7-3: Stretching and Shrinking

Unit Goals, Focus Questions, and Mathematical Reflections

Unit Goals

Similar Figures Understand what it means for figures to be similar

- Identify similar figures by comparing corresponding sides and angles
- Use scale factors and ratios to describe relationships among the side lengths, perimeters, and areas of similar figures
- Generalize properties of similar figures
- Recognize the role multiplication plays in similarity relationships
- Recognize the relationship between scale factor and ratio in similar figures
- Use informal methods, scale factors, and geometric tools to construct similar figures (scale drawings)
- Compare similar figures with nonsimilar figures
- Distinguish algebraic rules that produce similar figures from those that produce nonsimilar figures
- Use algebraic rules to produce similar figures
- Recognize when a rule shrinks or enlarges a figure
- Explore the effect on the image of a figure if a number is added to the x- or y-coordinates of the figure's vertices

Reasoning with Similar Figures Develop strategies for using similar figures to solve problems

- Use the properties of similarity to find distances and heights that cannot be measured directly
- Predict the ways that stretching or shrinking a figure will affect side lengths, angle measures, perimeters, and areas
- Use scale factors or ratios to find missing side lengths in a pair of similar figures
- Use similarity to solve real-world problems

7-3 Stretching and Shrinking: Focus Questions (FQ) and Mathematical Reflections

Investigation 1 Enlarging and Reducing Shapes	**Investigation 2** Similar Figures	**Investigation 3** Scaling Perimeter and Area	**Investigation 4** Similarity and Ratios
Problem 1.1 **Solving a Mystery: An Introduction to Similarity** FQ: What does it mean for two figures to be similar? **Problem 1.2** **Scaling Up and Down: Corresponding Sides and Angles** FQ: When you copy a figure at a certain scale factor (e.g. 150%), how does this value affect the measurements of the new figure?	**Problem 2.1** **Drawing Wumps: Making Similar Figures** FQ: How can you determine if two shapes are similar by looking at the rule for producing specific coordinates for the image? **Problem 2.2** **Hats Off to the Wumps: Changing a Figure's Size and Location** FQ: What types of coordinate rules produce similar figures? Nonsimilar figures? For a pair of similar figures, how can you use a coordinate rule to predict the side lengths of the image? **Problem 2.3** **Mouthing Off and Nosing Around: Scale Factors** FQ: How can you decide whether or not two shapes are similar?	**Problem 3.1** **Rep-Tile Quadrilaterals: Forming Rep-Tiles With Similar Quadrilaterals** FQ: What types of quadrilaterals are rep-tiles? How do rep-tiles show that the scale factors and areas of similar quadrilaterals are related? **Problem 3.2** **Rep-Tile Triangles: Forming Rep-Tiles With Similar Figures** FQ: Which types of triangles are rep-tiles? Explain. **Problem 3.3** **Designing Under Constraints: Scale Factors and Similar Shapes** FQ: How can you use scale factors to draw similar figures or to find missing side lengths in similar figures? **Problem 3.4** **Out of Reach: Finding Lengths with Similar Triangles** FQ: How can you use similar triangles to find a distance that is difficult to measure directly?	**Problem 4.1** **Ratios Within Similar Parallelograms** FQ: What information does the ratio of adjacent side lengths within a rectangle give you? **Problem 4.2** **Ratios Within Similar Triangles** FQ: For a pair of triangles, if the measures of corresponding angles are equal, how can you use ratios of side lengths to determine whether or not the triangles are similar? **Problem 4.3** **Finding Missing Parts: Using Similarity to Find Measurements** FQ: If two shapes are similar, how can you use information about the shapes to find unknown side lengths, perimeters, and areas? **Problem 4.4** **Using Shadows to Find Heights: Using Similar Triangles** FQ: How can you use similar triangles to estimate the heights of tall objects?
Mathematical Reflections 1a. When you enlarge or reduce a figure, what features stay the same? 1b. When you enlarge or reduce a figure, what features change? 2. Rubber-band stretchers, copy machines, and projectors all make images that are similar to the original shapes. What does it mean for two shapes to be similar? Complete the sentence below: *"Two geometric shapes are similar when…"*	**Mathematical Reflections** 1. If two shapes are similar, what is the same about them and what is different? 2a. What does the scale factor tell you about two similar figures? 2b. How does the coordinate rule for making two similar shapes relate to the scale factor? 3. Rubber band stretchers, copy machines, and coordinate grids all made images that are similar to (or scale drawings of) the original shapes. What does it mean to say two shapes are similar? Build on your statement from Mathematical Reflections 1: *"Two geometric shapes are similar when…"*	**Mathematical Reflections** 1a. If two polygons are similar, how can find the scale factor from one polygon to the other? Give specific examples. 1b. Suppose you are given a polygon. How can you draw a similar figure? 2. What does the scale factor between two similar figures tell you about the 2a. side lengths? 2b. perimeters? 2c. areas? 2d. angles? 3. If two figures are similar, how can you find a missing side length? 4. Describe how you can find the measure of a distance that you cannot measure directly. 5. What does it mean to say two shapes are similar? After completing Investigation 3, how can you build on your statements from Mathematical Reflections 1 and 2? *"Two geometric shapes are similar when…"*	**Mathematical Reflections** 1. If two triangles, rectangles, or parallelograms are similar, 1a. How does the ratio of two side lengths within one figure compare to the ratio of the corresponding side lengths in the other figure? 1b. What does the scale factor from one figure to the other tell you about the figures? 2a. Describe at least two ways to find a missing side length in a pair of similar figures. 2b. How can you find the height of an object that cannot be measured directly? 3. What does it mean to say that two shapes are similar? After exploring with ratios, build on your statements from Mathematical Reflections 1, 3, and 3: *"Two geometric shapes are similar when…*