5:4 Place Value to Thousandths

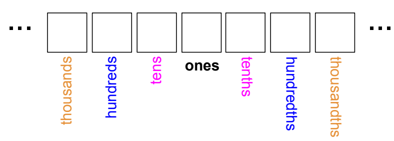
Teacher Notes

Central math concepts

In the place value system, a digit in one place of a multi-digit number represents 10 times as much as it represents in the place to its right. Equivalently, a digit in one place of a multi-digit number represents $\frac{1}{10}$ of what it represents in the place to its left. This description applies to both whole numbers and decimals.

1 is the unit from which the other units are created; 1 corresponds to what you are counting: what counts as one…the unit…in any given context. So in a string of digits like 30485, it is essential to know which place is the ones place. In the Middle Ages, the ones place was often indicated by an overline. With this convention, 30$\overline{4}$85 indicates the number 304.85. The overline convention is mathematically interesting because it highlights the symmetry of the place value system about the ones place (see the diagram).

Symmetry of the Place Value System About the Ones Place



Because of their compatible relative sizes, base-ten units can be bundled or unbundled into other base-ten units. Bundling and unbundling are central ideas in developing algorithms for calculation in base-ten. As noted in the *Progression* document,† the compatibility of place value units also leads to multiple ways to refer to a decimal number, as when we refer to 0.15 as “15 hundredths” or equivalently as “1 tenth and 5 hundredths.”

A decimal calculation can be performed (or justified) by rewriting the problem in fraction notation, performing the fraction calculation, and writing the result as a decimal. For example, $0.4 \times 0.9 = \frac{4}{10} \times \frac{9}{10} = \frac{4 \times 9}{10 \times 10} = \frac{36}{100} = 0.36$. However, the enormous practical benefit of the decimal system is that because the system is identical at each place, algorithms developed for whole-number computations can be applied or easily adapted to handle calculations with decimals.

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: reasoning about unit fractions, fraction equivalence, and products of unit fractions; and writing fractions as decimals and vice versa.

Extending the task

How might students drive the conversation further?

- Students could create their own versions of task 5:4 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 tenths + 5 thousandths = _____ .”

5:4 **(1)** Circle T for true or F for false.

(a) 9 thousandths + 5 hundredths > 3 hundredths + 2 tenths T F

(b) 92 hundredths + 4 thousandths > 0.924 T F

(c) 0.456 < 0.5 T F

(2) Write each number in the requested form.

(a) 7 thousands + 5 tenths = _____ (decimal)

(b) 0.1 tenths = _____ (decimal)

(c) $\frac{2}{100} + \frac{5}{1000}$ = _____ (decimal) = _____ (fraction in lowest terms)

Answer

(1) (a) False. **(b)** False. **(c)** True.

(2) (a) 0.507. **(b)** 0.01. **(c)** $0.025 = \frac{1}{40}$.

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

Refer to the Standards

5.NBT.A; MP.1, MP.6, MP.7. 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 5:4 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).

Students could trade their problems with a partner and check each other's answers.

- Students might know about countries where decimal separators other than the period are used. Students could show how numbers are written in other systems they are familiar with.
- Students could show what 7 tenths + 5 hundredths looks like on the number line.

Related Math Milestones tasks

5:5

5:5 Write the requested values.

$4087 \times 53 = ?$
$246 \times 914 = ?$
$9744 \div 12 = ?$
$1461 \div 6 = ?$
$4 - (8 - 4) = ?$

$\frac{1}{10} \div 10 = ?$
$\frac{7}{8} \times \frac{5}{3} = ?$
$8 \times ? = 73$
$3 \div \frac{1}{8} = ?$
$\frac{1}{2} + \frac{1}{3} - \frac{1}{5} = ?$
$\frac{1}{3} \div (6 \times 5) = ?$

$0.4 \times 0.9 = ?$
$0.75 \div 0.01 = ?$
$0.63 \div 0.3 = ?$
$0.86 + 0.4 = ?$
$0.72 - 0.17 = ?$
$0.02 + 0.2 = ?$
$0.8 - 0.55 = ?$
$637 - 1.31 = ?$

5:10

5:10 **(1)** Solve: $\frac{1}{3} = 0.1 + ?$
(2) Is there a number greater than $\frac{1}{5}$ and less than $\frac{1}{4}$? If you think so, find such a number. If you think there is no such number, explain why.
(3) Show one of the above problems and its solution on a number line.

6:14

6:14 *Pencil and paper* **(1)** $81.53 \div 3.1 = ?$ **(2)** $\frac{7}{8} \div \frac{2}{3} = ?$ **(3)** Check both of your answers by multiplying.

4:7

4:7 Write the values of the expressions. Read each completed equation aloud.

3 fifths + 2 fifths = ___

$\frac{6}{25} + \frac{6}{25} =$ ___

$\frac{1}{10} + \frac{3}{100} =$ ___ (fraction)
= ___ (decimal)

$\frac{1}{8} + \frac{5}{8} - \frac{3}{8} =$ ___

2:2

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 = ____

Task **5:5 Calculating** involves several procedural problems that rest on understanding of decimal place value. Task **5:10 Number System, Number Line** aims at synthesis of fractions and decimals into a unified conception of number supported by the number line.

In later grades, task **6:14 Dividing Decimals and Fractions** marks the culmination of decimal procedures with a decimal division calculation.

In earlier grades, task **4:7 Fraction Sums and Differences** involves unit thinking about fractions including fractions with denominators of 10 and 100. Task **2:2 Place Value to Hundreds** is an analogue of task 5:4 that involves base ten units of hundreds, tens, and ones.

Additional notes on the design of the task (continued)

- Place value units of tenths, hundredths, and thousandths 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 5:4? Locate 2-3 similar tasks in that unit. How are the tasks you found similar to each other, and to 5:4? In what specific ways do they differ from 5:4?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like 5:4 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.

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Teacher Notes

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?