4:11 School Kitchen

Teacher Notes

Math Milestones™

Central math concepts

By high school, converting units is a proceduralized skill—especially as applied in science coursework and laboratory work. In the elementary and middle grades, however, "converting units" is a thoughtful process of multiplicative reasoning that involves recognizing how many times-as-much a certain unit is than another unit. This reasoning might be fairly abstract or fairly concrete depending on the kind of quantity under consideration, ranging from base quantities such as length, mass, and time to derived quantities such as area, volume, speed, and force.

Grade 4 problems involve expressing measurements in a larger unit in terms of a smaller unit (CCSS 4.MD.A.1), within a single system of measurement. In such cases, the larger unit will be a whole-number multiple of the smaller unit. For task 4:11 in particular, weight is measured in both pounds and ounces. As measured by a calibrated scale, 1 pound weighs 16 times as much as 1 ounce. Therefore, a quantity of 45 pounds weighs 45 × 16 ounces. This is not the application of a remembered rule ("To convert pounds to ounces, multiply by 16") but rather the application of multiplication thinking to a remembered fact (1 pound is 16 ounces).

Unit thinking is prevalent throughout arithmetic, not just in the measurement domain. The idea of a unit is a coherent and unifying theme in school mathematics.[†] In task 4:11 for example, 6 ounces of cheese could be viewed as a unit, "1 pizza's worth of cheese." From this perspective, a final division step solves task 4:11 by measuring the kitchen's cheese supply in units of pizzas.

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: multiplying by a unit fraction; applying ideas of times-as-much in context; and basing multiplicative reasoning on math diagrams.

Extending the task

How might students drive the conversation further?

- Knowing that 45 pounds of cheese will make 120 pizzas with 6 ounces of cheese on each pizza, students could consider such questions as
  - What if the kitchen had 90 pounds of cheese instead of 45 pounds? How many pizzas would that make?
  - What if there were 3 ounces of cheese on each pizza instead of 6 ounces? How many pizzas would 45 pounds of cheese make in that case?
- Intuitive answers to questions like these could be checked by calculation.

4:11 A cook in the school kitchen uses 6 oz of cheese to make a pizza. The kitchen has 45 lb of cheese. How many pizzas will that make?

Answer

120.

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

Refer to the Standards

4.MD.A.2, 4.NBT.B.5; MP.1, MP.4. 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:

Application

Additional notes on the design of the task

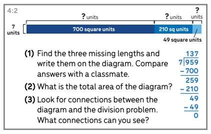
The numbers in the problem are such that they provide opportunities for grade-level procedures such as calculating 45 × 16 and 720 ÷ 6.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like 4:11? Locate 2-3 similar tasks in that unit. How are the tasks you found similar to each other, and to 4:11? In what specific ways do they differ from 4:11?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like 4:11 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?*

Related Math Milestones tasks

4:2



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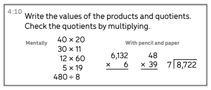

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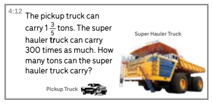
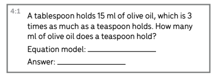
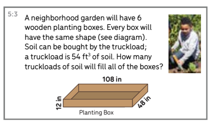


4:1

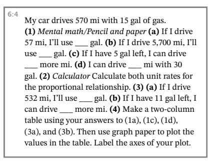


Calculations like those involved in task 4:11 are included from a conceptual point of view in task **4:2 Multi-Digit Division Concepts** and from a procedural point of view in task **4:10 Calculating Products and Quotients**. Task **4:12 Super Hauler Truck** is a word problem involving multiplicative comparison (situation type Compare with Larger Unknown), and task **4:1 A Tablespoon of Oil** is a word problem involving multiplicative comparison (situation type Compare with Smaller Unknown) that happens to involve quantities in common use as kitchen measurements.

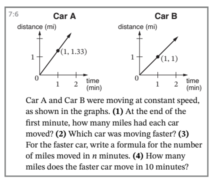
5:3



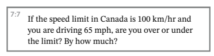
6:4



7:6

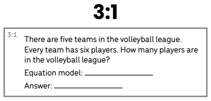


7:7

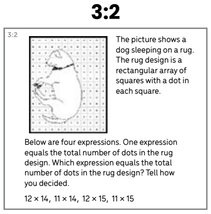


In later grades, task **5:3 Neighborhood Garden** involves two different units of measure for volume, with the larger unit being more convenient for solving the problem. Proportional relationships in tasks such as **6:4 Gas Mileage** involve derived quantities, and rates are compared in tasks **7:6 Car A and Car B** and **7:7 Speed Limit**.

3:1



3:2



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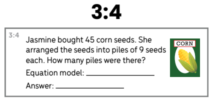
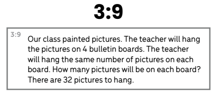


3:9



In earlier grades, tasks such as **3:1 Volleyball Players**, **3:2 Hidden Rug Design**, **3:4 Corn Seeds**, and **3:9 Bulletin Board Pictures** focus on the equal-groups concept of multiplication that is the precursor of times-as-much thinking.

† See Zimba (2013), "Units, a Unifying Theme in Measurement, Fractions, and Base Ten."

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

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?