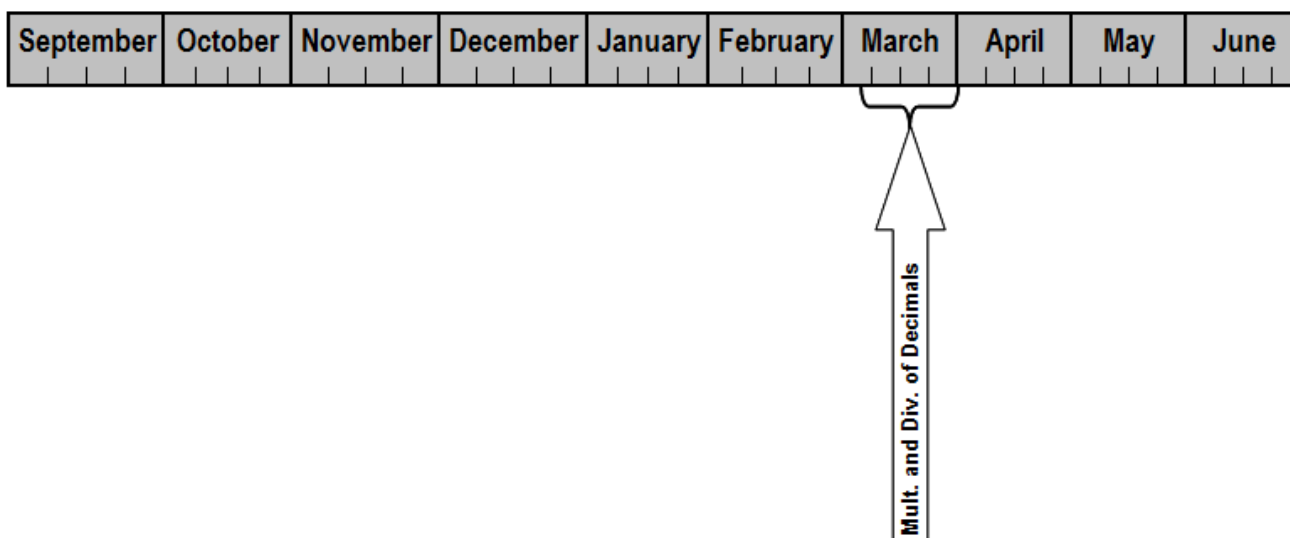


Multiplication and Division of Decimals

Suggested Time: $3\frac{1}{2}$ Weeks



Unit Overview

Focus and Context

This unit will draw upon students' previous knowledge of multiplication and division of whole numbers. The strategies that were previously taught and developed when working with whole numbers should be brought forward for use in this unit. Mental Math strategies are very important in this unit as well.

Estimation strategies are very important as students work with computing decimals. Students should be encouraged to estimate the product or the quotient before calculating the solution. In doing so, they will be able to determine if their calculated answer is reasonable. Estimation is also an essential tool for students to correctly place the decimal point in the product or quotient. As students work through this unit, they will be encouraged to use pencil and paper as well as technology and manipulatives to solve problems involving multiplying and dividing decimals.

Students will be working on multiplication and division of decimals to the thousandths involving single digit multipliers and divisors. Students should be encouraged to use concrete materials, such as base-ten blocks or decimal squares, which will promote a stronger conceptual understanding of the content rather than simply following a set procedure. These concrete and visual representations of student thinking will encourage them to develop, analyze and explain methods for solving problems involving multiplication and division of decimals.

Math Connects

It is very important to make real life connections involving decimals. The most obvious connection for students involves money. Students are familiar with using money and this connection needs to be stressed, especially at the start of this unit. This will help develop a sound understanding of working with decimals. Previous skills involving multiplication and division will be used to further develop the understanding of multiplication and division of decimals.

Process Standards Key

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

Curriculum Outcomes

STRAND	OUTCOME	PROCESS STANDARDS
Number	6N8 Demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors).	[C, CN, ME, PS, R, V]

Strand: Number

Outcomes

Students will be expected to

6N8 Demonstrate an understanding of multiplication and division of decimals (1-digit whole number multipliers and 1-digit natural number divisors).

[C, CN, ME, PS, R, V]

Achievement Indicator:

6N8.1 Predict products and quotients of decimals, using estimation strategies.

Elaborations—Strategies for Learning and Teaching

The focus is on multiplication of decimals with a one digit whole number multiplier. Division of decimals will be addressed later.

Estimation should play a significant role in students' development of personal strategies for multiplication of decimals. As a beginning point, consider this problem:

The farmer fills each jug with 3.7 litres of cider. If you buy 4 jugs, about how many litres of cider is that?

Students should see that 3.7 is about 4 and $4 \times 4 = 16$.

The students will then use any method to determine if their answer is correct. (Repeated addition, doing the actual multiplication, or using a concrete representation).

Students have had prior experience with estimating decimals. At this time, it may be necessary to review these concept with students. The strategies for estimation of decimals are the same as estimation of whole numbers. Students may benefit from practice in estimation of whole numbers prior to focusing on decimals.

Students will begin work on predicting products of decimals using estimation strategies. Quotients will be addressed later. They may need to be reminded of the various methods of estimating:

- **front-end estimation** – a method by keeping the first digit of the number and changing all the other digits to zero.
- **compatible numbers** – a method of using friendly or nice numbers that can be easily calculated mentally.
- **rounding** – a method by which a number is rounded up or down to the nearest whole, tenth, etc.
- **compensation** - a method of adjusting a computational estimate to make it closer to the calculated answer.

E.g., When estimating the product of 2.629 and 4:

* front-end estimation - $2.000 \times 4 = 8$

* compatible numbers - $2.5 \times 4 = 10$ or $3 \times 4 = 12$

* rounding - $3 \times 4 = 12$ or $2.6 \times 4 = 10.4$

* compensation - 2.629×4 . Think $2 \times 4 = 8$ (front end estimation)

0.629 is about $0.5 \times 4 = 2$, thus $8 + 2 = 10$.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Give students a choice of several multiplication expressions involving decimals multiplied by a single digit whole number. Ask them to choose one or two sentences and estimate the solution. Next, ask students to explain how they estimated the product(s) and to justify their thinking. (6N8.1)

Performance

- Ask students to use the information given to determine the better buy:
 - A. Apple juice – 2 L for \$1.99 or 4 L for \$3.89
 - B. Oranges – 4 for \$0.99 or 6 for \$1.59
 - C. Bananas – 3 kg for \$1.89 or 5 kg for \$3.19
 Ask students to explain how they know. (6N8.1, 6N8.2)
- Tell students a decimal number was rounded to 3. Ask them what that number could be. (6N8.1)

Resources/Notes

*Math Focus 6***Lesson 1: Estimating Products****6N8**

TG pp. 12 – 15

The text does not state dollar values with a decimal point. E.g., \$1200 Point out that this should be written as \$1200.00 The decimal point should be put in for even dollar amounts.

Strand: Number

Outcomes

Students will be expected to

6N8 Continued

Achievement Indicators:

6N8.1 Continued

Elaborations—Strategies for Learning and Teaching

Give students many opportunities to practice their estimating skills. As a class warm up, ask students to work in pairs. Each partner gives the other a decimal number and they take turns estimating the given number. As students begin working with estimating products of decimal and whole numbers, this warm up activity could be extended and partners take turns giving each other a number sentence and estimating the product sharing their strategies.

To make real life connections, create problems involving money using catalogues, and flyers, and also sport related data (e.g., speed times for downhill skiing).

As students continue to solve problems involving multiplication of decimals and whole numbers, they are only expected at this point to use estimation to solve the problem and not calculate the actual solution.

It is suggested that students estimate decimal numbers to the nearest whole, at first to make computation of estimated products easier. It is not necessary, at this point, to expect students to mentally calculate products of decimal numbers, as the focus is on estimation.

Base-ten materials, decimal squares, and number lines can be used to represent decimal numbers to help students recognize, for example, that when 3.7 is estimated students can see that it is closer to 4 than 3.

Giving students many opportunities to represent decimals with manipulatives is essential as they progress through their work in the multiplication and division of decimals. **It is important that students need to recognize when representing decimals, the one whole can be represented using different base-ten blocks.**

The book *Piece=Part=Portion: Fraction=Decimal=Percent* can be used to review decimals as it gives a good visual representation of each decimal indicated. Have a discussion about the various pictures and how they represent the decimal.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- As a mental math activity, ask students to find the product of 5.6×2 , using an estimation strategy of their choice. Then expand that to decimals in the hundredths, then the thousandths place. Ask students to explain how they know their estimate is reasonable.
(6N8.1, 6N8.2)
- Give students a grocery store flyer and ask them to select any item for purchase. Ask them if they were going to purchase 6 of the same item, about how much would it cost. They will need to be able to explain the strategy for estimation. Extend this to a specific dollar amount (e.g., \$100.00) and ask students to select the number of this item that they could purchase with this amount of money without going over.
(6N8.1, 6N8.2)

Resources/Notes

*Math Focus 6***Lesson 1 (Cont'd):** Estimating Products**6N8**

TG pp. 12 – 15

Related Literature (provided):Gifford, Scott. *Piece=Part=Portion:
Fraction= Decimal=Percent*

Strand: Number

Outcomes

Students will be expected to

6N8 Continued**Achievement Indicators:**

6N8.1 Continued

6N8.2 Solve a given problem that involves multiplication and division of decimals using multipliers from 0 to 9 and divisors from 1 to 9.

Elaborations—Strategies for Learning and Teaching

Students may want to use these pictures to help them understand the various ways to estimate the given decimal. This book can also be used to model ways to create problem solving situations, where students can practice using their estimation skills to estimate products of decimals and whole numbers. Ask students, for example, to look at the page where there is 1 stick of gum shown out of 5 in the package. Review how this fraction can be written as a decimal, 0.20 where this would represent the remaining sticks of gum in the package. Use this context to engage students in finding out how many packs of gum they would have. The visual representation will help students make the connection that when multiplying a whole number by a decimal, you can get a decimal number. They will be trading parts for a whole and counting what is left to get the answer.

Students should have a solid understanding of multiplying a single-digit whole number by a decimal number in the tenths place before they move on to multiplying a whole number by a decimal in the hundredths and thousandths place. The use of base-ten grids or decimal squares will help students visualize of the concept.

In previous work, students were only expected to solve problems using estimation. Now, students will continue to use their estimation strategies to solve problems but will also be expected to find the exact answer. Their estimate answer will now verify the reasonableness of their exact answer.

Students should be given opportunities to experience ‘real life’ estimation situations and realize that the most important estimate is not always the closest to the actual answer. E.g., If you needed 2.2 metres of string to wrap a parcel and you have 3 parcels to mail, how much string would you need? Most students would say $2 \times 3 = 6$ metres. While this is a close estimate, it would be inappropriate since you would not have enough string to wrap the parcel.

Most students should be able to easily relate money to decimals. This will be an easy concept to work with as flyers and catalogues can be used to show real life examples of decimals. Students can also talk about saving their allowances to buy something special, or solve problems where they are given a certain amount of money and can go on a shopping spree.

(continued)

 General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask the students to draw or build a model to illustrate $4 \times \$1.36$ and show the answer. Ask students to create a story problem based on the multiplication sentence and share it with a partner to solve. (6N8.2)
- Give students a grocery flyer and ask them to choose 3 of their favourite items. Ask them to determine how many of each item they could buy with \$90.00. (6N8.1, 6N8.2)

Paper and Pencil

- Ask students to determine how much more five cans of juice cost at \$1.29 each than 6 cans at \$0.99 each. (6N8.2)
- Present the following: Milk at school costs \$0.55. If there are 8 students in your class who order one milk per day, how much would it cost each day for milk in your class? How much would it cost for one week? (6N8.1, 6N8.2)
- Pose the following to students: If one school basketball jersey costs \$18.49, about how much would it cost to buy 9 jerseys. Show how you got your answer pictorially and explain your thinking. (6N8.1, 6N8.2)

Resources/Notes

Math Focus 6

Lesson 1 (Cont'd): Estimating Products

6N8

TG pp. 12 – 15

Math Focus 6

Lesson 2: Multiplying Money Amounts by One-Digit Numbers

6N8

TG pp. 16 - 19

Strand: Number

Outcomes

Students will be expected to

6N8 Continued

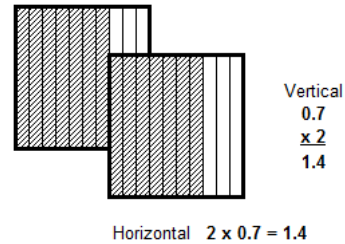
Achievement Indicator:

6N8.2 Continued

6N8.3 Place the decimal point in a product, using front-end estimation; e.g., for $15.205\text{ m} \times 4$, think $15\text{ m} \times 4$, so the product is greater than 60 m .

Elaborations—Strategies for Learning and Teaching

It is important that students draw or build models to show the multiplication sentence involving decimals. E.g., 2×0.7



Show the students (or ask them to find) 2 decimal squares for 0.7. Overlap them to illustrate the total shaded amount so students can see how one whole is created and how many parts of another whole there are.

Another way to illustrate this example is to use base-ten blocks. Students can represent 0.7 using seven rods, where one flat is equal to one whole. They could make 2 groups of 7 rods and see that there is a total of 14 rods. Knowing there are 10 rods in a flat, students should understand that 14 rods equals one whole and 4 tenths. Students can also use a number line to represent 2×0.7 . After placing 0.7 on the line, students could move another 0.7 along the line to arrive at 1.4.

Students need to know about the placement of the decimal points in the product of a multiplication problem. To do this, they could use front-end estimation.

E.g., There are 3 CDs that cost \$12.69 each. How much money would you need to buy these 3 CDs?

Which is the best choice for the correct answer?

- A) 380.70
- B) 3.807
- C) 38.07
- D) 3807.00

Think: Round 12.69 to 12 and $12 \times 3 = 36$. The answer from our choices has to be close to 36.

Patterns can be used to help students understand the placement of the decimal in the product of two decimal amounts.

E.g., $420 \times 4 = 1680$ $42 \times 4 = 168$ $4.2 \times 4 = 16.8$

Decimal placement can also be explored using a calculator but it is important that students practice applying mental math strategies.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Tell students to look at the following number sentence where the decimal point has been left out. Ask them to estimate the product to determine the placement of the decimal. Ask them to explain how estimation helped them correctly place the decimal point in the product.

$$3 \times 16.17 = 4851$$

(6N8.3, 6N8.1)

Portfolio

- Each product is missing a decimal point. Place the decimal in each product. Explain one answer.

(i) $15.97 \times 3 = 4791$

(ii) $4.326 \times 7 = 30282$ (6N8.4)

Resources/Notes

*Math Focus 6***Lesson 2 (Cont'd):** Multiplying Money Amounts by One-Digit Numbers**6N8**

TG pp. 16 - 19

Strand: Number

Outcomes

Students will be expected to

6N8 Continued**Achievement Indicators:**

6N8.4 Correct errors of decimal point placement in a given product or quotient without using paper and pencil.

6N8.2 Continued

Elaborations—Strategies for Learning and Teaching

Estimation is essential when determining the correct placement of the decimal in the product when multiplying a whole number by a decimal. Applying estimation strategies will help students correctly place the decimal point in the product.

E.g., You go to the store to buy 9 cases of water. Each case costs \$6.69. The cashier tells you the total is \$602.10. You know immediately that this is wrong. Explain what you think the cashier did to get this total.

Having students solve problems involving money will help them make a connection between using decimals in school and real life experiences. Putting decimals in the context of money rather than letting the decimal number stand alone will make learning more meaningful.

Using the book, *Math Curse* students can explore the various ways the character in the book finds decimals in his daily life. Ask students to discuss where they see and use decimals in their lives. Using the same context of the book, ask students to record all the ways they use decimals in one day, especially when they use multiplication of decimals to figure out a problem. For example, they may go to the cafeteria and buy three cookies for \$0.35 each. They would then need to know if \$1.00 is going to be enough money to buy all 3.

Give students 'play' money, (e.g., \$100.00) and various catalogues or flyers. Ask them to spend their money buying items of interest. The tricky part is that they have to buy the same item for their 2 friends. Ask them to make a list of things to buy and keep a record of how much they spend. Ask them to present to the class, what they would buy and how they were able to come up with the total cost. Students could also be encouraged to talk about how estimation of prices helped them to determine if the item(s) were affordable.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Ask students to explain why the product of 0.6 and 3 will have a digit in the tenths place. Use words, pictures and numbers to explain your thinking. (6N8.2)
- Ask students to explain whether or not John is right when he says that the answer to 4×4.5 is 0.18.
Ask them to use pictures, numbers and words to explain their thinking. (6N8.3, 6N8.4, 6N8.1, 6N8.2)

Presentation

- Give students several examples of multiplication sentences with the answers given. Place the decimal point in an incorrect spot and ask students to explain why the decimal place does not go there and explain where it should go and why.

E.g., $4.35 \times 6 = 2.615$

$6.487 \times 2 = 129.74$

(6N8.3, 6N8.4, 6N8.1)

Resources/Notes

Math Focus 6

Lesson 2 (Cont'd): Multiplying Money Amounts by One-Digit Numbers

6N8

TG pp. 16 - 19

Children's Literature (provided):

Scieszka, Jon and Smith, Lane.

Math Curse

Strand: Number

Outcomes

Students will be expected to

6N8 Continued

Achievement Indicators:

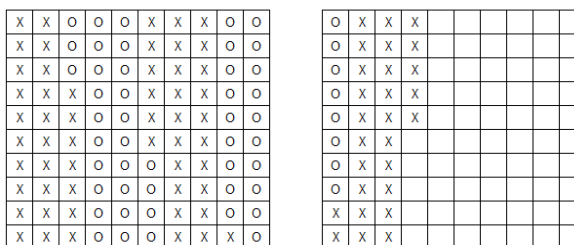
6N8.2 Continued

Elaborations—Strategies for Learning and Teaching

It is important for students to use manipulatives such as base-ten materials or decimal squares, as it may help them visualize the concept of multiplication more easily. Also, previous work on multiplying decimals in a money context may enable students to think about what the decimal means in a more meaningful manner. Although Grade 6 students have had prior experience modelling decimals where they would have used different blocks to represent one whole, it may be necessary to review this concept again as some students may struggle with the idea that one whole can be represented in different ways.

Using decimal squares, ask students to shade a blank hundreds grid (decimal square) to represent 0.27. Ask them how they could now use this square to represent or show 5×0.27 . Students should come to recognize that if they shaded 5 groups of 0.27 on the grid that they could represent the product of these numbers. Students can then be asked to explain other ways they could obtain the product.

The squares shown here indicate that the shading was done by repeatedly shading 27 parts (x's and o's) to fill up the squares where 135 blocks in total are shaded or 1 whole and 35 hundredths.

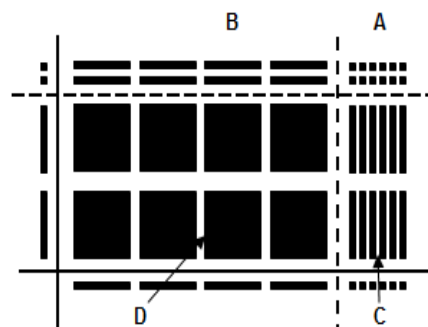


$5 \times 0.27 = 1.35$

Another strategy students could use to help them solve multiplication problems involving decimals is the area model. This model may have already been introduced to students in Grade 5 in multiplying whole numbers and now can be used to multiply whole numbers and decimals.

Demonstrate using a rectangle and base-ten materials students, as shown, to multiply 4.6×2.2 . The dotted lines divide the rectangle into sections.

$$\begin{array}{r}
 4.6 \\
 \times 2.2 \\
 \hline
 0.12 \text{ (12 hundredths) - A} \\
 0.8 \text{ (8 tenths) - B} \\
 1.2 \text{ (12 tenths or 1.2) - C} \\
 8 \text{ (8 ones) - D} \\
 \hline
 10.12
 \end{array}$$



General Outcome: Develop Number Sense

Suggested Assessment Strategies

Portfolio

- Tell students that a person's hair grows an average of 0.83 cm a month. Ask students to predict how long a child's hair would grow in 9 months if they never had a haircut. Ask them to explain their estimate. (6N8.1)

Resources/Notes

Math Focus 6

Lesson 3: Multiplying Decimals by One-Digit Numbers

6N8

TG pp. 20 - 24

Additional Reading (provided):

Van de Walle, John and Lovin, LouAnn H. (2006) *Teaching Student-Centered Mathematics, Grades 3-5*. pp.116-117

Strand: Number

Outcomes

Students will be expected to

6N8 Continued**Achievement Indicator:**

6N8.3 Continued

6N8.4 Continued

Elaborations—Strategies for Learning and Teaching

As students continue working with multiplication of decimals and whole number multipliers, they should be encouraged to continue to use estimation to verify that the answers to problems they solve are reasonable. One of the suggested estimation strategies is front-end estimation, where students simply look at the first digit and round all other digits to zero. Students should be cautioned that although this is a sound strategy for estimation, especially in correctly placing decimal points, it may be misleading. To illustrate this point, ask students to consider the following example:

Jillian is building a wood box. She measures the length to be 2.98 m, the width, 1.87 m and the height 1.6 m. To determine the amount of board she needs, Jillian uses front end estimation to get an idea of how much material to buy. What might happen if Jillian uses this strategy without finding the exact amount of board needed?

Students need to practice where to place the decimal point in a given product. Teach students to place the decimal point in products by methods other than simply counting decimal places in the factors as this does not promote an understanding of place value or number sense. The important concept students need to understand is the place value of the digit in the product will change according to the placement of the decimal. In an example such as $1.255 \times 2 = 2.51$ students should see that counting the decimal places will not help them verify if this answer is correct.

Help students to see the decimal number in terms of its value. For example, students should see that 1.62 is a little more than 1 and one half. When solving a problem that involves multiplying, for example 1.62 by 5, students should see the product would be a little greater than 5, but less than 10 as 1.62 is less than 2. They should also see that the exact product will be a little more than 7.5, as 5 groups of 1.5 is 7.5.

When making predications about the product of a decimal number and its whole number multiplier, the product has to be reasonable based on previous knowledge of decimals and place value. When students look at problems involving multiplication, they should be able to come up with a reasonable answer and be able to justify how they came up with that answer. This will not be automatic for some students and practice with manipulatives will be beneficial.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Tell students Jack wanted to pay each of his 3 friends \$10.15 each for helping him paint his shed. Ask students to estimate the total amount of money that Jack will have to pay to his friends. (6N8.3, 6N8.2)
- Ask students to explain why the decimal point in each of the following problems, is in the wrong place.
 - (i) Fred calculated that $315.2 \times 2 = 63.04$
How do you know his answer is incorrect? What is the correct answer? Show your workings.
 - (ii) The postman gave 9 students stamps that were valued at \$10.45 each. “The total cost of the stamps is \$940.50” exclaimed one student. Was she correct in saying that? Explain. (6N8.3, 6N8.4, 6N8.1)
- Tell students Mr. Brown took his family of 8 to a local fast food restaurant. A meal for each person cost \$9.59. Ask students to estimate what Mr. Brown’s bill will be before taxes and to calculate the total cost. Show your workings and strategies. (6N8.1, 6N8.2)
- Allie bought three bags of bird seed. Each bag weighed 0.398 kg. What is the total mass of all three bags of bird seed? Demonstrate your understanding in two different ways. (6N8.2)

Journal

- Ask students if they were to predict the answer for $\$21.57 \times 5$, would it be greater or less than one hundred? Ask them how do they know. (6N8.1)

Paper and Pencil

- Ask students to use base-ten blocks or decimal squares to solve the following:
 - (i) 4.8×2
 - (ii) 7.3×8
 - (iii) 3.1×7
 - (iv) 7.37×7
 - (v) 8.12×3
 (6N8.3, 6N8.2)
- Ask students to find the numbers that, when multiplied, give the products shown:

$$\begin{array}{r} \square \cdot \square \\ \times \square \\ \hline \square \square \square \end{array} \quad \begin{array}{r} \square \cdot \square \\ \times \square \\ \hline \square \square \square \end{array}$$

(6N8.3, 6N8.1, 6N8.2)

Resources/Notes

*Math Focus 6***Lesson 3: Multiplying Decimals by One-Digit Numbers****6N8**

TG pp. 20 - 24

Strand: Number

Outcomes

Students will be expected to

6N8 Continued**Achievement Indicators:**

6N8.5 Place the decimal point in a quotient, using front-end estimation; e.g., for $\$26.83 \div 4$, think $\$24 \div 4$, so the quotient is greater than \$6.

6N8.1 Continued

6N8.2 Continued

Elaborations—Strategies for Learning and Teaching

Focus is now on division of decimals involving 1 digit natural number divisors.

Many of the personal strategies students use to compute division using whole numbers can also be applied to division of decimals. Using base-ten materials hand in hand with these strategies will help students to become more efficient and accurate when dividing decimals.

The concept of division involving decimals is new to students in Grade 6. Therefore, it will be necessary to begin with a review of division of whole numbers (2-digit and 3-digit by 1-digit divisors) before beginning work on dividing decimal numbers.

As with multiplication of decimals, estimation should precede all calculations when beginning work on division of decimals. Students will only be expected to estimate quotients up to this point and will be required to calculate exact quotients later in the unit. These estimations will be a basis for students to test the reasonableness of their answers in later work. It is important that students use proper terminology when working with division. The use of key words such as quotient, divisor and dividend, should be encouraged.

Students have used front-end estimation as they multiplied decimal numbers by 1-digit whole numbers. Now they will use this estimation strategy to work with division of decimals and natural numbers in appropriately placing the decimal point in the quotient. Show students that by rounding the decimal number to the nearest whole number (that is a multiple of the divisor), they can then more easily identify a reasonable solution to the problem.

As in predicting products using estimation strategies, students can now use these same strategies to predict quotients of decimals. Students could also use the ‘think multiplication’ strategy as they predict quotients of decimals.

Also, students should be encouraged and provided with opportunities to use mental math to complete estimation problems. This can be achieved by having students practice estimating numbers on a regular basis.

Solving problems involving division of decimals may be a little more challenging for some students than multiplication of decimals. Using real life situations when presenting problems so that the numbers and operations have some sort of context for the students may make it easier for them to grasp. It is imperative to ask students to use manipulatives to model given problems where they can physically break apart the decimal numbers. This will help reinforce the concept of division.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

Present the following stories to students:

- Paula is building a bird house and she needs to have 24.6 m of lumber to complete the project. Each piece of lumber is 3 m long. Ask students about how many pieces of lumber will she need to build the bird house? (6N8.1, 6N8.5)

- Philip is going to the store. He has \$15.00 in his pocket and he wants to buy as many trays of strawberries as he can. One tray of strawberries cost \$3.69. Ask students how can estimation help Philip determine how many trays he can buy with his \$15.00? (6N8.5, 6N8.1, 6N8.2)

- Ask students to think of a situation where it is more practical to estimate the quotient involving a decimal dividend rather than finding the actual answer. Explain. (6N8.1, 6N8.2)

- Ask students to think of a situation where front-end estimation would not be the best estimation strategy to use when solving a division problem involving decimals. (6N8.1, 6N8.2)

- Engage students in Mental Math activities encouraging the use of front – end estimation. Ask them to estimate the following quotients.
 - (i) $36.317 \div 2$
 - (ii) $45.036 \div 3$
 - (iii) $16.02 \div 4$
 - (iv) $80.987 \div 9$ (6N8.5)

Portfolio

- Ask students to create their own math assignment, accompanied by the answer key, that would require them to use different estimation strategies to solve division problems. Encourage students to share their assignments with the class. (6N8.5, 6N8.1, 6N8.2)

Resources/Notes

*Math Focus 6***Lesson 4:** Estimating Quotients**6N8**

TG pp. 29-32

Strand: Number

Outcomes

Students will be expected to

6N8 Continued

Achievement Indicator:

6N8.2 Continued

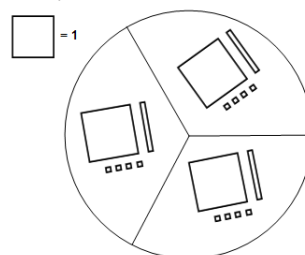
Elaborations—Strategies for Learning and Teaching

Division can be approached in a manner exactly parallel to multiplication. In fact, the best approach to a division estimate generally comes from thinking about multiplication rather than division.

Students will need a lot of practice with division of decimals. Use story problems and real life situations to create problems to be solved.

It is very important that students have a lot of opportunities to practice division of decimals using manipulatives and visual representations. Students can not be expected to solve division problems involving decimals using symbolic notation before completing work with this concept using ‘hands on’ materials. A strategy to introduce division of decimals by whole numbers would be to show students how to break apart a decimal into the desired number of groups. In using base-ten blocks, ask students to model or represent the decimal number to be divided. Ask them to indicate how many equal groups they need to break the decimal number into. Following the idea of equal sharing, ask students to share each of the base-ten blocks into the desired number of groups where they would share out all the flats, then the rods and so on. In doing this, some students may not recognize they can not share, for example 4 rods into 5 groups. They may continue their sharing by placing the 4 rods into the four available groups with the fifth group not having a rod. Students will need to be reminded in this case, the rods can be broken into units where equal shares are then possible. It is important that students continue to use manipulatives to model division of a decimal by a whole number when solving problems. Present examples, such as the following:

$3.42 \div 3$ – show your answer pictorially.



In the thinking multiplication strategy, students can look at the number of equal groups and think about what possible decimal number would be needed in each group to total the dividend.

E.g., $12.33 \div 3$

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Ask students to write a story problem using the following division sentence.

$$96.6 \div 7$$

- Ask students to find the quotient of $2.4 \div 4$. Ask them to show how they would use base-ten blocks to help. (6N8.2)

Resources/Notes

Math Focus 6

Lesson 5: Exploring Division of Decimals

6N8

TG pp. 33 - 36

Strand: Number

Outcomes

Students will be expected to

6N8 Continued**Achievement Indicator:**

6N8.2 Continued

Elaborations—Strategies for Learning and Teaching

Students would determine how much would be in 3 equal groups that would total 12.33. They could think that there has to be at least 4 wholes in each group as $4 \times 3 = 12$ with 0.33 left over. They could then see that there would be 0.1 in each group with 0.03 left over. From there, they could see that 0.01 would fit into each group. In total, there would be 4.11 in each group with no remainder. Students beginning this strategy would be strongly encouraged to use base-ten to model their thinking.

Students' attention must be drawn to the fact that when there is a remainder in a division equation, it does not mean a whole number – it means part of a whole number (a decimal).

In addition to having used estimation and creating models to divide decimals by one digit whole numbers, students need to formalize their understanding and connect the concrete and pictorial models to symbolic representation (using the algorithms).

Students have been working with solving problems using concrete materials and visual representations. This work should have allowed them to gain a good conceptual understanding of division. Now, students will formalize their understanding and connect the concrete and visual models to symbolic representations of division. Students cannot be expected to successfully accomplish this concept without first physically manipulating materials to divide decimal numbers.

When solving problems involving division of decimals, students need to be encouraged to choose their own strategies and be able to communicate their understanding of how their strategy works. Students will need time to develop critical thinking skills as they discover and begin to use more efficient strategies.

It is suggested that students focus on creating their own strategies to divide decimal numbers rather than following the traditional procedure. Students who can follow the steps to divide a decimal number by a whole number using the traditional algorithm does not necessarily show that they have an understanding of division. They do show they understand, or remember how to do the algorithm.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Give students the following problems and ask them to solve them.
 - Susie had 25.55 metres of string. She needed to hang 5 balloons from the gym ceiling. Ask students how much string did she use for each balloon if she hung each one equally? (6N8.1, 6N8.2)
 - A group of 7 students ordered pizza and the total cost was \$51.45. Ask students how much would each student have to pay if they shared the cost equally? (6N8.1, 6N8.2)
 - Tell students five friends found 4 loonies on the road. They are now trying to figure out how to equally share this amount. Ask students to help the friends by showing them how this could be done. (6N8.2)

Resources/Notes

Math Focus 6

Lesson 5 (Cont'd): Exploring Division of Decimals

6N8

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Math Focus 6

Lesson 6: Dividing Decimals by One-Digit Numbers

6N8

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Math Game: Low as You Go

6N8

TG pp. 42 – 43

Curious Math: Magic Squares

6N8

TG pp. 44 - 45

Strand: Number

Outcomes

Students will be expected to

6N8 Continued**Achievement Indicator:**

6N8.5 Continued

Elaborations—Strategies for Learning and Teaching

Before students begin multiplying decimals, it is useful to look at patterns with respect to the effect multiplying whole numbers by 0.1 and 0.01 and decimals by 10, 100 and 1000.

Multiplying or dividing by powers of 10 does not change the digits of a number, only the POSITION of each digit within the number. E.g., if you begin with 3.4, dividing by 10 or multiplying by 0.1 decreases the value of each part of the number by a factor of 10, and so the digits in the product change value and more over one place to the right, e.g., 3 ones are now 3 tenths, 4 tenths are now 4 hundredths. It is actually the digits that move, not the decimal point. (Small 2008. *Making Math Meaningful to Canadian Students K-8*)

6N8.2 Continued

When solving problems, students should be encouraged to use various strategies that enable them to work through problems to find a solution. As students engage in problem solving activities each day, ask them to keep track of the strategies they use to solve a problem. Model the use of these strategies with students and always look for opportunities (teachable moments) where students solve similar problems using different strategies. It is here that students will see that there really is more than one way to solve a problem.

One strategy Grade 6 students should become aware of is that of working backwards. The working backwards strategy sees students do something that reverses an action given in the problem. It may mean taking the total amount given and finding how that total was achieved or starting with the end result and reversing the steps you need to get those results.

Provide students with many examples of problems that could be solved using the working backward strategy. Model with the class how the strategy could be used. Explain that as in every strategy, the way it is used is determined by the context of the problem. To illustrate a problem that could be solved using the “working backward” strategy ask students to consider the following:

Dylan found a piece of lumber in his shed. He cut 12.34 cm off each end where the piece was broken. Then he cut the remaining piece of lumber into 3 equal pieces. Each piece is now 21.57 cm long. How long was the piece of lumber when Dylan found it?

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Katie said that 3.45×4 must be 1.380 because there is only one digit before the decimal place in 3.45, so there must be one digit before the decimal place in the product. Respond to what Katie said.
(6N8.3, 6N8.5, 6N8.4, 6N8.2)

Performance

- Ask students to answer the following questions:
 - (i) Keith cut 0.5 m from a length of rope. Then he cut what was left into four equal pieces. If each of the four pieces was 1.25 m long, what was the length of the rope before Keith cut it? (6N8.2)
 - (ii) Evan downloaded four songs on MP3 files from the Internet. Two file sizes were 2.7 MB, three were 4.6 MB, and the others were 2.7 MB, and 8.1 MB (MB - megabyte). After the downloads, the disk where he stored the files held 35.5 MB of data. How much data was on the disk before the downloads?
(6N8.2)

Resources/Notes

Math Focus 6

Lesson 6 (Cont'd): Dividing Decimals by One-Digit Numbers

6N8

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Math Focus 6

Lesson 7: Solving Problems by Working Backwards

6N8

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