Proportions: Drawing a Scale Model of Your Garden

Overview:

Students will solve real-world geometry problems by creating a proportional scale model of their school garden. They will use this information to determine how much fencing will be needed to enclose the garden and how to determine the cost of the enclosure. This is intended to be a 2 to 3 day lesson, with **Day 1 for data collection**, and **Days 2 (and 3) for completing the handout**. This lesson was created using the Mark Twain Middle School garden but the handout can be modified if using a different garden.

Objectives:

At the end of the lesson students will be able to:

- **Measure** the perimeter of the garden.
- **Use** measurements to create a scale model of the garden.
- **Determine** the cost of enclosing the garden.

Preparation:

- Print and review Handout.
- Make sure the perimeter areas around the garden are clear of any obstructions.
- Place colored flags around the garden to indicate where students should start and stop their measurements of lengths and widths.

Materials:

- Measuring tape (one per each small group)
- Colored chalk
- Handout: "Drawing a Scale Model of Your Garden" with a scale model image of the garden
- Graph paper for each group

On the Board:

- Scale model of the garden
- Vocabulary
- Student Reflection Questions

Suggested Snack:

- There is no suggested snack for this lesson. See our Healthy Snack Database for ideas.

Vocabulary:

- perimeter
- measuring tape
- length of a rectangle (the longer sides of a rectangle)
- width of a rectangle (the shorter sides of a rectangle)
- proportional relationship/ratio
- proportional scale model (drawing/blueprint)
- enclose

Learning Activities:

Day 1

1. Warm-Up Activity (5 min.)
   A. Review how to use the measuring tape by measuring one wall of the classroom.
   B. Show students the scale model (on Handout) and explain that the scale drawing has the same shape as the actual space that it represents but is smaller (proportional relationships). These drawings (or blueprints) are used by engineers, carpenters, designers, and architects when they are building something.
   C. Remind students the formula for perimeter (P = sum of all sides of an object).

2. Data Collection Activity (25 min.)
   A. **Tell** students they will be using the actual measurements of the garden to draw a scale model of the garden to determine how much fencing would be needed if we wanted to enclose our garden.
   B. **Divide** students into groups of 3, and pass out one handout and one piece of graph paper per group. **Highlight** some of the features on the handout (e.g., example of scale model, where they should record data). **Distribute** measuring tape and colored chalk to each group. **Assign** 2 groups per side at a time and encourage them to check their measurements with other groups. (For example, Groups 1 and 2 will measure Length #1. Groups 3 and 4 will measure Length #2.)
   C. Tell students that there are colored flags in the garden that will indicate where they should start and stop measuring each side.
      - Suggested roles:
        - Two students in each group will be the measurers.
        - One student will be the recorder. They will use the chalk to mark the length of each segment on the ground and record the data on the handout.
      - Suggested schedule:
        - 5 min. per length and rotate groups in a clockwise rotation around the sides of the garden.

D. Bring class back together and ask each group to share their findings. Discuss why certain groups could have different findings (e.g., perhaps students were not consistent in the way they were measuring).

<u>Days 2 (and 3)</u>

3. Handout Activity: Drawing a Scale Model (30 min.)
   A. If needed, calculate and draw one scaled side of the garden together on graph paper as a class before students complete the handout on their own. (Students may be able to do on their own depending on their level.)
      - Which mathematical operation would you use to create a smaller but proportional version of the garden? Addition, subtraction, multiplication, or division? (Division)
      - Calculate how many 1/4 inch graph paper squares would be needed to represent width 1, given that 1 graph paper square represents 8 feet. For your measurements, round up to the nearest whole foot (ex: 57.5 ft —> 58 ft).
        - 58 ft / 8 ft = 7.25 squares
      - When drawing width 1, make sure students start on the left most side of the graph paper to ensure enough space for the whole model.
   B. Have students complete questions 2 and 3 on the handout by calculating and drawing the remaining sides on graph paper.
   C. **Present** the following scenario to students:
      - Imagine you were going to enclose the garden with a fence. Using the number of feet around the garden's perimeter, estimate and calculate how many 8-foot panels you would need to enclose the entire garden.
      - Now, calculate the total cost of enclosing the entire garden with a fence if each 8-foot panel costs $25.
   D. Have students complete the rest of the handout together in their groups.

4. Snack (5 min.)
   A. Recipe from Healthy Recipe Database.

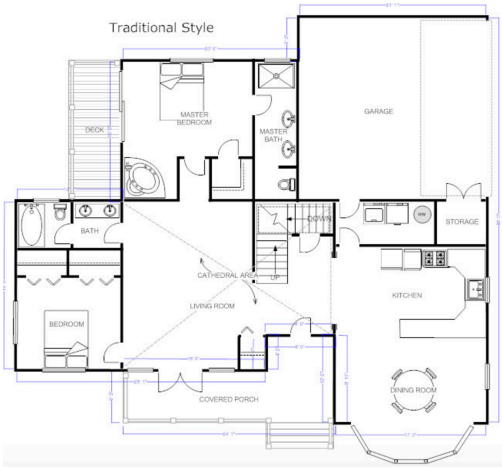
5. Reflection (5 min.)
   A. Have students answer the Reflection Questions in their math journals.

Student Reflection Questions:

1. How are scale models used in the real world?
2. What challenges did you face with this activity? What strategies did you use to overcome these challenges?

Assessment Questions:

1. How would you calculate the perimeter of this house? **(add up all of the side lengths)**
2. Which mathematical operation was used to create this scale model? **(division)**



Standards:

CCSS

- CCSS.MATH.CONTENT.7.G.A.1
  Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
- CCSS.MATH.CONTENT.6.RP.A.3
  Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.