▶ Grade 5 Topic 6: Use Models and Strategies to Divide Decimals

Big Conceptual Idea: Numbers and Operations in Base Ten (pp. 18-21)
Prior to instruction, view the Topic 6 Professional Development Video located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background (pp. 55A-55F), the Topic Planner (pp. 299A-299C), all 9 lessons, and the Topic Assessments (pp. 365-366A).

Mathematical Background: Read Topics 2-6 Cluster Overview/Math Background (TE, pp. 55A-55F)	Topic Essential Question: What are the standard procedures for estimating and finding quotients involving decimals? *Reference Answering the Topic Essential Questions (TE, pp. 361-362) for key elements of answers to the Essential Question.*

The lesson map for this topic is as follows:

6-1	6-2	6-3	6-4	6-5	6-6	6-7	6-8	6-9	Assessment

3 A/D/E days used strategically throughout the topic

Instructional Note:
Instruction is focused on standard 5.NBT.B.7 requiring students to perform operations with multi-digit whole numbers and with decimals to hundredths. Students will "…divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used" (Nevada Academic Content Standards (NVACS), 2010, 5.NBT.B.7).

Topic 6 will follow a similar trajectory to previous topics in the 2 through 6, 5.NBT cluster (NVACS, 2010). One cluster heading of this domain requires students to **understand the place value system**. To this end, Topic 6 will begin by asking students to use mental math and place-value patterns to divide a decimal by a power of 10. The use of place value patterns and reasoning will help students extend their knowledge of multiplication and division with whole numbers to include division with decimals. "General methods used for computing quotients of whole numbers extend to decimals…Students can summarize the results of their reasoning as specific numerical patterns and then as one general overall pattern such as "when the decimal point in the divisor is moved to make a whole number, the decimal point in the dividend should be moved the same number of places" (Common Core Standards Writing Team (CCSWT), 2015, p. 18). Estimation plays a very important role in connecting division with decimals to computing with whole numbers. In fact, the best approach to division estimation generally comes from thinking about multiplication rather than division (Van de Walle, Karp, Lovin, & Bay-Williams, 2014).

Several models are used in lessons 6-3 through 6-7. The long division algorithm is also shown and can be compared to other algorithms, strategies and models such as the area model (included in lesson 6-5). Since the **NVACS do not require 5th grade students to use the long division algorithm**, students can choose models, strategies and algorithms that work best for them at this point in their learning. Standard 5.NBT.B.7 also asks that students "relate their strategies to a written method and explain the reasoning used" (NVACS, 2010). This will be the focus of lessons 6-6 and 6-9 which ask students to **place a decimal or choose a solution using their number sense and ability to reason mathematically**. In 6th grade, students will use the long division algorithm to divide decimals. Students showing understanding of division concepts can begin to use the long division algorithm in preparation. Several of the lessons include practice problems requiring use of this algorithm.

Students will encounter and work with two different division problem types in Topic 6. Quotative division, also known as Measurement or "chunking" division, gives the group size and students must find the number of groups needed. An entry point to this type of division problem can be repeated subtraction or addition. Partitive division, also known as "dealing" division, gives the number of groups and not the number within each group. An entry point for this type of division problem can be dealing out the whole to individual groups one by one or in small quantities. Exposure to both types of division is important for building understanding. However, when students are using entry level strategies to make sense of division concepts, allowing time to explore one of the problem types before switching to the other can help to reinforce strategies and understandings.

Topic 6
Use Models and Strategies to Divide Decimals

Number of lessons: 9

A/D/E: 3 days

NVACS Focus: NBT.B

Total days: ~12

5th grade Curriculum Pacing Framework: Balanced Calendar

Math Practice 2: Reason abstractly and quantitatively

Focus on opportunities for students to develop *Mathematical Practice 2* behaviors as this is the focus of the Math Practices and Problem Solving, lesson 6-9. Reference the Teacher's Edition (TE, pp. F22-F22A) and the NVACS (2010, p. 6).

Essential Academic Vocabulary	
Use these words consistently during instruction.	
New Academic Vocabulary: (First time explicitly taught)	**Review Academic Vocabulary:** (Vocabulary explicitly taught in prior grades or topics)
	dividend *divisor* *quotient* *remainder* *tenths* *hundredths*

Additional terminology that students may need support with: annex zeros

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 <u>evidence of mathematical understanding</u>:

Guiding questions: "Are students using estimation to place the decimal in quotients?"

"Are students using multiplication to decide if a quotient is reasonable and/or correct?"

Lesson	Evidence	Look for
6-2	*Solve and Share* (student work samples)	Focus CTC around the big idea: • reasonable estimates for the context of the situation. • use of multiplication and number sense to make a reasonable estimate.
6-1	*Quick Check* (digital platform) Items 2, 3, 4 and 5	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".
6-4	*Solve and Share* (student work samples)	Focus CTC around the big idea: • student strategies and models, sense-making. • use of multiplication and place value understanding to explain reasonableness of solution and strategy.
6-4	*Quick Check* (digital platform) Items 2, 3, and 5	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".

Learning Cycle Assessments (summative)	*Topic Performance Assessments* SE pp. 361-366	Use *Scoring Guide* TE pp. 361-366A

Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 6-1: Patterns for Dividing with Decimals		
5.NBT.A.2 MP.2 MP.3 **MP.7**	**Access Prior Learning:** Students multiplied decimals by powers of 10 in Topic 4. In Topic 5 students divided using powers of 10. **Developing the Big Idea:** Students extend understanding of division and multiplication with powers of 10 to include decimals.	**Solve and Share:** The Partitive division problem identifies the number of groups and asks students to find the size of each group. Concrete strategies such as moving base ten blocks into 10 equal groups are very effective for modeling how to equal/fair share decimal pieces. Allow students opportunities to explore ways to divide the set into these named groups. Estimating will help students think about place value patterns and using multiplication understandings. For example, some students may choose to think about this problem as multiplication with a missing factor. What factor can be multiplied by 10 and make 279.4? Look for a range of student strategies and facilitate a discussion to draw out the idea that multiplication can be used to solve division problems with decimals. **Visual Learning:** A very similar problem to the *Solve and Share* is modeled and the movement of the decimal point is discussed. Help students connect these ideas back to the strategies and ideas discussed during the *Solve and Share*. *-continues on next page-*

		Guided and Independent Practice: These items ask students to use mental math. Consider allowing students to check their ideas by writing related multiplication facts as they work to cement an understanding of how patterns in place value can be used to determine decimal placement.

Assess and Differentiate: The *Intervention Activity* explicitly teaches the movement of the decimal when working with powers of 10. *Homework and Practice* items 25 and 25 ask students to solve an equation using a given value for a variable *n* (SE, *p.* 306).

*CTC: *Quick Check* (digital platform) Items 2, 3, 4 and 5 |

Lesson 6-2: Estimate Decimal Quotients

5.NBT.B.7

MP.1
MP.2
MP.3 | **Access Prior Learning:** Students have estimated in previous topics.

Developing the Big Idea: Estimation helps students build conceptual understanding by connecting division with decimals to multiplication and computing with whole numbers. | **Solve and Share:** The word "about" in the problem signals that an exact answer is not expected. Look for students using rounding and compatible numbers to create reasonable estimates. Facilitate a discussion using student ideas to support understanding that whole number strategies for estimating work to estimate quotients with decimals.

Visual Learning: Estimation is modeled using rounding and compatible numbers. How do these strategies compare to student strategies used during the *Solve and Share*? Consider revisiting the *Topic 6 Essential Question* to help students generalize rules about using whole number strategies and estimation to determine quotients with decimals.

The *Convince Me!* can be used to facilitate a discussion about how students can create more precise estimates.

Answers to the *Guided and Independent Practice* problems will vary as students are making estimations. Consider assigning fewer problems and asking students to allow more time for students to explain their thinking. Ask students questions such as, "How can you determine if your estimate is too high or too low?"

Assess and Differentiate: The **Intervention Activity** can be used as a part of the formative assessment process. If students are having trouble creating an appropriate whole number division problem using the samples, they may not understand how to use decimal place value to find the nearest whole number.

*CTC: *Solve and Share* (student work samples) |

Lesson 6-3: Use Models to Divide by a 1-Digit Whole Number

5.NBT.B.7

MP.1
MP.2
MP.4
MP.5
MP.6 | **Access Prior Learning:** Students used models to multiply with decimals in Topic 4.

Developing the Big Idea: Students build conceptual understanding of dividing with decimals using models to compute. | **Solve and Share:** Estimation will help students determine a reasonable answer and connect division with decimals to using whole number strategies. If students understand that each pen will cost about $1, they can use reasoning to place the decimal point in the quotient even if they ignore the decimal and compute with whole numbers. Models such as base ten blocks and hundreds grids also help students to see and understand how the decimal is placed in quotients. Share these strategies to help all students build conceptual understanding and deepening their number sense.

Visual Learning: The U.S. traditional long division algorithm is modeled for a problem using similar numbers. Help students connect their strategies to this algorithm. Students ready to use this algorithm should be able to explain how this strategy is similar to dividing with whole numbers. Why does it work? Many students will prefer to continue with strategies, models or algorithms based on place value such as, area models and partial quotients. How do we place the decimal when working with these strategies, models or algorithms? How can estimation help to improve precision with each?

Independent Practice: Items 4-7 force use of the long division algorithm. Consider moving students to items 8-11 to practice solving division problems using an approach of their choice.

Assess and Differentiate: Base ten blocks and the long division algorithm are modeled to solve a division problem with decimals on the *Reteach* page and the *Homework and Practice* page. |

Lesson 6-4: Divide by a 1-Digit Whole Number

5.NBT.B.7 MP.1 MP.2 MP.3 MP.4 **MP.8**	**Access Prior Learning:** Students have divided decimals by 1-digit whole numbers in previous lessons. **Developing the Big Idea:** Students continue to practice dividing decimals by 1-digit whole numbers to build conceptual understanding and procedural skill.	**Solve and Share:** A Partitive division problem is given. Since students know the number of groups, they can think about strategies to create equal sized groups. The bar diagram modeled can help students to use concrete and representational strategies to equal/fair share the 107.25 pounds of sand. Encourage students to try multiple strategies and have them explain their thinking. Help students to make connections between the strategies and the context of the problem. How do they know their strategies are appropriate and their solutions are reasonable? The *Look Back!* reminds students to use estimation. **Visual Learning:** A bar diagram is used to model the problem and the U.S. traditional long division algorithm is used to find the quotient. Help students make connections between these mathematical models. What strengths does each have? How can we decide which strategy to use? Why do we need to annex a zero when using the long division algorithm? The *Convince Me!* will make students think about what contexts call for division with decimals. The *Guided and Independent Practice* page items 3-8 force use of the long division algorithm. Students working with other strategies can move to items 9-16 to practice and build procedural fluency with a different division algorithm. **Assess and Differentiate:** *Homework and Practice* page items 1-4 force use of the long division algorithm. Consider moving students to items 5-12 to allow practice with multiple division algorithms. *CTC: **Solve and Share** (student work samples) *CTC: **Quick Check** (digital platform) Items 2, 3, 4, and 5

Lesson 6-5: Divide by a 2-Digit Whole Number

5.NBT.B.7 MP.1 MP.2 **MP.4** MP.7	**Access Prior Learning:** In Topic 5 students divided whole numbers by two-digit divisors. In previous lessons students divided decimals. **Developing the Big Idea:** Students build procedural skill with dividing decimals by two-digit whole number divisors.	**Solve and Share:** The context of this problem promotes use of an area model and multiplicative thinking. The missing factor can be found through creating partial products inside the area model until the total of 23.4 m is reached. Look for students able to model this problem as multiplication with a missing factor and ask them to share their thinking. How can the area model be useful when working with two-digit divisors? **Visual Learning:** The area model and long division algorithm are shown side by side. Help students draw connections between these strategies. Where do they see the same partial quotients and how are they similar to partial products? Consider revisiting the *Topic 6 Essential Question* to facilitate a discussion about how dividing with whole numbers and decimals use similar strategies. The *Convince Me!* reminds students to use estimation. Consider providing a blank page to allow and encourage use of the area model while solving the *Independent Practice* problems. **Assess and Differentiate:** Area models and the long division algorithm are shown side by side in the *Intervention Activity,* the *Reteach* page, and on the *Homework and Practice* page. Items 5-8 on the *Homework and Practice* page force use of the long division algorithm. Consider moving students to items 9-12 to encourage practice with multiple strategies.

Lesson 6-6: Use Number Sense to Divide Decimals

5.NBT.B.7 MP.2 MP.3	**Access Prior Learning:** Students have used multiplicative thinking to determine the size of products and worked with division in previous topics. **Developing the Big Idea:** Students will build conceptual understanding and connect to procedural skill through use of reasoning and number sense.	**Solve and Share:** Students must use number sense to place the decimal correctly into the digits of the quotient for several given division problems. Ask students to share their strategies and decide if they were successful. How does the size of the divisor effect the size of the quotient? The *Look Back!* can be used to further this discussion. Select students to share who have used a strategy based on number sense or place value understanding. Have these students explain how they used their strategy to correctly place the decimal. **Visual Learning:** An example of using reasoning to place the decimal is shown. Students can offer their own ideas or critique those given. The *Convince Me!* specifically asks students to use their own number sense and place value understanding to critique the reasoning of someone else.

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		Assess and Differentiate:
		A table modeling the relationship between the size of the divisor and quotient is provided on the *Another Look!* and on the *Homework and Practice* (SE, p. 335). Consider using this table to create an anchor chart to display in the room.

Lesson 6-7: Divide by a Decimal

5.NBT.B.7 MP.2 MP.3 **MP.4** MP.6 MP.7 MP.8	**Access Prior Learning:** Students have previously multiplied decimals and divided decimals. **Developing the Big Idea:** Students divide by a decimal for the first time. They will extend knowledge of division and working with powers of 10 to build conceptual understanding and procedural skill of this new content.	**Solve and Share:** This is a Measurement division problem. Since students know the size of the group, they are able to use strategies such as repeated subtraction/addition and skip counting/multiplication to solve this problem. These strategies are important for building conceptual understanding of how dividing a decimal by less than 1 results in a quotient larger than the dividend. **Visual Learning:** Hundredths grid models are shown and connected to using the long division algorithm. Why do we multiply the dividend and the divisor by a multiple of 10? This could be connected to creating equivalent fractions as well. If $a \div b = a / b$, then when we multiply the dividend and divisor by 10, we have not changed the problem. Instead we created an equivalent division problem that can be solved using whole number strategies. The *Convince Me!* asks students to think more about this concept. Teaching Tool 8 (hundredths grids) will allow students to model their thinking. Items 30-31 on *Math Practices and Problem Solving* remind students that number sense and place value understanding can be used to determine quotients (SE, p. 340). **Assess and Differentiate:** The *Reteach* page reinforces using powers of 10 to create equivalent division problems with whole numbers. These division problems can also be modeled as equivalent fractions.

Lesson 6-8: Continue to Divide with Decimals

5.NBT.B.7 MP.1 MP.3 MP.6 **MP.8**	**Access Prior Learning:** Students divided decimals by decimals in the previous lesson. **Securing the Big Idea:** Students will practice dividing decimals by decimals to build procedural skill with a division algorithm or strategy.	**Solve and Share:** This is a Measurement division problem. Students can use the same strategies they practiced during the *Solve and Share* in lesson 6-7 to apply to solving this problem. Some students may take chunks of 2.4 until the 8.4 lbs. of food is used up while others may skip count or multiply by 2.4 until they reach the correct total. Encourage students to attempt multiple strategies to build conceptual understanding. Help students make connections between the different strategies and discuss which strategies are more efficient or are appropriate to build procedural fluency. **Visual Learning:** Using estimation, number sense and place value understanding are modeled as strategies to determine if a quotient is reasonable. The U.S. long division algorithm is shown to divide a decimal by a decimal. The *Convince Me!* encourages students to use multiplication to check that the quotient is correct. Item 1 on *Guided Practice* can be used to facilitate a discussion clarifying when to annex zeros. **Assess and Differentiate:** Estimation and number sense are emphasized on the *Intervention Activity* and *Reteach* page.

Lesson 6-9: Math Practices and Problem Solving- Reasoning

5.NBT.B.7 MP.1 **MP.2** MP.3 MP.4 MP.6 MP.7	**Access Prior Learning:** Students have used MP.2 in previous lessons and topics. **Securing the Big Idea:** Students will apply understandings built during Topic 6 to a real world context.	**Solve and Share:** Encourage students to model this problem using pictures, numbers and/or equations before solving. Focus discussion on how students made sense of the problem and quantities before solving. This is a Partitive division problem; students know the number of groups but not the size of the group. Students can experiment with multiple strategies for decomposing the quantities to create equal/fair shares. Facilitate a discussion on how students made sense of the problem and worked with the given quantities. How are they modeling the thinking habits of MP.2 when they explain their reasoning? (p. 349). **Visual Learning:** The thinking habits of MP.2 are modeled for a Measurement division problem. The extra step of adding to find the total quantity is needed to solve this problem. Help students connect their strategies and thinking to those being modeled. The *Convince Me!* uses the same context as the *Visual Learning Bridge* with different numbers. However, this problem will have a remainder. Can students decide what the remainder represents in this context? Do they know what they need to do with the remainder? Will they drop the remainder, is the remainder the answer, will they have to make one more group? **Assess and Differentiate:** On the *Homework and Practice* page consider assigning items 1-3 or items 4-8 and asking students to explain their thinking.

References

Common Core Standards Writing Team. (2015). *Progressions for the Common Core State Standards in Mathematics (draft). Grades K-5, Number and Operations in Base Ten.* 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.

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 6-8* (2nd ed.). New York, NY: Pearson.