K:4 Bears Talk About Shapes

Teacher Notes

Central math concepts

As explained in the *Progression* document (p. 2),† the three themes of elementary-grades geometry are:

- Reasoning with shape components, shape properties, and shape categories;
- Composing and decomposing shapes; and
- Spatial relations and spatial structuring.

The first two of these themes are involved in the two claims being made by the bears in task K:4.

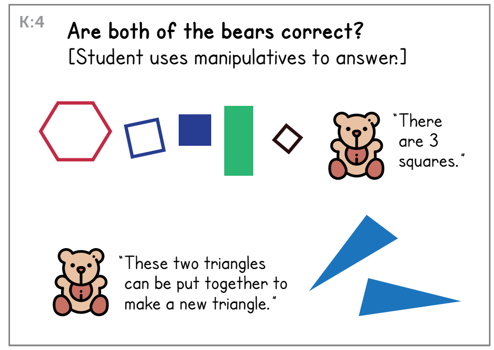
The first bear's claim involves shape categories. The *Progression* document (p. 3) describes *three levels of geometric thinking* that describe increasing sophistication with this learning progression:

- **Visual/Syncretic level**. Students recognize shapes, for example, a rectangle "looks like a door."
- **Descriptive level**. Students perceive properties of shapes, for example, a rectangle has four sides, all its sides are straight, opposite sides have equal length.
- **Analytic level**. Students characterize shapes by their properties, for example, a rectangle has opposite sides of equal length and four right angles.
- **Abstract level**. Students understand, for example, that a rectangle is a parallelogram because it has all the properties of parallelograms.

The first bear's claim can be settled using Visual/Syncretic and/or Descriptive reasoning. The task provides experience with identifying shapes regardless of non-essential attributes such as color, size, and orientation (p. 6).

To evaluate the second bear's claim, students can join the two triangles to make a new triangle, as shown in the figure that appears in the "Answer" section. Kindergarten students "not only build shapes from components, but also compose shapes to build pictures and designs. Initially lacking competence in composing geometric shapes, they gain abilities to combine shapes—first by trial and error and gradually by considering components—into pictures. At first, side length is the only component considered. Later experience brings an intuitive appreciation of angle size" (p. 7).

The fact that two distinct triangles can be created by joining the given triangles is an example of the general fact that many problems in mathematics have more than one solution. For another example in this grade, see task **K:7 Ten Pennies, Two Hands**.



Answer

Both bears are correct. With respect to the second bear's claim, the figure shows two possible ways to make a new triangle by putting together the two given triangles.

Task K:4 is designed for use with manipulatives or objects. Students might also use manipulatives to support their work on other tasks.

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

Refer to the Standards

K.G.A.2, K.G.B.4,6; MP.1, MP.3, MP.5, 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.

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: counting to tell how many; perceptual subitizing; and recognizing and naming shapes.

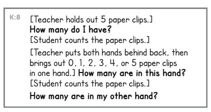
Extending the task

How might students drive the conversation further?

- With reference to the first bear's claim, if students correctly indicate that the bear is correct, they could continue the discussion by identifying the squares and counting them.
- With reference to the second bear's claim, students who composed a new triangle by joining the given triangles along the longer legs can compare their shape with the shape of a partner who composed a new triangle by joining the given triangles along the shorter legs. The two partners can then consider the problem of adding a rectangle to their two new triangles in such a way as to make a sailboat design.

Related Math Milestones tasks

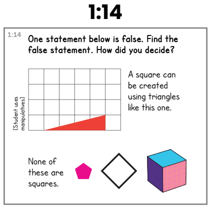
K:8



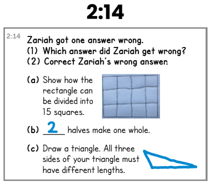
K:10

Counting, subitizing, or counting out small collections of 5 or fewer objects may be part of many kindergarten tasks, such as **K:8 Five Behind the Back**, **K:10 Hello, Dogs**, and others.

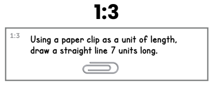
1:14



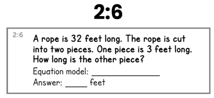
2:14



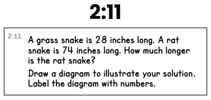
1:3



2:6



2:11



In later grades, tasks **1:14 Shape True/False** and **2:14 Correcting a Shape Answer** involve the three themes of elementary-grades geometry listed under "Central math concepts" for task K:4. Spatial structuring and composing/decomposing are involved in length measurement (iterating length units), as in task **1:3 Paper Clip Length Units**. Composing and decomposing is involved in adding and subtracting lengths, as in tasks **2:6 Cutting a Rope** and **2:11 Grass Snake vs. Rat Snake**.

Aspect(s) of rigor:

Concepts

Additional notes on the design of the task

The second bear's claim is intended to be explored using manipulatives. The first bear's claim could also be explored using manipulatives.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like K:4? Locate 2-3 similar tasks in that unit. How are the tasks you found similar to each other, and to K:4? In what specific ways do they differ from K:4?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like K: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. (2013, September 19). *Progressions for the Common Core State Standards in Mathematics (draft). Grades K–5, Geometry*. Tucson, AZ: Institute for Mathematics and Education, University of Arizona. Page numbers in these Teacher Notes refer to this *Progression*.

* 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?

