbers, proportions, and algebra.

"A man is like a fraction whose numerator is what he is and whose denominator is what he thinks of himself. The larger the denominator, the smaller the fraction."

Leo Tolstoy (1828 – 1910)

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N4. Demonstrate an understanding of the relationship between positive terminating decimals and positive fractions and between positive repeating decimals and positive fractions. [C, CN, R, T]**	Decimal numbers are simply another way of writing fractions. Decimals and proper fractions can both be represented using the part of a whole model. All fractions can be expressed as **terminating** $\frac{1}{2} = 0.5$ **or repeating decimals** $\frac{1}{3} = 0.\overline{3}$ and vice versa. Some students will already know the decimal equivalents of some simple fractions (e.g., $\frac{1}{2} = 0.5$, $\frac{1}{4} = 0.25$, $\frac{1}{5} = 0.2$) as well as any fraction with a denominator of 10, 100, or 1000. Students should be introduced to the terminology **terminating**, **repeating,** and **period** as well as to the bar notation used to indicate repeating periods. The patterns produced by fractions with a variety of denominators should be explored since many have particularly interesting periods. Students should use calculators when appropriate to find the decimal form for some fractions and predict the decimal for other fractions. Consider the difference in finding the decimal equivalents for sevenths and eighths. On a calculator we find $\frac{1}{7} = 0.142857142...$ $\frac{2}{7} = 0.285714285....$ $\frac{3}{7} = 0.428571428....$ Using a pattern we find $\frac{1}{8} = 0.125$ $\frac{2}{8} = 0.250$ therefore $\frac{3}{8} = ?$ (0.375) Students should also be aware of the effect of calculator rounding (i.e., automatic rounding caused by the limit on the number of digits which the calculator can display).

General Outcome: Develop Number Sense	
Suggested Assessment Strategies	**Resources/Notes**

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N4. Demonstrate an understanding of the relationship between positive terminating decimals and positive fractions and between positive repeating decimals and positive fractions. [C, CN, R, T]** ***(Cont'd)*** **Achievement Indicators**	
7N4.1 (It is intended that repeating decimals be limited to decimals with 1 or 2 repeating digits.) Predict the decimal representation of a given fraction, using patterns; e.g., $\frac{1}{11} = 0.\overline{09}$, $\frac{2}{11} = 0.\overline{18}$, $\frac{3}{11} = ?\ldots$	Give students a set of fractions such as $\frac{1}{13}, \frac{2}{13}, \frac{3}{13}$. Ask them to find a pattern using a calculator and then use the pattern to predict the decimal for other fractions such as $\frac{4}{13}, \frac{5}{13}, \frac{10}{13}$. Ask students to compare the decimals for the following pairs and have them discuss the similarities and differences they observe. a) $\frac{1}{12}$ and $\frac{1}{120}$ b) $\frac{3}{8}$ and $\frac{3}{80}$ c) Since the decimal for $\frac{3}{16}$ is 0.1875, ask students to predict the fraction that would produce a decimal of 0.01875. Some of the text exercises on p. 88-90 go beyond the 2 repeating digits of this achievement indicator. This can be explored in class activities, but should not be evaluated formally.
7N4.2 Match a given set of fractions to their decimal representations.	See Lesson 3.1 p. 89 #10.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Paper and Pencil 1. Given the following decimal representations of fractions as produce by a calculator: $\frac{1}{11} = 0.\overline{09}$, $\frac{2}{11} = 0.\overline{18}$, $\frac{1}{11} = 0.\overline{27}$, $\frac{1}{11} = 0.\overline{36}$ ask students to: A. predict the decimals for $\frac{5}{11}$ and $\frac{9}{11}$ B. predict the fraction which will have 0.636363... as a decimal C. predict what the decimal for $\frac{8}{11}$ would look like on a calculator display if the calculator is set to display 8 places after the decimal. D. predict the fraction which will have 0.909090… as a decimal 2. How does knowing that $\frac{1}{4} = 0.25$ help you find the decimal form of $\frac{3}{4}$? of $\frac{5}{4}$? *Informal Observation* Mix-up Match-up game. Each student would receive a card with either a decimal or a fraction. Students must circulate around the room to find the card which is equivalent to their own. Conclude the activity with the class by asking the students to explain why their cards belong together. (Refer to Appendix 3-A)	*Math Makes Sense 7* **Lesson 3.1** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 4–8 Master 3.11, 3.21 CD-ROM Unit 3 Masters ST: pp. 86–90 Practice and HW Book pp. 50–51 *Math Makes Sense 7* **Lesson 3.1** **(continued)**

General Outcome: Develop Number Sense

Specific Outcome

It is expected that students will:

7N4. Demonstrate an understanding of the relationship between positive terminating decimals and positive fractions and between positive repeating decimals and positive fractions. [C, CN, R, T]
(Cont'd)

Achievement Indicators

7N4.3 Sort a given set of fractions as repeating or terminating decimals.

7N4.4 Express a given fraction as a terminating or repeating decimal.

Elaborations: Suggested Learning and Teaching Strategies

See ProGuide Unit 3 p. 6. The following question illustrates the strategy using equivalent fractions with denominators of 10, 100 or 1000. This is a possible *Explore* activity.

Use a calculator, if necessary, to complete the following table.

Fraction	Equivalent fraction with a denominator, if possible, of 10,100 or 1000	Decimal equivalent	Repeating Decimal	Terminating Decimal
$\frac{1}{2}$	$\frac{5}{10}$	0.5		☺
$\frac{1}{3}$	-----	$0.\overline{3}$	☺	
$\frac{1}{4}$				
$\frac{1}{5}$				
$\frac{1}{6}$				
$\frac{1}{8}$				
$\frac{1}{9}$				
$\frac{1}{10}$				

These are some guiding questions that can lead class discussion.

a) Which fractions are equivalent to a repeating decimal? Can these fractions be written with a denominator of 10, 100 or 1000?
b) Which fractions are equivalent to a terminating decimal? Can these fractions be written with a denominator of 10, 100 or 1000?
c) How can you tell if a fraction is equivalent to a terminating or repeating decimal?

When expressing a given fraction as a terminating or repeating decimal, use a calculator if needed. If the denominator is greater than 10 and not a multiple of 10, a calculator will be needed.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Informal Observation

A graphic organizer such as a T-Chart may be useful here. Give the students a variety of fractions to classify as either terminating or repeating decimals. This may be done independently, as groups in a mix-up match-up game or as a whole class activity on the board. Ask students to justify the placement of the fractions.

Using a T-Chart: Categorize given fractions as terminating or repeating.

terminating	repeating
$\frac{1}{5}$	$\frac{4}{3}$
$\frac{7}{20}$	$\frac{9}{11}$

Journal

1. Does the fraction $\frac{1}{27}$ produce a repeating pattern?
   How could you show or explain this without the use of a calculator?

2. Chris had a calculator which displayed 2.3737374. Chris concluded that it was not a repeating decimal. Explain why Chris drew this conclusion and whether or not it is a correct conclusion.

Resources/Notes

Math Makes Sense 7
Lesson 3.1
(continued)

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N4. Demonstrate an understanding of the relationship between positive terminating decimals and positive fractions and between positive repeating decimals and positive fractions. [C, CN, R, T]** ***(Cont'd)***	Students are expected to be able to: • Write fractions in simplest form. • Find equivalent fractions. However, throughout this unit these concepts must be reinforced for all relevant achievement indicators.
Achievement Indicators	
7N4.5 Express a given terminating decimal as a fraction.	Using the concept of place value, impress upon students the importance of correctly naming a decimal number. If 0.37 is read as thirty-seven hundredths, the conversion to $\frac{37}{100}$ is easily made. But, naming 0.37 as "decimal three seven" or "point three seven" has no context, or frame of reference, for the student. This type of naming should be avoided.
7N4.6 Express a given repeating decimal as a fraction.	Note: Patterning in Connect p. 87 of the student text and the explanation in the ProGuide p. 6.
7N4.7 Provide an example where the decimal representation of a fraction is an approximation of its exact value.	Students must recognize that fractions such as $\frac{1}{6} = 0.1\overline{6}$ are exact values. When using a calculator to convert the fraction to its decimal form, the display will show 0.166666667 which is only an approximation of the value. Similarly, we often estimate values of fractions such as $\frac{1}{3}$ is approximately equal to 0.3.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Paper & Pencil 1. About 0.4 of a math class will be going on a field trip. Write the decimal in words, and as a fraction in simplest form. 2. Eighty percent of all life on Earth lives below the ocean's surface. Write 0.80 as a fraction in simplest form. 3. Dennis read that $0.\overline{7}$ of his favourite cereal was whole wheat. What fraction of his cereal is whole wheat? 4. The following numbers appear on three calculator screens. Match the correct displays to the correct fractions. Try to do this using what you know about repeating decimals and do not use a calculator. 0.55555556 — $\frac{2}{7}$ 0.28571429 — $\frac{5}{9}$ 0.30769231 — $\frac{4}{13}$	*Math Makes Sense 7* **Lesson 3.1** **(continued)**

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N7. Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:** • **benchmarks** • **place value** • **equivalent fractions and/or decimals.** **[CN, R, V]**	Number lines are particularly useful when comparing and ordering. In previous grades, students made conversions among proper and improper fractions. They are aware of the common fraction decimal equivalents ($\frac{1}{2}=0.5;\frac{3}{4}=0.75,\frac{1}{3}=0.\bar{3}$ etc.). They should also work with other common fractions including sixths and eighths. Students should develop a variety of strategies to compare fractions in addition to creating equivalent denominators. They should also be able to identify fractions between any two given fractions. Various strategies are suggested below. 1. Compare in relation to particular benchmarks such as $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{3}{4}$, and their decimal equivalents. 2. Compare based on common denominators. Example: If both fractions have the same denominator, the larger numerator represents the larger fraction. E.g. $\frac{5}{8}>\frac{3}{8}$. If denominators differ, students will write equivalent fractions with like denominators and then compare the numerators. 3. Have students compare based on common numerators. Example: If both fractions have the same numerator, the fraction with the smallest denominator is larger. E.g. $\frac{2}{7}>\frac{2}{9}$ 4. Convert all fractions to decimals and then compare tenths to tenths, hundredths to hundredths, and thousandths to thousandths. E.g. $\frac{1}{8}=0.125$ therefore $\frac{1}{8}<0.13$ because $0.125<0.130$ 5. Model fraction/decimal situations using various manipulatives like base-10 blocks, fraction pieces, pattern blocks etc.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Informal Observation Have students play FRIO (Fractions In Order) to reinforce their understanding of comparing and ordering. Each student gets five fraction (or decimal) cards out of a pack of cards, lays them out on a desk in the order they receive them, and is not allowed to change the order. Each student takes turns trading one of the cards for a new one from the pack. They place the new card in whichever location best helps in getting the cards in order. The object is to be the first to get one's cards in order. The pack should have sufficient cards to allow the game to run smoothly: • for groups of 3, there should be at least 30 cards per group, • for groups of 4, at least 40 cards per group.	

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N7. Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:** • **benchmarks** • **place value** • **equivalent fractions and/or decimals.** **[CN, R, V]** ***(Cont'd)***	
Achievement Indicators 7N7.1 Order the numbers of a given set that includes positive fractions, positive decimals and/or whole numbers in ascending or descending order; and verify the result, using a variety of strategies.	Place decimal numbers and fractions on number lines. Have students compare fractions greater than one by considering them as mixed numbers. For example, which is greater, $\frac{10}{8}$ or $\frac{7}{5}$? A possible answer: "I know $\frac{7}{5}$ is greater because $\frac{10}{8}$ is $1\frac{2}{8}$, $\frac{7}{5}$ is $1\frac{2}{5}$, and $\frac{2}{5}$ is greater than $\frac{2}{8}$." Have students choose the greater fraction or decimal in a given pair. Have them accurately defend their choice. Give students 5 decimal numbers that have friendly fraction equivalents. Keep the numbers between two consecutive whole numbers. (Example: 3.5, 3.125, 3.4, 3.75, and 3.66 are between 3 and 4.) Give them a number line encompassing the same two whole numbers. Use subdivisions that are only thirds, fourths, or fifths, without labelling them. Locate each decimal on the number line and provide the fraction equivalent for each (Van de Walle and Lovin, 2006, p.115).
7N7.2 Identify a number that would be between two given numbers in an ordered sequence or on a number line.	Ask students to estimate a value to make each of the following true: a) $0.4 < \frac{?}{8} < 0.7$ b) $\frac{3}{10} < 0.?< \frac{4}{10}$

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Informal Observation

Use a living number line. Each student is given a card with a fraction or decimal number. Students are to order themselves into a line based on the relative size of their number. Conclude by asking several students why they chose the position they did.
(Alternate version: Use a skipping rope as the number line. Students attach their number to the line in an appropriate position.)

Journal

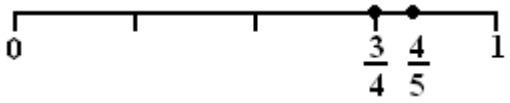
Suzie and Polly both worked very hard and have nearly completed their math assignment. Suzie has completed $\frac{5}{6}$ of the project and Polly has completed 0.8 of her project. Who was closer to completing the assignment? How do you know this?

Paper and Pencil

1. Have students place the following numbers on a number line:
   2.3 , 2.4, 2.32, 2.36, 2.327

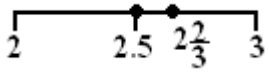
2. Arrange these numbers from least to greatest:
   $0.96,\ 0.\overline{9}\ ,\ 0.9,\ 0.\overline{96}\ ,\ 0.09$

3. Choose a number that would fit between the plotted points.
   A.



   Number in between: _____ Reason: _____

   B.



   Number in between: _____ Reason: _____

Resources/Notes

Math Makes Sense 7
Lesson 3.2
Unit 3: Fractions, Decimals, and Percents
TR: ProGuide, pp. 9–13
Master 3.12, 3.22
PM 23
CD-ROM Unit 3 Masters

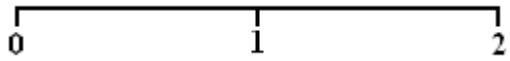
ST: pp. 91–95
Practice and HW Book pp. 52–54

Van de Walle and Lovin, 2006, p.115

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N7.Compare and order positive fractions, positive decimals (to thousandths) and whole numbers by using:** • **benchmarks** • **place value** • **equivalent fractions and/or decimals.** **[CN, R, V]** ***(Cont'd)*** **Achievement Indicators**	
7N7.3 Identify incorrectly placed numbers in an ordered sequence or on a number line.	See student text p. 95 #9 and ProGuide p. 13.
7N7.4 Position fractions with like and unlike denominators from a given set on a number line, and explain strategies used to determine order.	Use only fractional values in this case.
7N7.5 Order the numbers of a given set by placing them on a number line that contains benchmarks, such as 0 and 1 or 0 and 5.	Use number sets that contain numbers in a variety of formats.
7N7.6 Position a given set of positive fractions, including mixed numbers and improper fractions, on a number line; and explain strategies used to determine position.	

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Journal Choose three values that are not whole numbers and explain how you would write them in order using benchmarks. *Paper and Pencil* Write each of the following numbers in an appropriate location on the number line below. $\frac{3}{7}$, $1\frac{1}{3}$, $\frac{5}{9}$, $\frac{13}{12}$, $1\frac{4}{9}$, 0.45, 0.93  **When discussing the answer to this question, ask students to explain the strategies they used to determine the appropriate position on the line.	*Math Makes Sense 7* **Lesson 3.2** **(continued)**

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N2. Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected). [ME, PS, T]**	Students should know when it is appropriate to use a paper/pencil algorithm, a mental procedure, or a calculator for the mathematical operations involving whole numbers and/or decimals. They need to understand the relationship between whole number and decimal number operations, including order of operations begun in grade 6. Emphasis should be placed on place value and estimation ideas. Ensure that instruction does not focus on students simply mastering procedural rules without a conceptual understanding. It is important that a problem solving context is used to help ensure the relevance of the operations. Addition and subtraction questions should be presented horizontally, as well as vertically, to encourage alternative computational strategies. Students should be able to use algorithms of choice when they calculate with pencil-and-paper methods. While it is important that the algorithms developed by students are respected, if they are inefficient, students should be guided toward more appropriate strategies. For example, when adding numbers such as 4.2 and 0.23, students should be encouraged to add the whole numbers, tenths, and hundredths. **Estimation** should be considered an integral part of any computation. Estimation should be used to develop a sense of the size of an answer for any calculations involving decimals. For example, one might round each of the decimal numbers 2.8 x 8.3 for an estimate of 24 (3 x 8). Thus, the only reasonable answer would be one that is close to 24. Other strategies will be explored as they arise within the context of the achievement indicators. Multiplication or division of two numbers will produce the same digits, regardless of the position of the decimal point. As a result, for most practical purposes, there is no reason to develop new rules for decimal multiplication and division. Rather, the computations can be performed as whole numbers with the decimal being placed by way of estimation (Van de Walle and Lovin, 2006, p. 107).

General Outcome: Develop Number Sense	
Suggested Assessment Strategies	**Resources/Notes**
	Van de Walle and Lovin, 2006, p. 107

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N2. Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected). [ME, PS, T]** ***(Cont'd)*** **Achievement Indicators** 7N2.1 Solve a given problem involving the addition of two or more decimal numbers. 7N2.2 Solve a given problem involving the subtraction of decimal numbers. 7N2.3 Place the decimal in a sum or difference, using front-end estimation; e.g., for 4.5 + 0.73 + 256.458, think 4 + 256, so the sum is greater than 260.	The focus is on using addition and subtraction of decimals in problem solving contexts. Algorithms have been covered in previous grades. Again: Estimate **before** Calculate. Develop number sense. One estimation strategy for addition and subtraction explored in the student text is the **front-end strategy**. In this simple strategy, students perform operations from left to right using ***only the whole number*** part of each value. 9.2 + 3.5 + 12.72 = ? To estimate we think: 9 + 3 + 12 = 24 14.31 – 5.2 – 3.6 = ? To estimate we think: 14 – 5 – 3 = 6 Once this estimation is complete, the calculation must be performed. The estimation can be used to determine the relative magnitude of the solution. See the student text for examples. Note that rounding is not part of this strategy. Many students will likely use the **rounding strategy**: 13.25 + 3.9 = ? To estimate we think: 13 + 4 = 17

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
<u>*Journal*</u> Create three different addition/subtraction word problems. Each problem must have an answer of 4.2. <u>*Informal Observation*</u> Students can play the game *How Close Can You Get?* A really useful game for adding, subtracting, and comparing decimal numbrs. See ProGuide p.v and Master 3.6.	*Math Makes Sense 7* **Lesson 3.3** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 14–17 Master 3.13, 3.23 CD-ROM Unit 3 Masters ST: pp. 96–99 Practice and HW Book pp. 55–56

General Outcome: Develop Number Sense

Specific Outcome

It is expected that students will:

7N2. Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected). [ME, PS, T]
(Cont'd)

Achievement Indicators

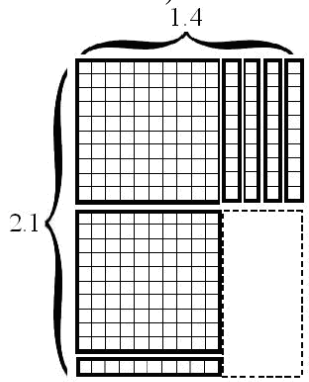
7N2.4 Solve a given problem involving the multiplication of decimal numbers with two digit multipliers (whole numbers or decimals) without the use of technology.

7N2.5 Place the decimal in a product, using front-end estimation; e.g., for $\$12.33 \times 2.4$, think $\$12 \times 2$, so the product is greater than $24.

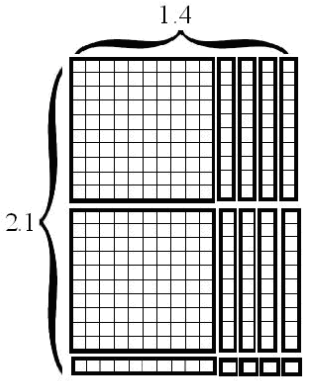
Elaborations: Suggested Learning and Teaching Strategies

Students have been using base 10 blocks in previous grades to discuss place value, to represent decimal numbers, and to add and to subtract decimals. They will have used base 10 blocks to multiply a decimal number by a whole number.

These achievement indicators focus on using multiplication of decimals in a problem solving context. The base 10 area model will be extended to 2-digit multipliers. This extension is a new concept for the students Refer to student text p.100 and ProGuide p.18. Further, an example using the area model (Base-10 blocks) is illustrated below.



This model represents multiplying 2.1 by 1.4. The strategy involves filling the dotted rectangle with blocks to complete a larger rectangular region.



With the region completed we determine the answer by counting 2 unit blocks, 9 tenths blocks, and 4 hundredths blocks. When combined we get 2.94

Focus on strategies such as rounding and front-end estimation.
Rounding: $4.7 \times 20.1 = ?$
To estimate we think $5 \times 20 = 100$

Front-end estimation: $6.1 \times 23.4 = ?$
To estimate we think 6 x 20 is 120 and 6 x 3 is 18 plus a little more for an estimate of 140.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Paper and Pencil Mary said to Sharon, "I'm thinking of a number that when multiplied by 8.7 gives a product of about 7.2." Give five numbers that Sharon could have used to answer Mary's question. Show how Sharon's estimates are reasonable. *Informal Observation* Students play the game *Beat the Clock*; a really useful game for estimating products. The *Take it Further* suggestion encourages estimation using 2 digit multipliers. See ProGuide (page V) and Master 3.7. **In any problem developed for assessment purposes, without the use of a calculator, only two digit multipliers can be used.**	The Archytech website for using base 10 blocks. It includes a java applet for producing the models of your choice. http://www.arcytech.org/java/b10blocks/instructions.html *Math Makes Sense 7* **Lesson 3.4** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 18–21 Master 3.14, 3.24 PM 22 CD-ROM Unit 3 Masters ST: pp. 100–103 Practice and HW Book pp. 57–59

General Outcome: Develop Number Sense

Specific Outcome

It is expected that students will:

7N2. Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected). [ME, PS, T]
(Cont'd)

Achievement Indicators

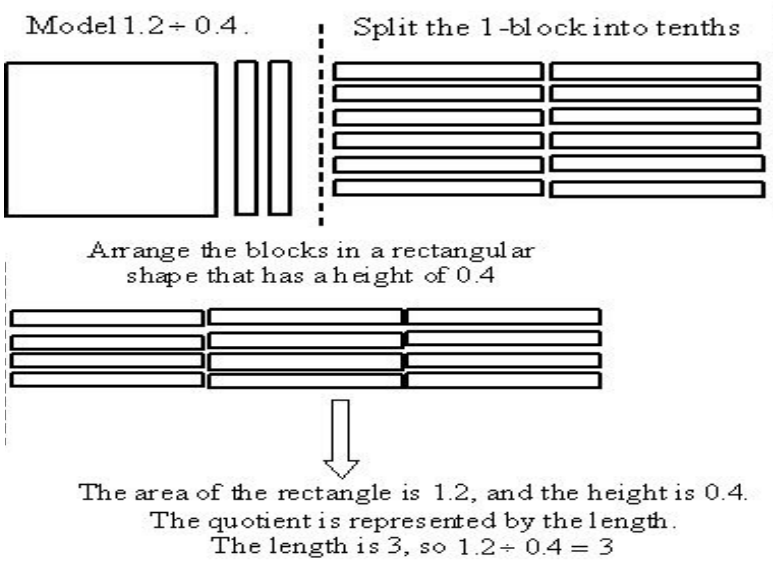
7N2.6 Solve a given problem involving the division of decimal numbers for 1-digit divisors (whole numbers or decimals) without the use of technology.

7N2.7 Check the reasonableness of solutions using estimation.

Elaborations: Suggested Learning and Teaching Strategies

Students will have used base 10 blocks to divide a decimal number by a whole number.

The base 10 area model will be extended to solve problems with 1-digit divisors. The focus is on using division of decimals in a problem solving context.



Again: Estimate **before** Calculate. Develop number sense.

Focus on estimating by rounding to the nearest whole number. This will allow students to correctly place the decimal in their answer by using number sense (not merely counting decimal places).

Students find this challenging when the divisor is smaller than 0.5. They cannot round to 0 as division by 0 is undefined. Another strategy is required to do this estimation.

Consider the following example: $4.2 \div 0.2 = ?$
Students will often think $4 \div 0 = ?$, which is undefined. Have students consider a simple 1 m board which must be sawed into 0.2 m pieces. Five equal pieces can be made. Using this idea, we know that a 4.2 m board is about 4 times larger than the 1 m board and will make 4 times as many pieces (5 x 4 = 20 pieces).

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
In any problem developed for assessment purposes without the use of a calculator, only one digit divisors can be used. *Paper & Pencil* 1. How many 0.3L glasses can be filled from a 1.5L bottle of water?	*Math Makes Sense 7* **Lesson 3.4 (continued)** **AND** **Lesson 3.5** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 22–25 Master 3.15, 3.25 PM 22 CD-ROM Unit 3 Masters ST: pp. 104–107 Practice and HW Book pp. 60–63

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N2. Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected). [ME, PS, T]** ***(Cont'd)***	
Achievement Indicators 7N2.8 Solve a given problem involving the multiplication or division of decimal numbers with more than 2-digit multipliers or more than 1-digit divisors (whole numbers or decimals) with the use of technology.	This achievement indicator allows students to use technology to complete problems. The student text clearly identifies the questions in Lessons 3.4 and 3.5 which lend themselves to the use of calculators.
7N2.5 Place the decimal in a product, using front-end estimation; e.g., for $\$12.33 \times 2.4$, think $\$12 \times 2$, so the product is greater than \$24.	Again: Estimate **before** Calculate. Develop number sense.
7N2.9 Place the decimal in a quotient, using front-end estimation; e.g., for $51.50 \text{ m} \div 2.1$, think $50 \text{ m} \div 2$, so the quotient is approximately 25 m.	

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Journal Carole used her calculator to complete each of the following calculations. Should she accept her answer in each case? Why or why not? A. $24.29 \times 3.8 = 923.02$ B. $8.9 \times 0.4 = 3.56$ C. $36.54 \div 2.9 = 12.6$ D. $8.76 \div 0.4 = 21.9$	*Math Makes Sense 7* **Lesson 3.4** **Lesson 3.5** **(continued)**

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N2. Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals to solve problems (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected). [ME, PS, T]** ***(Cont'd)*** **Achievement Indicators** 7N2.10 Solve a given problem that involves operations on decimals (limited to thousandths), taking into consideration the order of operations.	Students will have already used the order of operations, excluding exponents, but limited to whole numbers. This will now be extended to calculations with decimal numbers. Remember that for more than 1-digit divisors or 2-digit multipliers, the use of technology is necessary. **Note: Exponents will not be discussed at the Gr. 7 level.** Remind students that rules for order of operations are necessary in order to maintain consistency of results. It is important to provide students with situations in which they can recognize the need for the order of operations. Ask students to write a number sentence for the following problem: What is the total cost for a family with two parents and three children for theatre tickets? Children's tickets cost $8.50 and adult tickets cost $14.80. When students write a number sentence such as, 3 x $8.50 + 2 x $14.80, ask if this solution makes sense: 3 x $8.50 = $25.50 + 2 = $27.50 x $14.80 = $407.00. Clearly this answer is not sensible. We cannot simply do the operations in the order they appear. Discuss with students which order is appropriate and why. The order of operations for Grade 7 is as follows: Brackets, Division/Multiplication (from left to right), Addition/Subtraction (from left to right). Specific instruction should be given on calculator use with regard to the order of operations. Students should recognize the necessity of preparing problems for calculator entry. Students should also be aware that different calculators process the order of operations in different ways. Some calculators are programmed to address the order of operations automatically, and others are not.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Journal Compare the solution of $4\times7-3\times6$ with the solution of $4\times(7-3)\times6$. Are the solutions the same or different? Explain your answer. *Informal Observation* Use the calculator to answer the following question: Chris found the attendance reports for hockey games at the stadium to be 2787, 2683, 3319, 4009, 2993, 3419, 4108, 3539, and 4602. If tickets were sold for $12.75 each, and expenses amounted to $258,712.00, what was the profit for the stadium? *Paper and Pencil* 1. Write a number sentence for each of the following and solve it using the order of operations. A. Ms. Janes bought the following for her project: 5 sheets of pressboard at $8.95 a sheet, 20 planks at $2.95 each, and 2 liters of paint at $9.95. What was the total cost? B. Three times the sum of $34.95 and $48.95 represents the total amount of Jim's sales on April 29. When his expenses, which total $75.00, were subtracted, what was his profit? 2. Because the shift key of the keyboard did not work, none of the brackets appeared in these problems. If you have the right answers to both problems, identify where the brackets must have been. Use calculations to demonstrate the correctness of your answer. A. $4+6\times8-3=77$ B. $26-4\times4-2=18$	*Math Makes Sense 7* **Lesson 3.6** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 26–27 Master 3.16, 3.26 CD-ROM Unit 3 Masters ST: pp. 108–109 Practice and HW Book pp. 64–65

General Outcome: Develop Number Sense

Specific Outcome	**Elaborations: Suggested Learning and Teaching Strategies**
It is expected that students will: **7N3. Solve problems involving percents from 1% to 100%.** **[C, CN, PS, R, T]**	**Percents** are simply hundredths and, as such, are a third way of writing both fractions and decimals. Number sense for percent should be developed through the use of **benchmarks**: • 100% is all • 50% is half • 25% is a quarter • 10% is a tenth • 1% is one hundredth Students should be able to easily shift between **percent**, **fraction** and **decimal equivalents** in problem solving situations. For example, when finding 25% of a number, it is often much easier to use $\frac{1}{4}$ and then divide by 4 as a means of finding or estimating the percent. Students should make immediate connections between other percentages and their fraction equivalents, such as 50%, 75%, 33 $\frac{1}{3}$% and 20%, 30%, 40%, etc. Encourage students to recognize that percents such as 51% and 12% are close to benchmarks, which could be used for estimation purposes. Students should be able to calculate 1%, 5% (half of 10%), 10%, and 50% mentally using their knowledge of benchmarks. When exact answers are required, students should be able to employ a variety of strategies in calculating percent of a number.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Interview 1. Explain why 70% is not a good estimate for 35 out of 80. 2. Explain how to estimate the percentage when a test score is 26 correct answers out of 55. 3. Change each of the following to a percent mentally and explain their thinking: $\frac{2}{5}, \quad \frac{4}{25}, \quad \frac{6}{50}, \quad \frac{7}{20}$ 4. Indicate what percent of a book is left to read if the class read 60 out of 150 pages and explain their thinking.	

General Outcome: Develop Number Sense

Specific Outcome

It is expected that students will:

7N3. Solve problems involving percents from 1% to 100%.
[C, CN, PS, R, T]
(Cont'd)

Achievement Indicators

7N3.1 Express a given percent as a decimal or fraction.

7N3.2 Solve a given problem that involves finding a percent.

7N3.3 Determine the answer to a given percent problem where the answer requires rounding, and explain why an approximate answer is needed; e.g., total cost including taxes.

Elaborations: Suggested Learning and Teaching Strategies

Employ a variety of strategies when exact answers are required to calculate the percent of a number:

- changing percent to a decimal and multiplying
  $12\% \text{ of } 80 = 0.12 \times 80 = 9.6$
- finding 1% and then multiplying.
  $1\% \text{ of } 80 = 0.8, \text{ so } 0.8 \times 12 = 9.6$
- changing to a fraction and dividing
  $25\% \text{ of } 60 = \frac{1}{4} \times 60 = 60 \div 4 = 15$
  (This method works best with percentages that are more common.)
- using a calculator to find equivalent fractions
  $20\% \text{ of } 80 = \frac{20}{100} = \frac{4}{20} = \frac{?}{80}, \text{ so } ? = 16$

It is not necessary that a student become proficient in all four methods. The important thing is that a student has a method which works well for them.

The *Explore* activity on p. 111 of the student text, covered on p. 29 of the ProGuide and on Master 3.10, is a review of fractions and decimals, and is an effective introduction to equivalent percent values.

There are times when a full decimal answer does not make sense in a real world point of view. The students will need to learn when answers must be rounded in order to make sense.

Consider the following situations:
A sweater costs $20.99. Sales tax is 13%. How much tax will have to be paid? In this case, students will calculate $0.13 \times 20.99 = 2.7287$. When making purchases, money must be rounded to the cents (hundredths) and students should conclude the tax to be paid is $2.73.

A survey indicated that 42% of the students in a school wanted the cafeteria to add pizza to the menu. If there are 289 students in the school, how many of them want pizza?
In this case, students will calculate $0.42 \times 289 = 121.38$.
Clearly, the student should conclude 121 students want pizza. It makes no sense to speak of 0.38 of a person.

General Outcome: Develop Number Sense

Suggested Assessment Strategies	**Resources/Notes**
Informal Observation 1. Students play the game *Squeeze Play*. A really useful game for comparing and ordering fractions, decimals, and percents, and converting between them. See ProGuide p.v and Master 3.8a. 2. Use a mix-up match-up game in which students each receive a card with either a fraction, a decimal, or a percent. Students must circulate around the room to find the two other students whose cards correspond to theirs. Summarize the activity with the students by asking each group of three why they belong together. See Appendix 3-B. 3. Percent War. (Refer to Appendix 3-C) *Paper and Pencil* 1. Have students create problems that utilize percent. They can be given flyers from local supermarkets and/or department stores and use these to create problems which involve calculating the total savings when certain items are purchased at the sale price. 2. In a recent survey, 56% of students at Triton Middle School work at part-time jobs during the school year. If there are 378 students in the school, is 125, 200, or 560 a reasonable estimate for the number of students who work part time during the school year? 3. Byron took $85 to the mall to buy gifts. He wants to purchase a book for $13, a video game for $18 and a laptop bag for $40. Sales tax is charged at 13%. Does he have enough money with him to make these two purchases? If he does have enough money for all of his purchases, how much money will he have left after he finishes shopping?	*Math Makes Sense 7* **Lesson 3.7** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 29–31 Master 3.10, 3.17, 3.27 CD-ROM Unit 3 Masters ST: pp. 111–113 Practice and HW Book pp. 66–69 *Math Makes Sense 7* **Lesson 3.8** Unit 3: Fractions, Decimals, and Percents TR: ProGuide, pp. 32–34 Master 3.18, 3.28 CD-ROM Unit 3 Masters ST: pp. 114–116 Practice and HW Book pp. 70–72 The resource *Mental Math in the Junior High* includes good practice of these indicators in lessons 45-50.