Plan for Grade 6 Unit 5: Arithmetic in Base 10

Relevant Unit(s) to review: Grade 5 Unit 4: Wrapping Up Multiplication and Division with Multi-Digit Numbers
Grade 5 Unit 5: Place Value Patterns and Decimal Operations

Essential prior concepts to engage with this unit	By the end of grade 5, students learn to use efficient algorithms to fluently calculate sums, differences, and products of multi-digit whole numbers. They calculate quotients of multi-digit whole numbers with up to four-digit dividends and two-digit divisors. Students also calculate sums, differences, products, and quotients of decimals to hundredths. • Strategies are based on place value understanding, properties of operations, and the relationship between multiplication and division, as well as the relationship between addition and subtraction. • Students use concrete representations or drawings, such as rectangular arrays and area diagrams, as well as equations and other written methods.
Brief narrative of approach	In this unit, students learn an efficient algorithm for division and extend their use of other base-ten algorithms to decimals of arbitrary lengths. Because these algorithms rely on the structure of the base-ten system, students may need multiple opportunities to grapple with, look for, and articulate the connections between their strategies and place value relationships (the digit to the left of a digit is 10 times greater than the referent, the digit to it's right is 1/10 the value). Look for ways to make these connections visible, through the various representations used in this unit: area models, written expressions, and both properties of operations as well as the relationships between operations of multiplication and division. We recognize the goal is not simply mastery of the algorithms in focus in this unit, rather the goals are to provide students an opportunity to synthesize their understanding of number and operation as a foundation for other areas of study like expressions and equations, which is really an abstract form of arithmetic.

Lessons to Add	Lessons to Remove or Modify
Student performance on the 6.5 Check Your Readiness assessment will determine if these lessons need to be added. 1. Use visuals in synthesis of 5.5.1.2 to support discussion of Lesson 2 as needed 2. Add 5.4.11	Student performance on the 6.5 Check Your Readiness assessment will determine whether to skip optional lessons/activities (*). Remove only if performance is strong on corresponding items (see list). 1. Remove 6.5.2*- optional lesson 2. Remove 6.5.3.2*- optional activity 3. Remove 6.5.5.2*- optional activity 4. Remove 6.5.7.2*- optional activity 5. Remove 6.5.15 - culminating lesson and is tagged as optional
Lessons added: 1*	Lessons removed: 2*

Modified Plan for Grade 6 Unit 5

Day	IM lesson	Notes
	6.5 CYR assessment	6.5 Check Your Readiness assessment Note that the Check Your Readiness assessment includes item-by-item guidance to inform just-in-time adjustments to instruction within the lessons in 6.5.
1	6.5.1	Exploratory. Provides an opportunity to see what students bring to the table.
2	6.5.2 5.5.1	If students struggle with items 1 and 2 from the pre-unit diagnostic, plan to do this optional lesson, as well as Lesson 3 Activity 2. Images from 5.5.1 could be helpful in supporting students to see the connection between place value and the multiplicative relationships in play in this lesson. Emphasize the connection between base-ten diagrams and vertical calculations.

3	6.5.3	If students struggle with item 1 from the pre-unit diagnostic, plan to do the optional Activity 3.2. If students do well with item 4 on the pre-unit diagnostic, plan to connect place value diagrams to pennies, dimes, and dollars in this lesson. In doing so, it will support students to understand the connection between "unbundling" to decompose a larger base-ten unit into 10 units of lower place value (for example, 1 tenth as 10 hundredths) to make visible what is happening in the algorithm.
4	6.5.4	Students have opportunities to decide which operation (addition or subtraction) to perform and which strategy to use when finding sums and differences.
5	6.5.5	If students did well with item 3 from the pre-unit diagnostic, it may be possible to skip Activity 2 in this lesson. However, if students struggle with item 7 on the pre-unit diagnostic assessment, plan to do Lesson 5 Activity 2.
6	6.5.6	Students use an understanding of place value and fractions to reason about multiplication of decimals.
7	6.5.7	If students struggle with item 5 on the pre-unit diagnostic, plan to do the optional Lesson 7 Activity 2. Students use partial products and area diagrams to represent and find products of decimals.
8	6.5.8	Students work to understand how to use the product of whole numbers to find the product of decimals.
9	6.5 MU assessment	Use questions from the 6.5 Mid-Unit Assessment
10	5.4.11	Prompt with large numbers to support students to encourage a strategic approach to division. Students may decompose the dividend to facilitate finding the quotient.
11	6.5.9	In this first lesson on division, students revisit two methods for finding quotients of whole numbers without a remainder: using base-ten diagrams and using partial quotients.
12	6.5.10	Long division is introduced. Students have an additional opportunity to hone their understanding of place value by engaging in an exercise of error analysis.

13	6.5.11	Some students might find it helpful to use graph paper to help them align the digits as they divide using long division and the partial quotients method. Consider having graph paper accessible throughout the lesson.
14	6.5.12	Students have an opportunity to explain the division of a decimal by a whole number in terms of equal-sized groups.
15	6.5.13	Students see that to divide a number by a decimal, they can simply multiply both the dividend and divisor by a power of 10 so that both numbers are whole numbers.
16	6.5.14	Students use the given context to determine which arithmetic operations are relevant and use them to solve the problems. Additionally, they draw or use a diagram to help them make sense of the measurements and communicate their reasoning about the measurements (MP3).
17	6.5.15	Students apply operations with decimals to calculate the surface area of paper boxes in a context where they build open-top origami boxes.
18	6.5 End Unit Assessment	

Priority and Category List for Lessons

High priority (+), Medium priority (0), Low priority (-)

E: Explore, Play, and Discuss, D: Deep Dive, A: Synthesize and Apply

Lesson	Priority (+, 0, -)	Category (E, D, A)	Notes
6.5.1	0	E	This lesson activates students' previous experiences with the four operations, all in the context of planning for a party while staying within a budget (MP4).
6.5.2	+/-	E	This lesson is optional. Students use two methods—base-ten diagrams and vertical calculations—to find the sum and differences of decimals.
6.5.3	+	D	The second activity is optional. It gives students additional opportunities to practice summing decimals.

6.5.4	0	A	Supports students to work toward fluency. Students encounter longer decimals (beyond thousandths), find missing addends, and work with decimals in the context of situations.
6.5.5	0	E	Students use what they know about fractions and place value to calculate products of decimals beyond the hundredths. Through repeated reasoning, students see how the number of decimal places in the factors can help them place the decimal point in the product (MP8).
6.5.6	+	D	Students continue to develop methods for computing products of decimals, including using area diagrams.
6.5.7	+	D	Students continue to use area diagrams to find products of decimals, while also beginning to generalize the process. Students connect multiplication of decimals to that of whole numbers (MP7), look for correspondences between geometric diagrams and arithmetic calculations, and use these connections to calculate products of various decimals.
6.5.8	0	A	Students continue to use the structure of base-ten numbers to make sense of calculations (MP7) and consolidate their understanding of the themes from the previous lessons.
6.5.9	0	E	In the first lesson on division, they revisit two methods for finding quotients of whole numbers without a remainder: using base-ten diagrams and using partial quotients. Partial quotients are presented as vertical calculations, which also foreshadows long division.
6.5.10	+	D	This lesson introduces students to long division. Students see that in long division the meaning of each digit is intimately tied to its place value and that it is an efficient way to find quotients.
6.5.11	+	D	Students perform division of two whole numbers that result in a terminating decimal.
6.5.12	+	D	This lesson serves two purposes. The first is to show that we can divide a decimal by a whole number the same way we divide two whole numbers. The second is to uncover the idea that the value of a quotient does not change if both the divisor and dividend are multiplied by the same factor.

6.5.13	+	D	Students integrate the understandings from the previous 2 lessons to find the quotient of two decimals.
6.5.14	0	A	Students apply their knowledge of operations on decimals to two sporting contexts.
6.5.15	-	A	An optional culminating lesson of the unit. Students investigate the relationship between the side lengths of the origami paper and the edge lengths of the boxes, they also connect to their work on ratios.

Lesson 11: Different Partial Quotients

- Let's use what we know about multiplication and place value to find quotients.

Warm-up: Notice and Wonder: Ways to Record

What do you notice? What do you wonder?

Clare's strategy:

$364 \div 13$

$13 \times 10 = 130$

$13 \times 20 = 260$

$13 \times 5 = 65$

$13 \times 3 = 39$

$364 - 260 = 104$

$104 - 65 = 39$

$39 - 39 = 0$

Jada's strategy:

$130 \div 13 = 10$
$130 \div 13 = 10$
$65 \div 13 = 5$
$39 \div 13 = 3$

$364 \div 13 = 28$

11.1: Division Expressions

Take turns:

1. Choose a set of expressions that, when added together, is equal to $308 \div 14$. Not all expressions will be used.

2. Explain to your partner how you know that your cards represent a sum that is equal to $308 \div 14$.

   (Pause for teacher directions.)

3. Choose one of the sets of expressions whose sum is equal to $308 \div 14$ and use it to find the value of $308 \div 14$.

11.2: Choose Your Own Partial Quotients

For each expression, choose one of the partial quotients and, beginning with that expression, find the value of the quotient.

1. $360 \div 15$
    - $150 \div 15$
    - $300 \div 15$
    - $60 \div 15$
2. $945 \div 45$
    - $45 \div 45$
    - $450 \div 45$
    - $900 \div 45$
3. $992 \div 31$
    - $165 \div 31$
    - $341 \div 31$
    - $310 \div 31$
4. How did you decide which partial quotient to use to begin finding the quotient? Did you change your mind with any of the problems?

Lesson 1: What is One Thousandth?

- Let's make sense of thousandths.

Warm-up: Estimation Exploration: One Tiny Piece

What fraction of the whole picture is a single square tile?

Record an estimate that is:

too low	about right	too high

1.1: What Do You Know About Thousandths?

1. What do you know about 1 tenth?

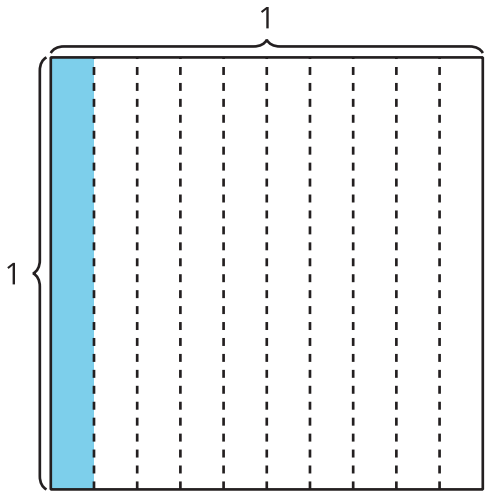
2. What do you know about 1 hundredth?

3. What do you know about 1 thousandth?

1.2: Represent Numbers on a Hundredths Grid

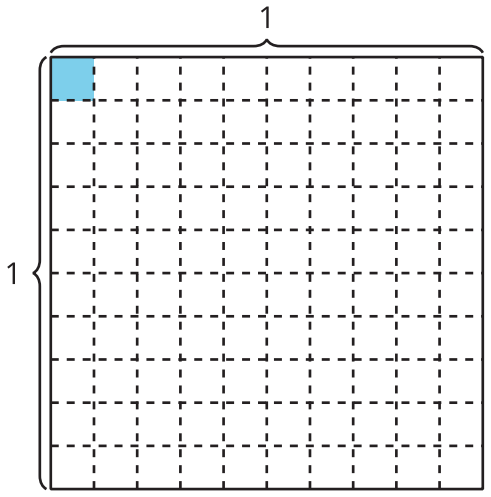
1. The grid represents 1. What does the shaded region represent?

   Be prepared to explain your reasoning.



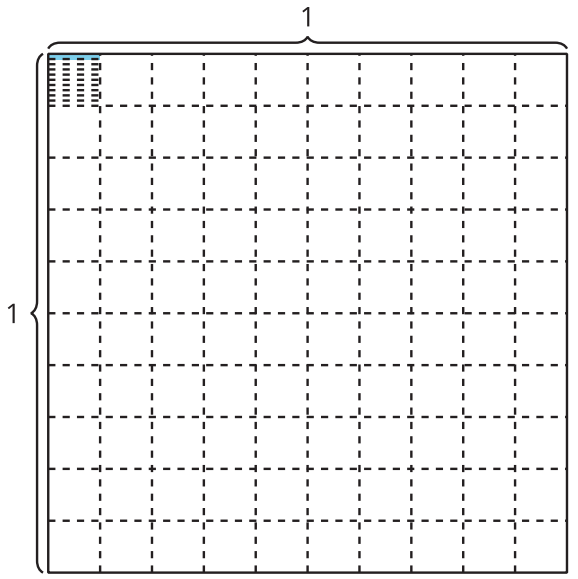
2. The grid represents 1. What does the shaded region represent?

   Be prepared to explain your reasoning.



3. How many of the small rectangular pieces (one of them is shaded) are there in the unit square?

   Explain or show your thinking.



4.

Fraction	Decimal
$\frac{1}{10}$	0.1
$\frac{1}{100}$	0.01
$\frac{1}{1000}$	?

   How do you think we write the number one thousandth as a decimal? Explain your reasoning.