Name:____ Date:______________________ Period:____________

3.1.1 What do these shapes have in common?

Dilations

Today you will be introduced to a new transformation that enlarges a figure while maintaining its shape, called a **dilation**. After creating new enlarged figures, you and your team will explore the interesting relationships that exist between figures that have the same shape.In your teams, you should keep the following questions in mind as you work together today:

3-1. WARM-UP STRETCH

Before computers and copy machines existed, it sometimes took hours to enlarge documents or to shrink text on items such as jewelry. A pantograph device (like the one shown below) was often used to duplicate written documents and artistic drawings. You will now employ the same geometric principles by using rubber bands to draw enlarged copies of a design. Your teacher will show you how to do this.

During this activity, discuss the following questions:
What do the figures have in common?
What do you predict?
What specifically is different about the figures?

3-2. In problem 3-1, you created designs that were similar, meaning that they have the same shape. But how can you determine if two figures are similar? What do similar shapes have in common? To find out, your team will need to create similar shapes that you can measure and compare.

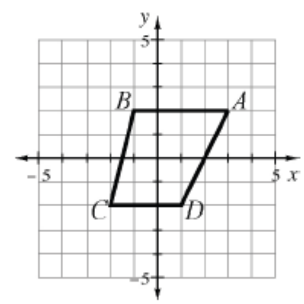

Diagram #1

a. Obtain a Lesson 3.1.1 Resource Page from your teacher. On it, find the quadrilateral shown in Diagram #1 at right.

Dilate (stretch) the quadrilateral from the origin by a factor of 2, 3, 4, or 5 to form $A'B'C'D'$. Each team member should pick a different enlargement factor. You may want to imagine that your rubber band chain is stretched from the origin so that the knot traces the perimeter of the original figure.

For example, if your job is to stretch $ABCD$ by a factor of 3, then A' would be located as shown in Diagram #2 at right.

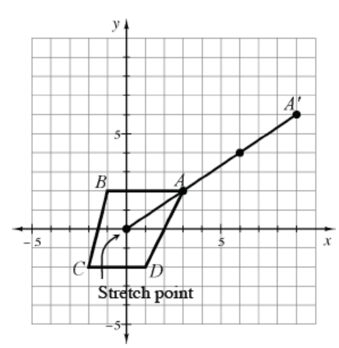

Diagram #2

b. Carefully cut out your enlarged figure and compare it to your teammates' figures. How are the four enlargements different? How are they the same? As you investigate, make sure you compare both angles and side lengths of the similar figures. Be ready to report your conclusions to the class.

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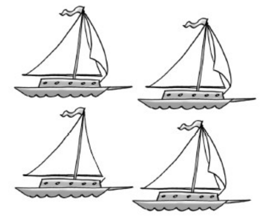
3-3. WHICH SHAPE IS THE EXCEPTION?



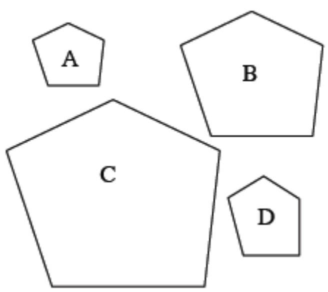
Sometimes figures look the same and sometimes they look very different. What characteristics make figures alike so that you can say that they are the same shape? How are figures that look the same but are different sizes related to each other? Understanding these relationships will allow us to know if figures that appear to have the same shape actually do have the same shape.

Your Task: For each set of figures below, three are **similar** (meaning that they are related through a sequence of transformations including dilation), and one is an exception. Find the exception in each set of figures.

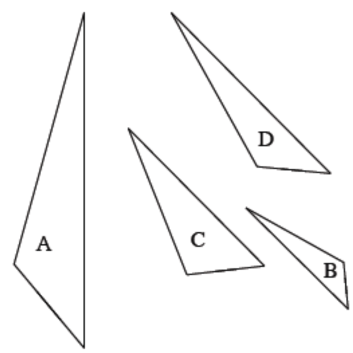
Use tracing paper to answer each of these questions for both sets of shapes below:

Which figure appears to be the exception? What makes that shape different from the others?
What do the other three shapes have in common?
Are there commonalities in the angles? Are there differences?
Are there commonalities in the sides? Are there differences?

a.



b.



3-4. LEARNING LOG

Write an entry in your Learning Log about the characteristics that figures with different sizes need to have in order to maintain the same shape. Add your own diagrams to illustrate the description. Title this entry “Same Shape, Different Size” and include today’s date.

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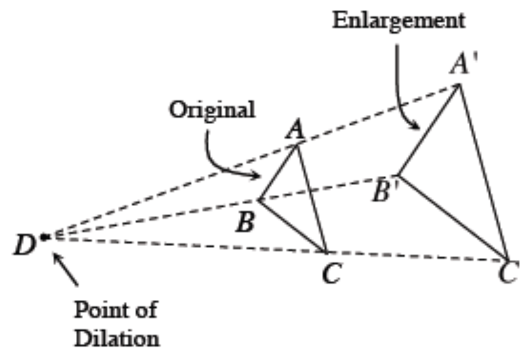
METHODS AND MEANINGS

MATH NOTES

Dilations

The transformations you studied in Chapter 1 (translations, rotations, and reflections) are called rigid transformations because they all maintain the size and shape of the original figure.



However, a **dilation** is a transformation that maintains the shape of a figure but multiplies its dimensions by a chosen factor. In a dilation, a shape is stretched proportionally from a particular point, called the **point of dilation** or **stretch point.** For example, in the diagram at right, ΔABC is dilated to form $\Delta A'B'C$. Notice that while a dilation changes the size and location of the original figure, it does not rotate or reflect the original.

Note that if the point of dilation is located inside a shape, the enlargement encloses the original, as shown below right.