Scale Ella
Guide and Answer Key for Instructors

The *Scale Ella* animation is available on iTunes U (search "Math Snacks") and at mathsnacks.org

Learning Objectives:
The Scale Ella animation is about scale factor. By watching the animation, completing the activities in the *Learner Guide*, and completing at least one bonus activity, students learn that:

- There is a number (the scale factor) that creates the relationship between two items that are being compared to one another.
- Multiplication and division are inverse operations.
- If the scale factor is less than one, the size of an object or a number is being decreased.
- If the scale factor is greater than one, the size of an object or a number is being increased.
- The scale factor can be represented as a decimal, whole number or fraction.

Animation Discussion

With your students, watch the 10-minute animation *Scale Ella* at http://www.mathsnacks.org and spend about 10 minutes discussing the big ideas or key points in the animation. Ask:

- In what ways are Scale Ella and Scaleo's powers the same? How are they different? Can you provide an example from the animation?
- Think of examples in the animation where something was scaled up or made bigger. Think of examples where something was scaled down or made smaller. How would you describe the numbers that scale things up? How would you describe the numbers that scale things down?
- Would you rather have the power to scale things up or down? Why? Give an example of something you would scale up and scale down in your own life.

Learner Guide Page 1

Learner Guide Page 2

Vocabulary	Scale factor, fraction

Bonus Activities

Select one or more of these activities to do with your students after they have completed the *Learner Guide*.

1. ART WORK: Give students a piece of blank paper. Have them measure a 4 in. x 4 in. square.

    • Have them draw a picture inside the square. It can be as simple or complex as you like, but it would be better if it covers the entire square.

    • Have students draw the 4 in. x 4 in. grid over their picture (could also fold it to get the lines).

    • Have students pick a scale factor. For example, if they scale it up by 2, the new picture will be 8 in. x 8 in. or scaling down the picture by ½ would yield 2 in. x 2 in.

    • Using the scale factor, have students create a grid with the new dimensions, including the small squares inside the frame.

    • Have students redraw their picture by copying each individual square. This can be done as a large group or individually.

2. Create a puzzle from a picture. Give each student a small piece of the puzzle and have them scale it up by a factor of 3. If they increase their piece using the same scale factor as everyone else, they should be able to put the "big" puzzle back together. (NOTE: This can be done with scale factors other than 3.)

3. Research the increase (or decrease) in population of a city or state by comparing the 2000 census to the 2010 census. Have students calculate the scale factor that accounts for the increase or decrease. Make predictions for the population in 2020 and 2040 using this scale factor.

4. YOUR HOUSE: (Supplies: 1 cm grid paper, rulers, poster board or butcher paper)

    • Have students design a rectangular house on a 1 cm grid piece of graph paper.

    • Have students pick a scale factor between 3 and 6.

    • Have students recalculate the dimensions of their house using the scale factor.

    • Have students redraw their house scaled up on a piece of butcher paper or a poster board.

    • Have students share their houses with the class.

5. YOUR BRIDGE: (Supplies: 1 cm or 1 in grid paper, rulers, balsa wood, glue)

    • Have students design the bottom and sides of a bridge with dimensions you provide for height, width and length.

    • Have students pick a scale factor to adjust their bridge. (sf>1 will increase size, sf<1 will decrease size).

    • Have students draw their scaled bridge on graph paper.

    • Have students cut balsa wood into proper dimensions and have them assemble their bridges using the scaled drawings. Students can work in teams of two where one student builds the initial bridge while the other student builds the scaled model.

    • Have students present their bridges to the class.

6. Have students discuss questions 3–5 from the *Learner Guide* in small groups. Have them draw a picture to represent the increase or decrease of the items they selected. This will add a visual element to these problems.

1. **The regular size of a twin bed is 39" wide, 75" long and 24" high. Scaleo has scaled your bed to this size: 13" wide, 25" long and 8" high.**
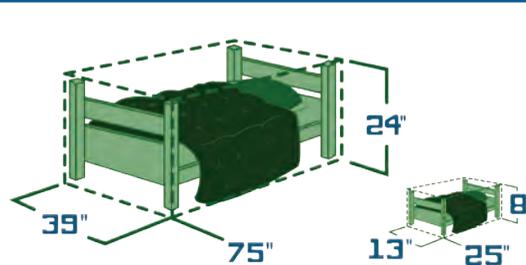
a. **What can Scale Ella do so that you can sleep comfortably tonight?**

Answers will vary, but should include some discussion about scaling the bed up or your height down.

2. **Scaleo has now scaled you to be bigger by a scale factor of 7. What is your new height?**

Answer: _____ x 7 = _____   Your Height x Scale Factor = Your New Height. (Answers will vary)

a. **Will you fit on a regular-sized bed?**

Answers will vary: If new height is greater than 75", the answer would be no, but if new height is less than 75", the answer would be yes.

b. **If you can't, what can Scale Ella do to help you?**

Answers will vary: Scale Ella can scale you down or scale the bed up; scale factors will vary, but final height should be less than 75", or the bed size should be larger than the student's height.

3. **You have been given Scale Ella's powers, but before you scale items you have to practice by scaling numbers. Pick a scale factor that will increase the numbers and a scale factor that will decrease the numbers. Once you pick your numbers, complete the table.**

Note: Before having students do this problem, have a discussion with them about which scale factors SCALE UP and which scale factors SCALE DOWN. (sf > 1 scale up and sf < 1 scale down.)

Numbers	Scale Up by	Scale Down By
.05	*Answers will vary*	*Answers will vary*
1/2	*Answers will vary*	*Answers will vary*
7	*Answers will vary*	*Answers will vary*
13	*Answers will vary*	*Answers will vary*
25	*Answers will vary*	*Answers will vary*
102	*Answers will vary*	*Answers will vary*

Answers should be multiples of the numbers the students selected and the numbers from column 1 in the table.

If students use division to scale the numbers down instead of using fractions or decimals, validate their thinking and have a discussion about various ways to scale down.

4. **If you could scale up three things in your life by a factor of 5, What would you scale up? Why?**

Answers will vary depending on student choices.

5. **If you could scale down three things in your life by a factor of 1/5, What would you scale down? Why?**

Answers will vary depending on student choices.

Common Core State Standards of Mathematics

4.MD.1	Know relative sizes of measurement units within one system of units including km, m, cm…. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.
5.MD	Convert like measurement units within a given measurement system.
5.MD.1	Convert among different sized standard measurement units within a given measurement systems, and use these conversions in solving multi-step, real world problems.
7.G	Draw, construct, and describe geometrical figures and describe relationships between them.
7.G.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from scale drawing and reproducing a scale drawing at a different scale.

Math Snacks animations, games and support materials address all of the Common Core State Standards for Mathematical Practices when used as recommended in the teacher guide.