



Grade Level: 4-6

Theme:

- The artist in his or her environment

Curriculum Framework Emphasis:

- Mathematics (Calculations and Estimations)
- The Arts

Common Curriculum Goals:

- Solve problems by calculating rates and ratios

Objectives:

- Find measures by using scale drawings.
- List several ways in which scale drawing could be used.
- Explain how an artist can use scale drawings to create artwork.

Materials:

- Graph paper
- Transparency of graph paper
- Overhead projector

SCALE DRAWING

Jack McLarty

ACTIVITIES

To be completed before viewing the Jack McLarty video:

Part A – Using Ratios to Make Scale Drawings (45-50 minutes)

Scale drawing is simply drawing something larger or smaller than it actually is. For example, map makers (cartographers) use scale drawings to draw maps. They start by taking careful measurements of an actual area, such as a park. They measure everything they see in the park, such as where the picnic tables are located, and how big they are. They write down all of the measurements they take. When all of the measurements have been taken and written down, they then use that information to create a map of the park. But the actual map is not the same size as the real park, it is much smaller. Cartographers have solved the problem of making maps accurate, and that is by using ratios.

1. Consider the following questions:

- Why don't they make the maps the real size of the park?
- Can you think of any jobs that might use scale drawings, besides mapmakers?
- If you are going to use a map to plan a vacation with your family, why is it important that the map be accurate?

2. Discuss the definition of a ratio. A ratio is a comparison of the size of an object in the drawing to the actual size of the object. For example, if a picnic table measures 6 feet long by 4 feet wide, and you wanted to fit a drawing of the table on a piece of notebook paper, you would have to use a ratio to draw the table accurately, so that the proportions remain the same. This means that a rectangular picnic table won't turn out looking like the shape of a long, skinny ruler on the drawing. It will still have its nice rectangular shape.

3. Go through the following steps together using the picnic table as an example:

- The actual size of the table is 6 feet long by 4 feet wide. In a scale drawing, if the table measures 3 inches long, what is the measurement of the width of the table? Use a ratio to find out.

$$\frac{\text{length in the drawing} = 3 \text{ inches}}{\text{actual length of table} = 6 \text{ feet}}$$

- Scale is usually written as a ratio comparing some number to one. We want to find an equivalent ratio in which one of the numbers is one.

$$\frac{3 \text{ in}}{6 \text{ ft}} = \frac{1 \text{ in}}{w \text{ ft}} (w = \text{width})$$

VOCABULARY

- scale
- ratio
- sketch
- measurement
- mural
- enlarge
- proportion
- reduce

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ACTIVITIES CONTINUED

- Use cross multiplication to find w .

$$\begin{aligned} 3 \times w &= 6 \times 1 \\ 3 \times w &= 6 \\ 3 / 3 \times w &= 6 / 3 \\ w &= 2 \end{aligned}$$

- The equivalent ratio is 1 inch : 2 feet. For every 2 feet that the object actually measures, would be drawn as 1 inch long in the scale drawing.
- Now that the ratio is known, we can use that information to figure out what the width of the table should be in the drawing.

$$\frac{1 \text{ in}}{2 \text{ ft}} = \frac{w \text{ in}}{4 \text{ ft}} \text{ (length in the drawing)} \\ \text{(actual measurement)}$$

- Use cross multiplication to find out the answer.

$$\begin{aligned} 1 \times 4 &= 2 \times w \\ 4 &= 2 \times w \\ 4 / 2 &= 2 / 2 \times w \\ 2 &= 1 \times w \\ 2 &= w \end{aligned}$$

- The width of the table in the scale drawing should be 2 inches.

4. Pass out graph paper and have the students try scale drawing. Use a transparency of graph paper to solve the problem using an overhead projector as you work with students.

5. Making an object smaller:

- On the graph paper, you will draw an eraser. The actual size of the eraser should be 10 squares long by 4 squares wide. Draw the eraser on your graph paper.
- Now we want to reduce the size of the eraser in our drawing. The ratio you will use to make the drawing of the eraser smaller is 2 to 1. That means for every 2 squares on the actual eraser, will now be drawn as only 1 square on the scale drawing. This ration can be written in three ways: 2 to 1, 2 : 1, or $\frac{2}{1}$
- What are the dimensions of the scale drawing of the eraser at this ratio?

$$\frac{\text{actual length of the eraser}}{\text{length of the eraser in the drawing}} = \frac{10 \text{ squares}}{/}$$

$$\frac{10 \text{ squares}}{/} = \frac{2}{1}$$

- Use cross multiplication to find out how long the eraser will be in the scale drawing.

$$\begin{aligned} 10 \times 1 &= / \times 2 \\ 10 &= / \times 2 \\ 10 / 2 &= / \times 2 / 2 \\ 5 &= / \end{aligned}$$

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ACTIVITIES CONTINUED

• The length of the eraser in the scale drawing will be 5 squares. What will the width of the eraser be in the scale drawing? Use the ratio and cross multiplication to find out. (Check students' answers.)

6. Making an object larger:

• Now we want to enlarge the size of the eraser in our drawing. The ratio you will use to make the drawing of the eraser larger is 1 to 3. That means for every 1 squares on the actual eraser, will now be drawn as 3 squares on the scale drawing.

• What are the dimensions of the scale drawing of the eraser at this ratio?

$$\frac{\text{actual length of the eraser}}{\text{length of the eraser in the drawing}} = \frac{10 \text{ squares}}{/}$$

$$\frac{10 \text{ squares}}{/} = \frac{1}{3}$$

• Use cross multiplication to find out how long the eraser will be in the scale drawing.

$$10 \times 3 = / \times 1$$

$$30 = /$$

• The length of the eraser in the scale drawing will be 30 squares. What will the width of the eraser be in the scale drawing? Use the ratio and cross multiplication to find out. (Check students' answers.)

Part B – Using Scale Drawings to Create Artwork (50-60 minutes)

1. Consider the following question before viewing the video of Jack McLarty: How might an artist use scale drawing to help him create artwork?

2. Introduce Jack McLarty. Tell students that Jack McLarty is a local artist who has created several murals in public buildings, such as schools and government buildings. A mural is a very large piece of artwork applied directly to a wall or a ceiling.

3. As you watch the video, look for examples of large murals created by Jack McLarty. Also watch for ways the artist may use scale drawing to make small drawings to help him plan out his artwork.

4. When watching the video, stop the film and focus on the following two projects:

• Portland City Hall Mural: Jack McLarty says he uses pieces of plywood 12" x 12" square for the finished pieces of the mural. How might he have used scale drawing to design the final mural?

• Jack McLarty's sketchbook of the design of the public auditorium mural and film of the finished mural.

5. Discuss how artists use sketchbooks to jot down ideas about artwork when they have them, and how this can be helpful to the artist later when formulating the design for a project.

6. Discuss again how Jack McLarty may have used his sketchbook to establish the design for the public auditorium mural, and then used scale drawing to make the mural the final size.

7. Consider the following question after viewing the video: Where did students see examples of large murals created by Jack McLarty? (City Hall mural, Laurelhurst School, Buckman School, Public Auditorium mural)

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ACTIVITIES CONTINUED

8. Through discussion, reinforce the main ideas of using a sketchbook to plan artwork, and utilizing the sketches to create a scale drawing of the finished piece.

9. Let students know that in the next lesson, they will get to create scale drawings of their own.

PART C – Creating a Scale Drawing (45-50 minutes)

Students will have the opportunity to create their own scale drawings.

1. Pass out a half sheet of graph paper to each student.
2. Have students outline an area containing 15 x 15 squares.
3. Ask students to create a simple pencil drawing (like Jack McLarty's) with the 15 x 15 square area.
4. When the drawings are complete, pass out a new sheet of graph paper to each student.
5. Tell students they will enlarge their drawing using a scale of 1 to 2.
6. Ask them to draw in the new square which will contain the scale drawing using the ratio of 1 to 2. What are the dimensions of the new array? (30 x 30 squares)
7. Direct students to look at just one square of their original drawing. Then they will duplicate the lines in that one square inside of the area of 4 squares on the enlargement. (Give a demonstration on the overhead.)
8. Give students time to complete the scale drawings to enlarge their artwork.
9. Display original drawing with enlarged scale drawing to compare and discuss.

EVALUATION

- Completed math papers showing problem solving using ratios when working with the class on the picnic table scale drawing.
- Completed enlargement of artwork using scale drawing.
- Involvement in all class discussions.

EXTENSIONS/ADAPTATIONS

- Graph paper with larger squares can be used for younger students.
- Assign younger students a simple design to practice enlargements using a scale drawing first, such as a flower or tree.
- Create a second, finished piece of artwork using scale drawing, to reduce the size of the actual object.

RESOURCES

Ryerson University. Drawing to Scale.

http://www.ryerson.ca/rta/handbook/tvpaperwork/drawing_to_scale.htm

WebMath.com – Ratios.

<http://www.webmath.com/index.html>