

## ► Grade 4 Topic 10: Extend Multiplication Concepts to Fractions

**Big Conceptual Idea:** [Number and Operations- Fractions](#) (pp. 121-125)

Prior to instruction, view the *Topic 10 Professional Development Video* located in Pearson Realize online. Read the Teachers' Edition (TE): *Cluster Overview/Math Background* (pp. 461A-461F), the *Topic Planner* (pp. 539I-539K), all 6 lessons, and the *Topic Assessments* (pp. 585-586A).

<p><b>Mathematical Background:</b> Read Cluster Overview (TE, pp. 461A-461F)</p>	<p><b>Topic Essential Questions:</b> How can you describe a fraction using a unit fraction? How can you multiply a whole number by a mixed number?</p> <p><i>Reference TE (p. 539) and Answering the Topic Essential Questions (TE, pp. 583-584) for key elements of answers to the Essential Questions.</i></p>
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**Topic 10**  
**Extend Multiplication Concepts to Fractions**

Number of lessons: **6**

A/D/E: **3** days

**NVACS Focus:**  
NF.B, MD.A

**Total Days: ~9**

[4<sup>th</sup> grade Curriculum](#)  
[Pacing Framework:](#)  
[Balanced Calendar](#)

**The lesson map for this topic is as follows:**

10-1	10-2	10-3	10-4	10-6	10-5	Assessment
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3 A/D/E days used strategically throughout the topic.

### **Instructional note:**

This topic is the last of the cluster group for standard 4.NF.B, "build fractions from unit fractions by applying and extending previous understanding of operations of whole numbers" (Nevada Academic Content Standards (NVACS), 2010). Focus instruction on 4.NF.B.4, which is to apply and extend previous understanding of multiplication to multiply fractions by a whole number. Students "first experience with multiplication of fractions should involve finding fractions of whole numbers" (Van de Walle, Karp, Bay-Williams, 2010, p. 317).

Models are important when students are beginning to understand fractional concepts. The different models give students various opportunities to learn fractions. These different models include; region or area, length or number line and set models. For example, "an area model helps students visualize parts of the whole. A linear model shows that there is always another fraction to be found between any two fractions-an important concept that is underemphasized in the teaching of fractions" (Van de Walle, et al., 2010, p. 288). Van de Walle, et al. (2010), continues to emphasize the use of models, "It is important to remember that students must be able to explore fractions across models. If they never see fractions represented by length, they will struggle to solve any problem or context that is linear. As a teacher you will not know if they really understand the meaning of fractions unless they can model a fraction using different context or models" (pp. 290-291).

"Students can also use the distributive property and find the partial products, just as they do when multiplying two-digit whole numbers. The process is more conceptual and also lends itself to estimation, either before the partial products are determined or after" (Van de Walle, et al., 2014, pp. 246-247). "Misconceptions can be intensified when students are too quickly pressed to memorize rules, such as "multiply both the top and bottom" and are not given adequate time to explore multiplication of fractions conceptually" (Van de Walle, et al., 2014, p. 247). Van de Walle, et al., go on to list a variety of misconceptions students develop about multiplication of fractions:

- treating the denominator the same as in addition/subtraction problems
  - inability to estimate approximate size of the answer due to the idea that "multiplication makes things bigger"
  - matching multiplication situations with multiplication, not division
  - using key word strategies
- (2014, p. 247)

### **Math Practice 4: Use tools strategically**

Focus opportunities for students to develop *Mathematical Practice 4* behaviors, as this is the focus of the Math Practices and Problem Solving, lesson 10-6. Reference the Teacher's Edition (pp. F24-F24A) and the NVACS (2010, p. 7).

**Note:** The purpose of the curriculum guides is for additional considerations. Therefore, not all components may have additional notes included in this guide.

<b>Essential Academic Vocabulary</b> Use these words consistently during instruction.	
<b>New Academic Vocabulary:</b> (First time explicitly taught)	<b>Review Academic Vocabulary:</b> (Vocabulary explicitly taught in prior grades or topics)
	<i>unit fraction</i> <i>mixed number</i>

**Additional terminology that students may need support with:** equations, whole, part of the whole, expression, distributive property, partial products, time, area model or open array

**\*Collaborative Team Conversations (CTC)**

Consider using *one* of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for evidence of mathematical understanding:

**Guiding question:** "Are students developing conceptual understanding and moving their thinking from less sophisticated understandings (fraction strips) toward equations through use of repeated addition or multiplication?"

Lesson	Evidence	Look for
10-3	<b>Solve &amp; Share</b> (student work samples)	Focus CTC around the big idea: <ul style="list-style-type: none"> <li>• student strategies and models.</li> <li>• use of repeated addition of the unit fraction or fraction.</li> <li>• use of multiplication of a whole number by a fraction or unit fraction.</li> </ul>
10-6	<b>Quick Check</b> (digital platform)	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".

Learning Cycle Assessments (summative)	<b>Topic Performance Assessment</b> SE pp. 585-586	Use <i>Scoring Guide</i> TE pp. 585-586A
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Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
<b>Lesson 10-1: Fractions as Multiples of Unit Fractions- Use Models</b>		
<b>4.NF.B.4a</b>  MP.2 MP.4 MP.7	<p><b>Access Prior Learning:</b> In third grade, students learned the meaning of multiplication, including as repeated addition. In the previous topic, students learned to represent a fraction <math>a/b</math> as a sum of the fractions.</p> <p><b>Beginning of the Big Idea:</b> In this lesson, students combine these understandings to write a fraction <math>a/b</math> as a product of a <math>x \times 1/b</math>.</p>	<p><b>Solve &amp; Share:</b> Consider changing the <i>Solve &amp; Share</i> and instead use item 19 from <i>Math Practices and Problem Solving</i> to elicit more student strategies and to increase the cognitive demand. Item 19 states, "Mark is slicing tomatoes for 4 members of his family. Each person will get <math>1/6</math> of the tomato. What fraction of the tomato will Mark slice?" Consider connecting the <i>Solve &amp; Share</i> to item 19 after students have had opportunity to work on the problem, shared strategies and a discussion has taken place.</p> <p><b>Visual Learning:</b> The mathematics terminology, unit fraction, is discussed in the <i>Visual Learning</i>. Students use the unit fraction to show multiplication as repeated addition. Students make connections to previous grade and topics to solve fraction multiplication problems. Consider reading the <i>Prevent Misconception</i> prior to the lesson to support students as they multiply fractions (Teacher's Edition (T.E.), p. 544).</p> <p><b>Convince Me:</b> Consider facilitating a discussion around the <i>Convince Me!</i> to connect ideas in this lesson to ideas in Topic 9 related to the parts of the fractions and their meaning.</p> <p><b>Another Example:</b> The <i>Another Example!</i> connects unit fractions to a fraction greater than one. Consider giving students opportunity to use tools as a discussion is facilitated around the problem. Connect the <i>Another Example!</i> to the <i>Visual Learning Animation</i>.</p> <p><b>Independent Practice/Math Practices and Problem Solving:</b> Students do not need to do all the problems in their Student Edition. Ask students to complete the <i>Quick Check</i> items (marked with a pink check mark) first and continue on to other items as appropriate. Consider giving students multiple opportunities to use various strategies, tools and models to complete the problems to extend their understanding.</p>

Lesson 10-2: Multiply a Fraction By a Whole Number- Use Models		
<p>4.NF.B.4b 4.NF.B.4a 4.NF.B.4c</p> <p>MP.2 MP.4 MP.7 MP.8</p>	<p><b>Access Prior Learning:</b> In the previous lesson, students learned to write a fraction as the product of a whole number and a unit fraction.</p> <p><b>Developing the Big Idea:</b> In this lesson, students will learn to multiply a whole number by a fraction as repeated addition of a fraction.</p>	<p><b>Solve &amp; Share:</b> Consider giving students an opportunity to use tools and other representations to solve the problem. Share student strategies who may have used concrete tools, representations like a bar diagram, repeated addition or multiplication to solve the problem. As an extension, consider having students compare the two different quantities.</p> <p><b>Look Back:</b> Consider facilitating a discussion around the <i>Look Back!</i> as students revisit equivalency.</p> <p><b>Visual Learning:</b> Consider reading the <i>Prevent Misconceptions</i> prior to teaching the lesson (TE, p. 550). In the <i>Visual Learning Animation</i>, students learn to multiply using repeated addition by drawing pictures or drawing a number line to show the distance Dori walks. Consider having students solve the problem before showing the video.</p> <p><b>Convince Me:</b> Consider using the <i>Convince Me!</i> to facilitate a discussion as students need to understand that both addition and multiplication can be used, due to joining equal-sized groups.</p> <p><b>Another Example:</b> Consider facilitating a discussion based on the connection between the <i>Convince Me!</i> and <i>Another Example</i> to show how addition and multiplication can be used.</p> <p><b>Assess and Differentiate/Intervention Activity:</b> Consider using the <i>Intervention Activity</i> to reinforce the unit fraction.</p>
Lesson 10-3: Multiply a Fraction By a Whole Number- Use Models		
<p>4.NF.B.4b 4.NF.B.4a 4.NF.B.4c</p> <p>MP.2 MP.4 MP.6 MP.7</p>	<p><b>Access Prior Learning:</b> In the previous lesson, students used models to multiply whole numbers by a fraction.</p> <p><b>Beginning of the Big Idea:</b> In this lesson, students will learn and apply two procedures to multiply fractions by a whole number.</p>	<p><b>Solve &amp; Share:</b> Provide students the opportunity to use tools and/or models to solve the problem. Consider removing the "Think Bubble" from the <i>Solve &amp; Share</i> to formally assess student's strategies used. The <i>Solve &amp; Share</i> is considered a rate problem as students are given the unit ratio to find how many cups of orange juice for 8 gallons. This may be more difficult to access for students; yet is a necessary part of the standards in 4<sup>th</sup> grade (multiplicative comparison).</p> <p><b>Visual Learning:</b> Consider reading the <i>Prevent Misconceptions</i> before teaching the lesson (TE, p. 556). Be cautious when showing students, a procedure for multiplying fractions. Connect the procedures to the Associative Property and consider letting students make connections between the procedures and models by giving them an opportunity to use what they have previously learned.</p> <p><b>Independent Practice/Math Practices and Problem Solving:</b> Students do not need to do all the problems in their Student Edition. Ask students to complete the <i>Quick Check</i> items (marked with a pink check mark) first and continue on to other items as appropriate. Consider giving students multiple opportunities to use various strategies, tools and models to complete the problems.</p> <p><b>Assess and Differentiate/Intervention Activity:</b> Consider encouraging students to use tools or representations before having students apply the procedures learned in the <i>Visual Learning</i>.</p> <p>*CTC: <i>Solve &amp; Share</i> (student work samples)</p>
Lesson 10-4: Multiply a Whole Number and a Mixed Number		
<p>4.NF.B.4c</p> <p>MP.1 MP.3 MP.7</p>	<p><b>Access Prior Learning:</b> In Topic 3, students learned how to use the distributive property and partial products to multiply whole numbers. In Topic 9, they learned how to rename a mixed number as a fraction greater than one. In the previous lessons, students learned how to multiply a whole number by a fraction.</p>	<p><b>Solve &amp; Share:</b> Consider encouraging students to use tools and representations to solve the problem.</p> <p><b>Look Back:</b> As students are sharing the strategies used in <i>Solve &amp; Share</i>, consider facilitating a discussion around the <i>Look Back!</i> as students need to understand the context of the problem type (number of groups unknown) and why they multiply.</p> <p><b>Visual Learning:</b> In the <i>Visual Learning Animation</i>, students learn how to multiply fractions by using the Distributive Property and partial products. Students also learn how to multiply mixed numbers by changing the mixed number to a fraction greater than one (improper fraction). Consider giving students the opportunity to work out each of these strategies.</p>

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	<p><b>Beginning of the Big Idea:</b> In this lesson, students will use previous knowledge to multiply a whole number by a mixed number.</p>	<p><b>Convince Me:</b> Facilitate a discussion around the <i>Convince Me!</i> during the <i>Visual Learning Animation</i>, so students make connections as the model is shown.</p> <p><b>Independent Practice/Math Practices and Problem Solving:</b> Students do not need to do all the problems in their Student Edition. Ask students to complete the <i>Quick Check</i> items (marked with a pink check mark) first and continue on to other items as appropriate. Consider giving students multiple opportunities to use various strategies, tools and models to complete the problems.</p> <p>Consider facilitating a discussion around item 19, as it is a rate, multi-step problem. Students may need support in accessing this item.</p> <p><b>Assess and Differentiate/Intervention Activity:</b> Consider using the <i>Intervention Activity</i> with all students, as the activity has students compare multiplying a whole number with multiplying a mixed number. Students use an open array and partial product to show the two problems. Consider facilitating a discussion around how the fractional part can be treated as another place value.</p>
<b>Lesson 10-6: Math Practices and Problem Solving- Model with Math</b>		
<p>4.NF.B.4c 4.NF.B.3d 4.MD.A.2</p> <p>MP.4 MP.1 MP.2 MP.6</p>	<p><b>Access Prior Learning:</b> In previous topics and lessons, students have modeled and solved problems in multiplication of whole numbers, dividing whole numbers and adding and subtracting fractions and mixed numbers.</p> <p><b>Developing the Big Idea:</b> In this lesson, students continue to model and solve problems involving multiplying whole numbers and fractions or mixed numbers.</p>	<p><b>Note:</b> Consider using Lesson 10-5 after Lesson 10-6 as 10-5 uses all the operations to solve for time, and 10-6 focus is on multiplication of fractions and mixed numbers.</p> <p><b>Solve and Share:</b> Consider removing the bar diagrams to elicit more student strategies and increase the cognitive demand. Also, consider having students estimate before solving the problem.</p> <p><b>Look Back:</b> Consider using the <i>Look Back!</i> as students write number sentences that go along with the <i>Solve &amp; Share</i> problem.</p> <p><b>Convince Me:</b> Consider facilitating a discussion around the <i>Convince Me!</i> as students make connections between a mixed number and a fraction greater than one (improper fraction). Students also continue developing their understanding of equivalency.</p> <p><b>Guided Practice:</b> Consider encouraging students to use tools and other representations to solve the <i>Guided Practice</i> items.</p> <p>*CTC: <i>Quick Check</i> (digital platform)</p>
<b>Lesson 10-5: Solve Time Problems</b>		
<p>4.MD.A.2 4.NF.B.4c</p> <p>MP.1 MP.2 MP.3 MP.4 MP.5</p>	<p><b>Access Prior Learning:</b> In third grade, students learned relationships between units of time and solved problems by adding and subtracting time in minute intervals.</p> <p><b>Beginning of the Big Idea:</b> In this lesson, students solve problems using all four operations with intervals of time.</p>	<p>Consider giving students opportunity to use tools and representations to answer the different problems in this lesson. Also, focus on equivalency and regrouping.</p> <p><b>Assess and Differentiate/Intervention Activity:</b> Consider doing the <i>Intervention Activity</i> with students who may still be struggling with elapsed time.</p>

## References

- Common Core Standards Writing Team. (2011, May 29). *Progressions for the Common Core State Standards in Mathematics (draft). Numbers and Operations-Fractions*. Tucson, AZ: Institute for Mathematics and Education, University of Arizona.
- Council of Chief State School Officers. (2010). The Nevada Academic Content Standards. Retrieved from [http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards\\_Instructional\\_Support/Nevada\\_Academic\\_Standards/Math\\_Documents/mathstandards.pdf](http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf).
- Van de Walle, J.A., Karp, K., Bay-Williams, J. (2010). *Elementary and middle school mathematics: Teaching developmentally*. New York, NY: Pearson.

Van de Walle, J. A., Bay-Williams, J. M., Lovin, L. H., & Karp, K. S. (2014). *Teaching student-centered mathematics: Developmentally appropriate instruction for grades 3-5* (2<sup>nd</sup> ed.). New York, NY: Pearson.

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