

Module: Mathematics

Lesson Title: Order by Size

Standards for the Lesson

Florida Adult Basic Education Mathematics Standards
Solve problems involving measurement and conversion from a larger unit to a smaller unit. (CCR.MA.ABE.3.3.1)
Solve mathematical and real-world problems involving area, surface area, and volume. (CCR.MA.ABE.3.3.4)
Produce congruence and similarity using physical models, transparencies, or geometry software. (CCR.MA.4.4.3)

Interpreting the Standards

1 Standards	2 Skills Included in the Standard	3 Concepts Included in the Standard	4 Through a Particular Context	5 Cognitive Demand/Levels of Thinking	6 Sample Activity
Solve problems involving measurement and conversion from a larger unit to a smaller unit. (CCR.MA.ABE.3.3.1)	solve	measurement and conversion problems	Use of manipulatives and real-world objects	DOK 2	Provide students with different shapes and have them determine which has the larger/smaller area. Have students select a real-world object and enlarge it by a given percentage.
Solve mathematical and real-world problems involving area, surface area, and volume. (CCR.MA.ABE.3.3.4)	solve	real-world area problems		DOK 2	
Produce congruence and similarity using physical models, transparencies, or geometry software. (CCR.MA.4.4.3).	produce	congruence and similarity		DOK 2	

Objective of the Lesson

Students will:

- Experience how “big ideas” in geometry, such as area or similarity, can be developed from an intuitive (visual) level through more formal levels.

Materials

- Flipchart and markers
- Post-its
- Scissors
- Calculators
- Tape
- Rulers (marked in cm and mm)
- Graph paper
- **Handout A: Order by Size**
- **Handout B: Giant Size**
- A collection of rectangular objects of different sizes (one per 3 or 4 participants) with a post-it on each (2x, 3x, 5x, 10x, 1.5 times, 150%).

Instructional Plan

Overview

This lesson develops participants’ awareness of theories and research about how geometric sense making develops. Rather than beginning with geometric formulas and their application, participants will consider levels of reasoning that lay the foundation for understanding geometric concepts. Students will determine different ways of calculating area and will determine similarity of figures, as well as identifying methods for increasing the size of an object.

Process

Introduce the lesson by sharing with students that today they will complete two different activities that deal with measurement. Both activities will require that students work in teams while they are exploring and discovering measurement concepts.

Activity 1: Order by Size

Prior to the lesson, copy **Handout A: Order by Size** onto colored paper. Cut out the four shapes and place them into an envelope. Make enough envelopes for the class.

Divide the class into small groups of three to four students. On each table, place scissors, graph paper, pens or pencils, rulers, and calculators. Distribute an envelope to each group.

Ask students to order the four rectangles by size of their areas and to come to their own individual conclusion about the order. Share with students that they can only use the tools that are on their tables. Challenge each small group to find at least three ways they could do the problem. One of the ways is to measure with a ruler and then use a formula. Ask students to determine other ways that they may determine which is larger.

After 10 minutes, regroup and ask for volunteers to describe various strategies they used to arrive at the solution. Record the strategies on chart paper.

Sample ideas may include:

- Cutting out the shapes and lay them over one another
- Tracing the shapes on centimeter grid paper and count the square centimeters
- Using a formula

Discuss how there are often many ways to solve a problem. Ask students whether any of the strategies were more/less accurate and why. Discuss how “exact” students measured the sides of the different figures, e.g., to the nearest $1/16$, $1/8$, etc. of an inch.

Next have students complete an activity to determine similarity in shapes.

Activity #2: Similarity—Giant-Size

Prior to the lesson, have available for each team, scissors, rulers, yardsticks, calculators, and a pile of everyday rectangular objects (dollar bill, matchbook, a paper towel sheet, a book, etc.). On each object place one Post-It note on which you have written a “factor” by which the object should be “blown up”—for example $2x$, $3x$, $5x$, $10x$, 1.5 times, 150% , and so on. Be sure that the “factor” is possible for the object, given the space and materials available.

Have students work together in teams of three or four, taking 10 or 15 minutes to complete the activity. Challenge students to be open to various ways to approach the problem.

Distribute one piece of newsprint per team, markers, rulers, and yardsticks. Have an assortment of rectangular objects (one per 3 or 4 participants) with a Post-It attached to the back indicating the factor by which to “blow up” the object. Teams will create an n -times “blow-up” of a small rectangular object (e.g., dollar bill, tea bag, calculator, sheet of paper, etc.) and display it with the original object for all to see.

Have students display their posters and spend time looking at each.

Sample Debriefing Questions

Use the following as discussion questions:

- Do the blow-ups look right? Why/why not?
- How did others go about the process? (visually, numerically?)
- Which object appears to be enlarged by the greatest factor? By how much?
- How would you compare the original perimeter and area to the new perimeter and area?
- Do any of these other objects look similar to yours? How would you go about proving that?

The point of the discussion is that students may have a sense of when objects look similar, but similarity can also be tested numerically, algebraically, by measuring, or by laying objects on top of one another. Each way deepens a student's understanding of the "big idea."

Modifications for Different Levels

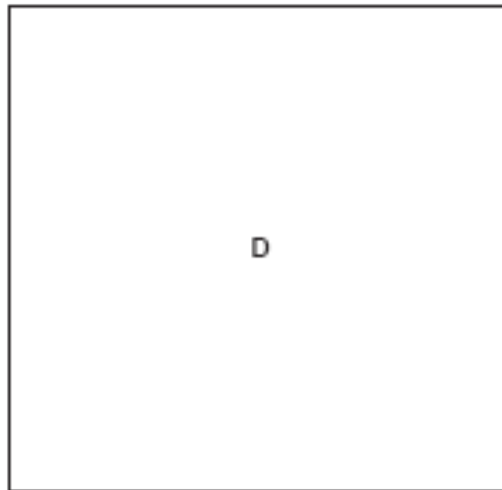
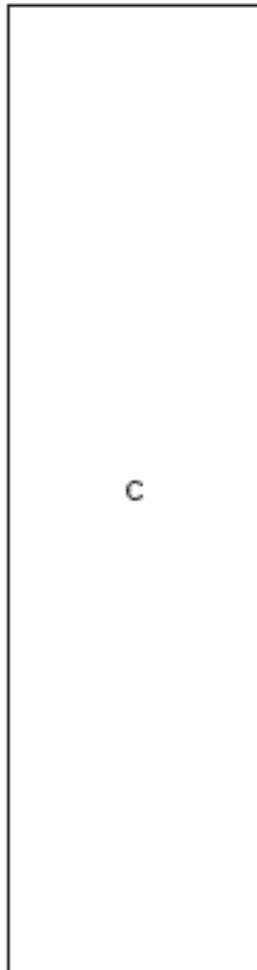
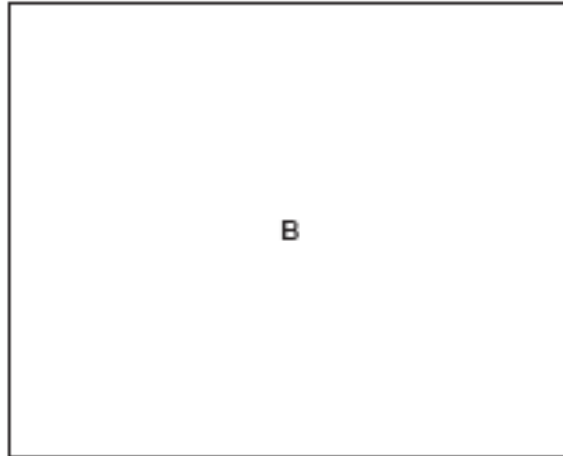
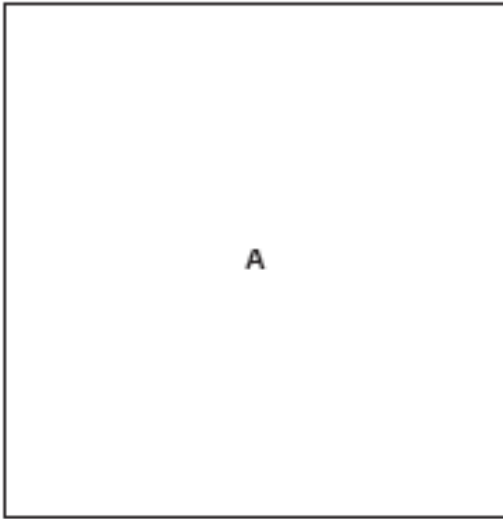
This lesson can be used with all levels of learners. Students at lower levels of ABE math will use skills such as: cutting out the shapes and laying them over one another; visualizing an answer, tracing the shapes on grid paper and counting the square units, or "guesstimating" an answer.

Students at higher levels of math skills will use strategies such as: using a formula, applying proportions, determining an algebraic equation, or using measurement tools.

The important aspect of this lesson is to have students work at their level and explore and discover the "big ideas" of similarity, proportional increases/decreases, and congruence.

Handout A: Order by Size

Order by Size



Handout B: Giant Size

1. Team up and choose one of the objects.
2. “Blow up” the object the indicated number of times.
3. Compare the dimensions, areas, and perimeters of the two objects.
4. Hang up your poster, displaying both objects.
5. Look at the other teams’ posters. Compare and contrast