EUREKA MATH™ TIPS FOR PARENTS

KEY CONCEPT OVERVIEW

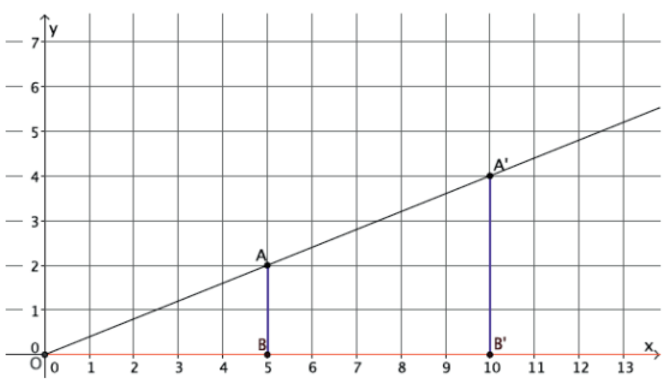
In Module 3, students are introduced to a new transformation called a **dilation**, which results in an image that is the same shape but a different size than the original. Because a dilation **magnifies (enlarges)** or **shrinks (reduces)** the original shape, it is not a rigid motion. Students will use a rule called the **fundamental theorem of similarity**, or FTS, to examine the effect of dilations on **coordinates**. Through this work, students will develop a precise **definition of dilation**. During this module, your child will be asked to use a ruler, a compass, and a calculator. Making these tools available at home will help your child complete his work.

You can expect to see homework that asks your child to do the following:

- Use side lengths to calculate the **scale factor** of a dilation and classify it as an enlargement or a reduction.
- Use the definition of dilation to solve for the length of an unknown side in the original shape or dilated shape, as well as calculate the scale factor used in the dilation.
- Create images by dilating an original figure using the given **center of dilation** and scale factor. Students will dilate objects with straight or curved sides.
- Determine the sequence of transformations used on an original object to create an image.
- Calculate the scale factor used to return an image back to the original figure.
- Use the fundamental theorem of similarity to solve for segment lengths and coordinates of points and to find congruent angles and parallel lines.

SAMPLE PROBLEMS *(From Lesson 5)*

1. Find the length of segment $A'B'$ using the diagram. Explain.



If the points A and B are both dilated by a scale factor of 2, the segments AB and $A'B'$ will be parallel, with the length of segment $A'B'$ (4) equal to twice the length of segment AB (2). Therefore, $|A'B'| = 2|AB|$, and $4 = 2 \cdot 2$.

2. Point D (0, 11) is dilated from the origin by scale factor $r = 4$. What are the coordinates of point D'?

$$D'(4 \cdot 0, 4 \cdot 11) = D'(0, 44)$$

3. Point $E(-2, -5)$ is dilated from the origin by scale factor $r = \frac{3}{2}$. What are the coordinates of point E'?

$$E'\left(\frac{3}{2} \cdot (-2), \frac{3}{2} \cdot (-5)\right) = E'\left(-3, -\frac{15}{2}\right)$$

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

HOW YOU CAN HELP AT HOME

You can help at home in many ways. Here are some tips to help you get started.

- Maps are perfect examples of dilations. Actual distances are shrunk to fit on paper or a screen. Talk to your child about how the definition of dilation is used to make accurate maps. Find the scale factor for a map by checking the map key. For example, if 1 inch represents 5 miles, the scale for the actual distance on the map is $\frac{1}{5}$.
- Using the definition of dilation, provide numbers for two of the following three parts of a dilated image: original length, image length, or scale factor. Have your child solve for the unknown part. For example, if the image length is 10 cm and the original length is 2 cm, your child would solve for the scale factor, r, by dividing the image length (10) by the original length (2), which equals 5.

TERMS

Angle-preserving: Maintaining the original measure of an angle (e.g., 45 degrees) when a transformation is performed.

Center of dilation: The point from which the dilation was magnified or shrunk.

Coordinates: The location of a point on the coordinate plane, written as (x, y). The first number is always the x-value of the point (left/right), and the second number is always the y-value of the point (up/down).

Definition of dilation: The precise definition used to solve for an unknown segment length or scale factor. The definition is written as $|A'B'| = r|AB|$, meaning that the length of the new, dilated segment is equal to the scale factor times the length of the original segment.

Dilate/Dilation: A type of transformation that moves every point in the original object closer to or farther from a point, called the center of dilation. Dilations are often referred to as enlargements or reductions. When describing a dilation, a student should write the following: *The original object was dilated by a scale factor of [insert number] about (or using) center point* P.

Effect of dilation on coordinates: When the center of dilation is the origin and the scale factor is r, an original point (x, y) becomes (rx, ry). For example, multiply the original coordinates (2, 5) by a scale factor of 4 to find the new (dilated) coordinates (8, 20).

Fundamental theorem of similarity: If you dilate points A and B from the same center point C using the same scale factor, corresponding side $\overline{DE}$ of the magnified/reduced shape will have the following properties:

a. It will be parallel to side $\overline{AB}$ of the original shape.
b. Its length will be equal to the scale factor times the length of side $\overline{AB}$.

Magnification/Enlargement: A dilation that lengthens each side of the original shape by a given scale factor. The object's image will also be farther from the center of dilation. Every enlargement has a scale factor with a value greater than 1.

Scale factor: A number associated with the size of the dilation. This number can be multiplied by the original lengths to obtain the new lengths. We often use the variable r to represent the scale factor.

Shrinking/Reduction: A dilation that shortens each side of the original shape by the given scale factor. The object's image will also be closer to the center of dilation. Every reduction has a scale factor with a value between, but not equal to, 0 and 1.