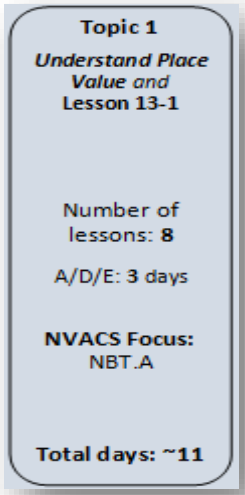
Grade 5 Topic 1: Understand Place Value; Lesson 13-1 embedded



Big Conceptual Idea: Numbers and Operations in Base Ten (pp. 18-21)

Prior to instruction, view the Topic 1 Professional Development Video located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background (pp. 1A-1F), the Topic Planner (pp.1I-1K), all 8 lessons, and the Topic Assessments (pp. 51-54A). Consider including questions from the Topic 13 Assessment including problems 1-4, 11 and 14 (TE pp. 769-770).

Mathematical Background: Read Topic 1 Overview and Math Background (TE, pp. 1A-1F)	Topic Essential Question: How are whole numbers and decimals written, compared, and ordered? *Reference Answering the Topic Essential Questions (TE, pp. 51-52) for key elements of answers to the Essential Question.*

The lesson map for this topic is as follows:

1-1	1-2	1-3	13-1	1-4	1-5	1-6	1-7	Assessment

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

5th grade Curriculum Pacing Framework: Balanced Calendar

Instructional note:

Topic 13 ideas are included in Topic 1 and will be reinforced throughout the 5th grade year. Students begin using the concepts and vocabulary introduced in Topic 13 during Topic 1 instruction. The vocabulary introduced (i.e., expression vs. equation) helps students develop the ability to write and interpret numerical expressions from a given context. A focus on understanding the relationships between values in a context before calculating will support mathematical problem solving and reasoning throughout the 5th grade. Consider displaying lesson 13-1 materials and problems if it is impractical to pull the unit pages from the Volume 2 student books.

Topic 1 focuses on deepening understanding of place value. Students will be exposed to the thousandths place for the first time. Focus instruction on 2010 Nevada Academic Content Standards (NVACS) 5.NBT.A.1, 5.NBT.A.2, 5.NBT.A.3a, 5.NBT.A.3b. and 5.NBT.A.4. These standards emphasize understanding the place value system and include:

- recognizing that the value of a digit changes to be 10x greater or 1/10 of the original digit when moved left or right
- explaining patterns in the number of zeros of a product when multiplying by a power of 10
- the placement of a decimal when multiplying or dividing by a power of 10
- using exponents to denote powers of 10
- reading, writing, and comparing decimals to thousandths
- using place value understanding to round decimals.

Students will work extensively with these concepts during instruction in Topics 2 through 6. Fifth graders will use place value understandings to add, subtract, multiply, and divide with whole numbers and decimals. Working with place value in context will build and strengthen understanding. Van de Walle, Karp, Lovin, and Bay-Williams (2014) assert, "…there is no need to separate place-value instruction from computation instruction. Children's efforts with the invention of their own computation strategies will both enhance their understanding of place value and provide a firm foundation for flexible methods of computation" (p.176). Further, the National Council of Teachers of Mathematics (2000) claim, "It is not necessary to wait for students to fully develop place-value understandings before giving them opportunities to solve problems with two and three-digit numbers. When such problems arise in interesting contexts, students can often invent ways to solve them that incorporate and deepen their understanding of place value" (p.83).

In Topic 1 students will be asked to round decimals. Rounding is an estimation strategy. "The term estimation refers to a number that is a suitable approximation for an exact number given the particular context" (Van de Walle, Karp & Bay-Williams, 2010, p. 241). Number lines are useful tools for building a conceptual understanding of the value of decimals that will allow students to use rounding successfully. Students need to recognize words and phrases that signal estimation such as; about, approximately, close to, etc. Another important consideration for using estimation is given by Van de Walle et al.,

> Do not reward or emphasize the answer that is the closest. It is already very difficult for students to handle "approximate" answers; worrying about accuracy and pushing for the closest answers only exacerbates this problem. Instead, focus on whether the answers given are reasonable for the situation or problem at hand (p. 242).

This topic has a total of 7 lessons with 3 additional days for assessment, differentiation and enrichment (A/D/E). Consider using the additional days added to this topic to establish classroom routines and expectations that will lay the groundwork for a classroom culture focused on a problem solving approach to mathematics. Ideas could include:

- Accessing of, strategic use, and clean-up of manipulatives
- Discussion norms
- Positive Mathematical mindsets and beliefs in a 'doing mathematics' problem based classroom
- Integrating ideas from the *Math Practices and Problem Solving Handbook* (TE, pp. F19-F36), *Problem Solving Guide* (TE, p. F29), and the Problem Solving Recording Sheet (TE, p. F30), and instructional strategies from the ELL Handbook

Solve and Share:
The Solve and Share begins each lesson in enVisionmath 2.0. It gives students the opportunity to engage in the mathematical thinking using their prior knowledge, making connections to new learning and strategies. The focus should not be about getting the correct answer but rather about building conceptual understanding, making connections and allowing students to practice explaining and sharing their thinking.

Possible guiding questions for Solve and Shares (for all Topics)

- What information does the problem give you?
- What do you still need to know?
- What is the problem asking you?
- Explain the strategy you used.
- Justify your answer to your partner/team.
- How do you know?
- What steps did you take to solve the problem?
- Do you agree? Why or why not?
- Can you prove your answer with a model?
- Have/Could you used another strategy to solve your problem?

It is possible that not all students will secure the place value concepts taught in this Topic. Students will continue to practice and apply place value understanding in future Topics as they work with operations involving multi-digit whole numbers and decimals. Topics 2, 3, 4, 5, and 6 begin with lessons integrating place value understandings with new content. It is not necessary for students to complete all practice problems during instruction and assessment to demonstrate understanding. Strategically choosing fewer items from the *Guided* and *Independent Practice* pages will allow students to explore this content at a deeper level.

Math Practice 7: Look for and make use of structure
Focus on opportunities for students to develop *Mathematical Practice 7* behaviors as this is the focus of the Math Practices and Problem Solving lesson, 1-7. Reference the Teacher's Edition (TE) and the NVACS (TE, pp. F27-F27A; NVACS, 2010, p.8).

- This topic has 3 additional days for assessment (A), differentiation (D) and enrichment (E) referenced in the pacing framework as (A/D/E) days. Use these days where appropriate to be learner responsive.

- Students do not need to do all of the *Independ Practice & Problem Solving* problems. Use graph/blank paper, sticky notes or other tools when appropriate to reduce scaffolding and provide additional work space.

▸ Grade 5 Topic 13: Write and Interpret Numerical Expressions

Big Conceptual Idea: K-5 Operations and Algebraic Thinking (pp. 32-35)
Prior to instruction, view the Topic 13 Professional Development Video located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background (pp. 731A-731F), the Topic Planner (pp. 731I-731J), all 5 lessons, and the Topic Assessments (pp. 769-772A).

Mathematical Background: Read Topics 13 Cluster Overview/Math Background (TE, pp. 731A-731F)	Topic Essential Question: How is the value of a numerical expression found? *Reference Answering the Topic Essential Question (TE, pp. 769-770) for key elements of answers to the Essential Question.*

Topic 13 Instructional Note:
Instruction is focused on Nevada Academic Content Standards (NVACS) cluster 5.OA.A., "Write and interpret numerical expressions" (2010). This cluster is composed of two standards:

- 5.OA.A.1: Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

- 5.OA.A.2: Write simple expressions that record calculations with number, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 x (8 + 7). Recognize the 3 x (18,392 + 921) is three times as large as (18,392 + 921) without having to calculate the indicated sum or product.*

Students have been working with numerical expressions and equations since kindergarten and with the Associative Property and parenthesis starting in 3rd grade. In fifth grade, the convention of order of operations is explicitly taught. Students may not initially see the need for this convention. In Lesson 13-1, students are given an expression to evaluate with little direction. It's possible that students may go left to right, do the easier pieces first (addition for many), or use order of operations. These differing strategies can produce many possible solutions for the same expression. If multiple solutions are seen, then students have discovered the reason for the convention. Using order of operations assures that every numerical expression or equation is unique and has only one possible value. Imagine the confusion of trying to represent a context using a number model if several interpretations were possible. Using order of operations will make it possible for students to interpret and represent more complicated real world contexts using the language of mathematics.

Students appreciate learning that while order of operations are a convention, they also make sense mathematically due to the meanings of these operations. An example such as the following can illustrate this point: Consider the expression *(4 + 5 + 5 + 5)*. Fifth graders know it is more efficient to show repeated addition as multiplication. In that case, the expression could be reinterpreted as *4 + (5 x 3)*. The two expressions are equivalent. Yet, if evaluated left to right so that the expression reads *(4 + 5) x 3*, the value does not match that of the original expression. However, when order of operations is followed, the same value is found for both expressions. Order of operations is necessary to keep the value of these two expressions equivalent and stable.

Teachers often incorporate acronyms to help students remember the correct order of operations. Many teacher find that the PEMDAS acronym creates misconceptions because it leads students to believe that multiplication must happen before division and that addition is calculated before subtraction. Using the acronym GEMS can help to avoid these misconceptions.

G Grouping symbols: NVACS state that parentheses, brackets and braces may be used as grouping symbols. The P in PEMDAS can be misleading because it does not include other grouping symbols.

E Exponents: Fifth graders have experience representing powers of 10 with exponents.

M Multiplication and it's inverse; division: Using only one letter to represent both operations may help students to think of them together as equal and inverse operations and calculate left to right.

S Subtraction and it's inverse; addition: Again, using one letter to represent two inverse operations may help students to consider the operations an equal priority and calculate left to right.

Topic 1 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)
exponent power base value expanded form thousandths equivalent decimals	

Additional terminology that students may need support with: annex, number name, standard form

Topic 13 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)
evaluate order of operations parentheses	*numerical expression* *equation* *expression*

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 questions: "Are students able to represent powers of 10 values using multiple forms (ex. fraction notation, decimal notation, exponents, expanded form)?"
"Are students able to compare and round decimals while using multiple representations?"

Lesson	Evidence	Look for
1-3	*Homework and Practice* (student work samples) Items 22, 24 and 26	Focus CTC around the big idea: • use of place value understanding to determine value of a digit. • use of exponent notation for powers of 10. • use of fraction notation to represent powers of 10.
1-3	*Quick Check* (digital platform)	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".
1-6	*Math Practices and Problem Solving* (student work samples) Items 23 and 26	Focus CTC around the big idea: • representations in explanation and comparison of digit value based on place value. • use of place value understanding to round decimals.
1-6	*Quick Check* (digital platform) Items 4 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. 51-54	Use *Scoring Guide* TE pp. 51—54A

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

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 1-1: Patterns with Exponents and Powers of 10		
5.NBT.A.2 MP.1 MP.2 MP.4 MP.5 MP.6 MP.7	Access Prior Learning: Students built and used place value understanding to perform operations with multi-digit numbers in 4th grade (4.NBT.A, 4.NBT.B) Beginning of the Big Idea: Students will use knowledge of single-digit multiplication facts to analyze patterns in products created by multiplying by different powers of 10. They will also see powers of 10 written with exponent notation.	Solve and Share: While solving this problem, students will benefit from using tools such as base ten blocks or place value charts to discover and analyze patterns in the products created. Facilitate a discussion about the patterns and connections seen between factors and products when multiplying by a power of 10. The *Look Back!* offers students a chance to practice modeling their ideas with numerical expressions. Visual Learning: Students will see powers of 10 written in exponent form. A common misconception for students is that 10^2 is 10 x 2 or 20. Students need to understand 10^2, 10 x 10, and 100 are equivalent methods for writing a power of 10. Consider asking students to write the exponent form and expanded form of powers of 10 to cement this understanding. Facilitate a discussion using the *Convince Me!* problem to draw attention to patterns in the number of zeros in the products. During the *Guided and Independent Practice*, consider rewriting some practice items varying the order of the factors or exponents to challenge students' thinking. All items on these pages will give the power of 10 as the second factor. Assess and Differentiate: The *Intervention activity* directs students to make flash cards that will reinforce the concept of equivalence for powers of 10 written in standard form, expanded form, and exponent form. Consider adding more time to explore the patterns of our base-ten system as students match and connect equivalent names.

Lesson 1-2: Understand Whole Number Place Value		
5.NBT.A.1 MP.2 MP.3 MP.4 MP.7	Access Prior Learning: In 4th grade students used place value understanding to recognize that a digit in one place represents ten times what it represents in the place to its right (4.NBT.A.1) Developing the Big Idea: Students will extend their knowledge of place value to include the 100 millions place. They will also develop the idea that each place has a value equal to 1/10 of what is represented in the place to its left.	Solve and Share: This problem will draw out students' varied understandings about place value and allow misconceptions to be tackled. Facilitate a discussion that highlights any student observations about place value. A common student misconception is to name the location of the digit when asked for the value. Remind students of the difference between place (where the digit is) and value (what the digit is worth in that place). Consider using a place value chart (Teaching Tool 3, *Teaching Resource Masters Volume 2)* as a visual scaffold. Visual Learning: The *Visual Learning* addresses how the standard, expanded, and exponent forms afford exploration of a digit's value based on its place. Students examine how a digit represents 1/10 the value of the digit to its left. Consider using the *Convince Me!* to facilitate a discussion that will extend students' understandings of place value to include this new concept. Check for understanding by asking students to compare digit values. *Another Example*, raises the question, "How many times as great is the 5 in the hundred thousand place compared to the 5 in the thousands place?" (pp. 13-14). Extend with probing questions, including "How many times LESS is the 5 in the hundreds place." These questions allow students to show understanding of the place value system while also drawing out misconceptions that need to be addressed. Assess and Differentiate: The *Intervention activity* asks students to create a place value chart and then enter different powers of 10. Use this to help students to see and analyze patterns in the numbers of zeros.
Lesson 1-3: Decimals to Thousandths		
5.NBT.A.1 MP.2 MP.3 MP.4 MP.6 MP.7	Access Prior Learning: In 4th grade, students used decimal notation to represent fractions with denominators of 10 and 100 (4.NF.C.6) and compared decimals to hundredths (4.NF.C.7). Developing the Big Idea: Students extend their knowledge of place value to include the thousandths place. They will also express decimals as fractions with denominators of 10, 100, and 1,000.	Solve and Share: Facilitate a discussion that builds upon what students already know and recognize about place value to include the thousandths place. Consider using decimal place charts (Teaching Tool 6, *Teacher's Resource Masters Volume 2*) to help students see the structure of decimal place value. Look for students who are able to use decimal and fractional notation to share examples. The *Look Back!* is a good tool to formatively assess whether students are able to read and interpret decimal place values to the thousandths. Visual Learning: Highlight that decimals can be expressed as fractions with denominators of 10, 100, or 1,000. Help students to verbalize comparisons of digits in different place values. Revisiting and facilitating a conversation based on the *Topic Essential Question* will help students access this content. The *Convince Me!* offers an excellent opportunity for students to practice using precise mathematical language. Assess and Differentiate: Using or creating a place value chart will benefit students struggling to use place value to read digits. Using the *Intervention Activity* and/or *Center Games* will help reinforce the decimal and fractional notation relationship. Additional engaging problems are found on the *Math Practices and Problem Solving* page or *Homework and Practice* (p. 22). *CTC: *Homework and Practice* (student work samples) Items 22, 24 and 26 *CTC: *Quick Check* (digital platform)
Lesson 13-1: Order of Operations		
5.OA.A.1 MP.2 MP.3 MP.4 MP.5	Access Prior Learning In previous grades and topics students evaluated expressions with parenthesis. Developing the Big Idea Students will evaluate expressions using the order of operations.	Solve and Share: This problem shows how performing correct math calculations can result in two different answers if the correct order of operations is not followed. The phrase "neither student made a mistake in the calculations" may lead students to believe that both answers are valid. If students struggle to determine more than one possible solution, consider giving them the solution and asking them to identify the steps performed to arrive at that solution. Look for students who put parentheses around their first step. It is possible students will not know which solution is the correct one. The *Look Back!* can be used to facilitate a discussion. Why is it important to follow the steps in an agreed upon order? Visual Learning: The *Visual Learning Bridge* models how to solve an expression with multiple operations using the correct order of operations. Students may be tempted to take shortcuts and perform steps mentally. Why is it important to rewrite the problem after each step is performed? The *Convince Me!* asks students to reason about an incorrect answer. This is an opportunity to introduce the GEMS acronym (see instructional note). *-continues on next page-*

		Assess and Differentiate: Consider deleting items 5, 10, 12, and 17 in the *Guided & Independent Practice* section. These work with rational numbers that are not secure at this time of the year. Topic 13 assessment problems such as 1-4, 11, and 14 (TE pp. 769-770) can be used during the Topic 1 assessment.
Lesson 1-4: Understand Decimal Place Value		
5.NBT.A.3a MP.1 MP.2 MP.3 MP.4 MP.7 MP.8	Access Prior Learning: In previous lessons in this topic students have represented whole numbers and decimals using various forms. Students also used standard form, expanded forms and number names (word form) in 4th grade (4.NBT.A.2) Developing the Big Idea: Students will deepen their conceptual understanding of place value by representing equivalent decimals using various forms. This understanding lays the groundwork for comparing decimals in later lessons (5.NBT.A.3b).	Solve and Share: Consider providing a Decimal Place-Value Chart (Teaching Tool 6, *Teachers Resource Masters Volume 2*) to each student. Students will need to understand the value of each digit and extend that knowledge to include units of time. Scaffolding questions are located in the *Look Back!* and could be used to facilitate a discussion about this problem. Visual Learning: The standard, expanded, and number name forms are modeled using the same decimal. Draw out the idea that all three forms are equivalent because they represent the same value. The *Convince Me!* pushes thinking further by asking students to compare values of digits in different place values. Students comfortable moving between the various forms for representing a decimal value could move to the *Math Practices and Problem Solving* page for more challenge. Assess and Differentiate: The *Reteach* page contains visual models such as hundreds grids and a place value chart to help students represent decimals. These representations are appropriate for all students. Consider asking students to use concrete tools such as base 10 blocks if they need more time to build a conceptual understanding of decimal place value. Students may need more practice reading the names of decimal numbers correctly using place value language.
Lesson 1-5: Compare Decimals		
5.NBT.A.3b MP.1 MP.3 MP.4 MP.6 MP.7	Access Prior Learning: Students built understandings of decimal place value in previous lessons. Developing the Big Idea: Students will deepen conceptual understanding of decimal place value while comparing decimals to the thousandths place.	Solve and Share: Consider providing Decimal Place-Value charts (Teaching Tool 6, *Teacher's Resource Masters Volume 2*). Encourage students to use what they know about the structure of place value to compare these decimals. This could lead to a discussion about students using the mathematical habits of MP.7. Use questioning to draw out ideas about how place value can be used to compare numbers including decimals. Visual Learning: A number line is an excellent visual to build conceptual understanding of decimal value and connects to whole number strategies. As a check for understanding, consider asking students to plot the cockroach lengths on the number line. The *Visual Learning Animation* will build on this and provide a step-by-step procedure for comparing decimals. Encourage students to explain why these steps work based on place value understanding. Ask students what happens if we start comparing at the left most digit without first thinking about the value of the digits. This will avoid a common misconception noted in the Teacher's Edition (TE, p. 30). The *Convince Me!* offers a chance for students to compare decimals and explain their thinking. Challenge students to use a number line to justify their solutions. A discussion based on this problem will reveal understanding; as well as, misconceptions. Address these misconceptions during the discussion.
Lesson 1-6: Round Decimals		
5.NBT.A.4 MP.1 MP.2 MP.3 MP.4 MP.6 MP.7	Access Prior Learning: Students rounded whole numbers in 4th grade (4.NBT.A.3) Students have worked with decimal place value in previous lessons in this topic. Developing the Big Idea: Rounding decimals requires a conceptual understanding of decimal place value. This knowledge will be connected to a procedural understanding of how to round numbers.	Solve and Share: A number line is used to help students compare decimal values to whole numbers (Teaching Tool 12). Consider using the *Look Back!* problem as a starting point for a discussion about how to decide where a decimal value will fall on the number line and how to determine the closest whole number. Ask students if they can explain why the number line is a useful tool for comparing and rounding decimals. Making connections to whole number and fraction benchmarks such as 0, $\frac{1}{4}$, $\frac{1}{2}$, and 1 will help students connect decimal ideas to content worked with in 4th grade and assists in solidifying place value understanding and number sense. Visual Learning: A connection is made between a number line and a step by step procedure for rounding. To ensure that students are building a conceptual understanding of rounding instead of memorizing a procedure, ask them to explain why the rules work to round decimals. This question will likely reveal misconceptions. Address student misconceptions while comparing the number line to the procedure for rounding. Teaching Tool 12 is a number line that could be used by students during the *Guided and Independent Practice*. *-continues on next page-*

		Assess and Differentiate: The *Reteach* page will show another example of using a number line to round decimals. *CTC: *Math Practices and Problem Solving* (student work samples) Items 23 and 26 *CTC: *Quick Check* (digital platform) Items 4 and 5
Lesson 1-7: Math Practices and Problem Solving- Look For and Make Use of Structure		
5.NBT.A.3a 5.NBT.A.3b MP.1 MP.6 MP.7 MP.8	Access Prior Learning: Students built content knowledge about decimal place value during the previous lessons in this topic. Securing the Big Idea: Students will need to apply knowledge of decimal place value and rounding given a real world context.	Solve and Share: Look for students making use of the structure of the decimal place value system to compare the decimal values. Ask these students to share their strategies and highlight that they are using the mathematical habits of MP.7. Consider facilitating a discussion about how students' strategies and explanations connect to the Thinking Habits (SE, p. 41). Visual Learning: The hundredths decimal chart used to visually represent decimal values offers an opportunity for students to make conjectures about decimal place value patterns and strategies for comparing. Have students analyze the chart to discover and explain patterns in place value. Use the chart in *Math Practices and Problem Solving* to have students generalize and prove their ideas (SE, p. 44). Consider using this chart to formatively assess, discover and address any misconceptions students may have about decimal place value. Assess and Differentiate: The *Reteach* page contains another blank hundredths decimal chart. Consider using to address misconceptions observed during the *Visual Learning* portion of this lesson. The varied structure of the *Homework and Practice* page can provide students with more challenge.

References

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