LessonTitle: Stretching Sam the Man **Geo 7.1a**

Utah State Core Pre-Algebra Standards 2.3, 3.1, 4.2 Geometry Standards 3.1 Process Standards 1-5

Summary

In this lesson, students stretch Sam the Man proportionately and disproportionately using rubber bands and then graph paper. Then they analyze the stretched figure. You may wish to skip the stretching activity using rubber bands—the activity though valuable for students, isn't easily implemented.

Enduring Understanding	Essential Questions
Similar figures are figures which are exactly the same but stretched or shrunk proportionally. Every dimension of the figure is shrunk or stretched by the same growth factor. Therefore the angles are congruent.	What does similar mean in geometry?
Skill Focus	**Vocabulary Focus**
• Similarity • Exponential growth • Dimensions and area	

Materials Rubber bands, butcher paper, transparency of Sam the Man heads (for examining congruent angles)

Launch Suggestions: "We thought that reviewing ordered pairs might be a good way to launch the activity, but we also thought that the activity itself is a great launch into Similar figures, as well as a review of graphing, slope, and proportions. We liked the questions on the activity."

Explore (Teacher and student roles)

- How do you create similar figures?
- What is a scale factor?
- What happens to the area of a figure when the dimensions are multiplied by a scale factor?

Summarize

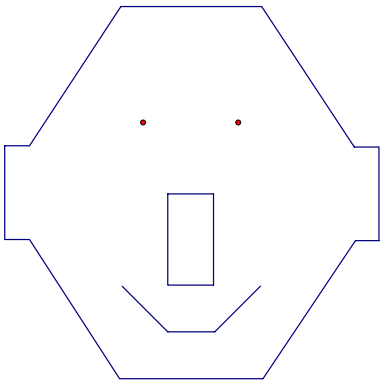
Application: "…a good independent application was to have the students create their own pictures using ordered pairs."

Assess

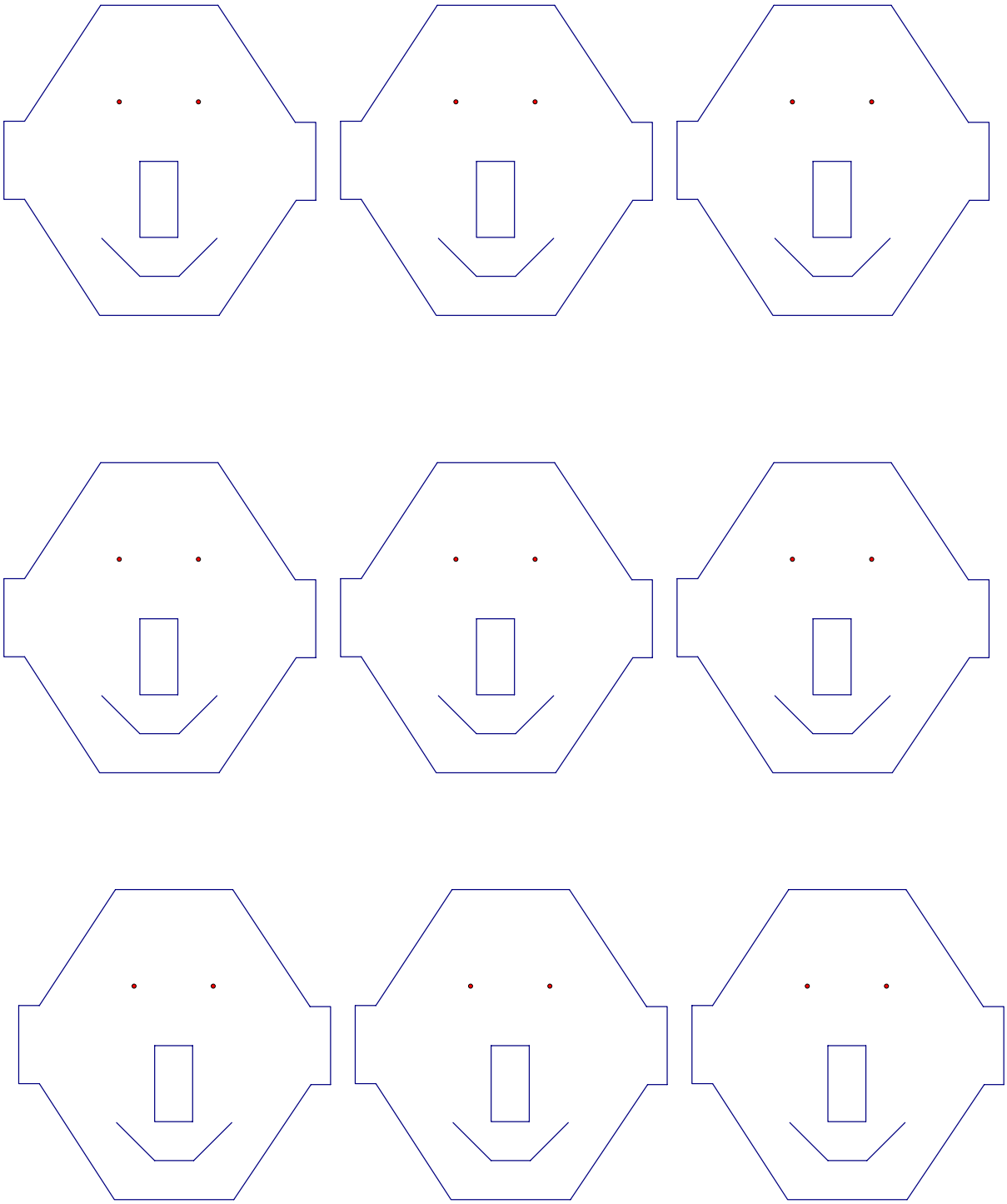
Teacher Information

1) If you choose to have students stretch Sam using rubber bands,give each group a large piece of butcher block paper and 2 rubber bands. Then follow the directions on the worksheet. Have them try to stretch Sam using 2 rubber bands. When they are successful, they can progress to 3, 4, and 5 rubber bands in order to complete the worksheet.
2) Stretching Sam using graph paper is the easier method which works effectively. (The experience of stretching using rubber bands is a very real way to experience similar figures) Students graph Sam the Man by hand, using graph paper or Geometer's Sketchpad. If using Geometer's sketchpad, drag the grid center to the lower left corner. Then change the grid scale so that both x and y axis show at least 25 units.

Students will need a Sam the Man head transparency to observe the angles. Make an overhead transparency of the Sam the Man sheet found below. Cut out the heads and give one to each group.

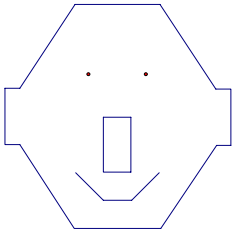


Create an overhead copy of the following—cut each group a transparency copy of the head.



Stretching Sam the Man

(using rubber bands)



- Tape a large sheet of paper across a desk; Then Glue or tape the copy of Sam the Man about halfway down a large sheet of paper and about 10 inches from the left side of the paper.
- Mark a point about 3 inches from the left of the paper (more than 1 rubber band length from Sam).
- Tie two rubber bands together. One student places a pencil through the loop of one of the rubber bands and then places the point of the pencil on the marked point on the paper.
- A second student places a pencil through the loop of the other rubber band and stretches the bands until the **knot** is above a line on Sam the Man.
- The first student holds his pencil still. The second student traces the picture of Sam the Man by moving the pencil so that **the knot moves around the line** on the Sam the Man picture.
- Examine the length of the nose bottom and side. Record the measurements below.
- What happens to your enlargement when you move the fixed position of the left hand pencil?_____
- Can you make the enlargement larger by changing positions?_____
- What do you think you will have to do to make the enlargement larger?
  _____
- Repeat using 3 rubber bands. Then 4 rubber bands. Record information below.

Number of Rubber Bands Used in Enlargement	Length of Nose bottom	Length of Nose side	Ratio of bottom to side
Original	1	2	1/2
2 rubber bands			
3 rubber bands			
4 rubber bands			
5 rubber bands			

What patterns do you see in the lengths of the nose dimensions?

What could we say about the enlargements?

How can you determine how big to make a rubber band chain to get the size enlargement you want?

Stretching Sam the Man

(using coordinate points on graph paper)

Use graph paper or Geometer's Sketchpad to graph this assignment.

1. From the column marked Sam I, plot the points on the grid paper. Connect the points for the head. Do the same for the nose and mouth. The eyes are dots. Print.
2. When you finish Sam I, use the function rule (2x, 2y) to determine the points for Sam II. Predict what you think will happen to Sam I in the graph of Sam II. _____

   _____

   Graph and print.
3. Determine the points for Sam III. Perform the function (3x, 3y) on the original Sam I points. Graph and print.
4. Determine the points for Sammy and Manny. Perform the functions on the original Sam I points. Predict what you think will happen to Sam I in the graphs of Sammy and Manny

   _____

   Graph and print.

Points		Sam I	Sam II	Sam III	Sammy	Manny
		(x, y)	(2x, 2y)	(3x, 3y)	(3x, y)	(x, 3y)
Head	A	(6, 0)				
	B	(8, 3)				
	C	(8.5, 3)				
	D	(8.5 ,5)				
	E	(8, 5				
	F	(6, 8)				
	G	(3, 8)				
	H	(1, 5)				
	I	(0.5, 5)				
	J	(0.5, 3				
	K	(1, 3)				
	L	(3, 0)				
		Connect				
Start Over						
Mouth	M	(3, 2)				
	N	(4, 1)				
	O	(5, 1)				
	P	(6, 2)				
Start Over						
Nose	Q	(4, 2)				
	R	(5, 2)				
	S	(5, 4)				
	T	(4, 4)				
		Connect				
Eyes (dots)	U	(5.5, 5.5)				
	V	(3.5, 5.5)				

Summary of the Noses

Sam	Rule	Bottom Edge	Side Edge	Ratio: Bottom/Side	Area	Perimeter
1	(x, y)					
2	(2x, 2y)					
3						
4						
5						
						42
		10				
Sammy						
Manny						

What conclusions can you draw about Sam I, II, and III?

How are the Sammy and Manny pictures different that Sam I, II, and III?

Lay the angles of the clear copy of Sam I over the angles of Sam II and III and Sammy and Manny. Why are the angles the same for Sam I, II, and III and different for Sammy and Manny? (Find out what a scale factor means and use this term in your answer.)

Sam I, II and III are similar. Using your observations about SAM I, II and III come up with a definition for similar in geometry.