2:2 Place Value to Hundreds

Teacher Notes

Central math concepts

The place value system derives its power from several notable features:

1. **The base-ten units.** Because base-ten units increase exponentially in size (ones, tens, hundreds, thousands, and so on, increasing at each place by a factor of ten), enormous quantities can be represented with few digits. For example, consider the diameter of the Sun, approximately 865,000 miles. To write this number using tally marks would require about a hundred sheets of paper…but only six digits were required to represent the number using base-ten units.
2. **Flexible bundling and unbundling of the base-ten units.** Because of their compatible relative sizes, base-ten units can be bundled or unbundled into other base-ten units. Ten ones make a larger unit called "a ten." Ten tens make a larger unit called "a hundred." And ten hundreds make a larger unit called "a thousand." It follows, then, that a hundred ones make a hundred, a thousand ones make a thousand, and a hundred tens make a thousand. Bundling and unbundling are central ideas in base-ten calculation algorithms. Rods, flats, and cubes provide concrete illustrations of base-ten units and how they can be bundled and unbundled.
3. **Positional notation.** The location of each digit in a multi-digit number corresponds to a base-ten unit, with the units ordered by convention from right to left in increasing order of size. The digit in a given place tells how many copies of the corresponding unit are in the number. For example, the quantity 9 hundreds and 8 ones is written as 908.

These three aspects of place value work together, and understanding place value entails coordinating all three aspects. For example, working with rods, flats, and cubes won't by itself teach place value, because these manipulatives aren't connected to positional notation.

As noted in the relevant *Progression* document,[†] the place value system is a single system that includes both whole numbers and decimals:

> The relationship between values represented by the places in the base-ten system is the same for whole numbers and decimals: the value represented by each place is always 10 times the value represented by the place to its immediate right. In other words, moving one place to the left, the value of the place is multiplied by 10. In moving one place to the right, the value of the place is divided by 10. Because of this uniformity, standard algorithms for computations within the base-ten system for whole numbers extend to decimals. (p. 2)

The place value system is often considered one of the most impressive inventions in the history of mathematics. For the most part however, students are learning place value not as a standalone topic of study, but rather as a necessity for learning to calculate sums and differences of multi-digit numbers with understanding.

2:2

(1) True or false?

(a) 2 hundreds + 3 ones > 5 tens + 9 ones

(b) 9 tens + 2 hundreds + 4 ones < 924

(c) 456 < 5 hundreds

(2) Write the number that makes each statement true.

(a) 7 ones + 5 hundreds = _____

(b) 14 tens = _____

(c) 90 + 300 + 4 = _____

Answer

(1) (a) True. (b) True. (c) True.
(2) (a) 507. (b) 140. (c) 394.

Click here for a student-facing version of the task.

Refer to the Standards

2.NBT.A; MP.1, MP.6, MP.7, MP.8. Standards codes refer to www.corestandards.org. One purpose of the codes is that they may allow a task to shed light on the Standards cited for that task. Conversely, reading the cited Standards may suggest opportunities to extend a task or draw out its implications. Finally, Standards codes may also assist with locating relevant sections in curriculum materials, including materials aligned to comparable standards.

Aspect(s) of rigor:

Concepts

Additional notes on the design of the task

- Task 2:2 is designed to target conceptual understanding, even though it only asks for brief answers rather than extended writing or other language demands. Teachers can also question students about the thinking that led to their answers, individually or in a group setting (and students can question each other).

The *Progression* document includes many additional useful points relevant to the teaching and learning of place value in grade 2, including the following:

- "Unlike the decade words, the hundred words indicate base-ten units. For example, it takes interpretation to understand that "fifty" means five tens, but "five hundred" means almost what it says ("five hundred" rather than "five hundreds"). Even so, this doesn't mean that students automatically understand 500 as 5 hundreds; they may [at first] only think of it as the number said after 499 or reached after 500 counts of 1" (p. 8).
- "Comparing magnitudes of two-digit numbers uses the understanding that 1 ten is greater than any amount of ones represented by a one-digit number. Comparing magnitudes of three-digit numbers uses the understanding that 1 hundred (the smallest three-digit number) is greater than any amount of tens and ones represented by a two-digit number" (p. 8).

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: reasoning about numbers within 100 based on their size in terms of tens and ones; and fluency with the count sequence within 1000.

Extending the task

How might students drive the conversation further?

- Students could create their own versions of task 2:2 by keeping the digits the same but mixing up the place value units. For example, part (2) (a) could be mixed up to read "7 hundreds + 5 ones = _______."
Students could trade their problems with a partner and check each other's answers.
- Could it lead to confusion and trouble in society if some schools taught their students that 924 means 9 hundreds, 2 tens, and 4 ones while other schools taught that 924 means 9 ones, 2 hundreds, and 4 tens? Students could discuss the value of having society agree on a single way of writing and reading numbers.

Related Math Milestones tasks

2:7

2:7 (1) Write the number that makes the statement true.
6 hundreds + 3 tens + 4 ones
= 5 hundreds + _____ tens + 4 ones.
(2) How do you know your statement is true?
(3) Look for connections between your statement and this subtraction problem. What connections can you see?

$$\begin{array}{r} \overset{5\ 13}{634} \\ -\ 482 \\ \hline 152 \end{array}$$

2:10

2:10 Check the subtraction by adding.
946 − 678 = 268

3:14

3:14 Write the sums and differences.

With pencil and paper: 351 + 472; 264 + 438; 625 − 261; 831 − 444

Mentally: 800 − 300; 240 + 540; 365 − 165; 612 − 13

1:2

1:2 True or false?
6 tens + 4 ones < 4 ones + 7 tens

7 ones + 5 tens = _____

1:8

1:8 90 − 40 = ______
9 apples − 4 apples = ______ (number) ______ (unit)
9 cups − 4 cups = ______ (number) ______ (unit)
9 tens − 4 tens = ______ (number) ______ (unit)

Task **2:7 Subtraction Regrouping** relates a calculation procedure to fundamental concepts of place value. Task **2:10 Three Digit Addition/**

Additional notes on the design of the task (continued)

- Place value units of hundreds, tens, and ones appear in several different orders so that relating the named quantities to base-ten numerals in positional notation is part of the task.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like 2:2? Locate 2-3 similar tasks in that unit. How are the tasks you found similar to each other, and to 2:2? In what specific ways do they differ from 2:2?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like 2:2 help students converge toward grade-level thinking about the important mathematics in the task? What factors would you consider in choosing when to use such a task in the unit?*

† Common Core Standards Writing Team. (2015, March 6). *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.

* Math Milestones™ tasks are not designed for summative assessment. Used formatively, the tasks can reveal and promote student thinking.

Subtraction emphasizes the relationship between addition and subtraction in a three-digit calculation.

In later grades, task **3:14 Fluency within 1000 (Add/Subtract)** is a fluency task involving calculation of three-digit sums and differences.

In earlier grades, task **1:2 Tens and Ones** is an analogue of task 2:2 that involves base ten units of tens and ones. Task **1:8 Subtracting Units** emphasizes unit thinking in two-digit subtraction of multiples of ten.

Anticipating and responding to student thinking about the task

Imagine how students might think about the task, and what you might see and hear while they work.

On this page, you can write your thoughts on the following questions.

Solution Paths

- What solution paths might you expect to see?
- What representations might you see? What correspondences between those representations might be noticed by students (or be worth pointing out to students) and discussed by them?
- What misconceptions or partial understandings might be revealed as students work on the task? How could you respond to these positively and productively?

Language

- What might you expect to hear from students engaged with the task? What does that language reveal about their mathematical thinking, and how might you respond to different ways of thinking?
- If students are using early English or using multiple languages in an integrated communication system, how might you help their classmates see those mathematical ideas as valuable?
- Even when using nascent language, students are thinking and communicating their thinking. What might it look like to respond positively and productively to the mathematics in their thinking before giving feedback on the language used?

Identity, Agency, and Belonging

- How can you engage students' interests, experiences, or funds of knowledge?
- How can you build students' self-confidence as learners, thinkers, and doers of mathematics?
- What choices are there for a student to make in the task? How can you build students' agency to the point where they notice and make these choices to solve problems?
- How might one use feedback to build student agency? Where might there be opportunities to build students' self-confidence?