

M2C3 MATH MODELING LESSON OVERVIEW

LESSON TITLE: Designing a Garden

STANDARDS ALIGNMENT:

GRADE 3	GRADE 4	GRADE 5
<p>3.OA 8. Solve two-step problems using the four operations. Represent these problems using equations with letter standing for the unknown quantities.</p> <p>3.MD . Geometric measurement: understand concepts of area and relate area to multiplication and addition.</p> <p>3.MD. 6: Measure areas by counting unit squares</p> <p>3. MD. Geometric Measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.</p> <p>3.MD 8. Solve real world and mathematical problems involving perimeters of polygons...</p>	<p>4.NF.B.3 Solve multistep word problems posed... Represent these problems with equations with a letter standing for the unknown quantities.</p> <p>4.MD. Solve problems involving measurement and conversion from a larger to smaller unit.</p> <p>4.MD. 3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.</p>	<p>5.OA. Write and interpret numerical expressions.</p> <p>5. NBT. Perform operations with multidigit whole numbers and with decimals to hundredths.</p> <p>5.MD. Convert like measurement units within a given measurement system.</p> <p>5. MD. 3. Recognize volume as an attribute of solid figures an understand concepts of volume.</p>
<p>MP: 1 Make sense of problem and persevere in solving them.</p> <p>MP: 2 Reason abstractly and quantitatively.</p> <p>MP: 3 Construct a viable argument and critique the reasoning of others.</p> <p>MP: 4 Model with mathematics.</p>	<p>MP: 1 Make sense of problem and persevere in solving them.</p> <p>MP: 2 Reason abstractly and quantitatively.</p> <p>MP: 3 Construct a viable argument and critique the reasoning of others.</p> <p>MP: 4 Model with mathematics.</p>	<p>MP: 1 Make sense of problem and persevere in solving them.</p> <p>MP: 2 Reason abstractly and quantitatively.</p> <p>MP: 3 Construct a viable argument and critique the reasoning of others.</p> <p>MP: 4 Model with mathematics.</p>

CONNECTIONS (Consider while planning):

- Previous Math Knowledge: *What prior math knowledge and experiences does this lesson consider and/or build on?*
 - Operations with whole numbers and decimal numbers (money)
 - Area of a rectangle and square measure
 - Perimeter of rectangle and linear measure

- Volume and cubic measure
- Reading tables/charts
- Knowledge of rates, for example, per square foot, per bag, per stake, per roll

- Cultural/Community/Family Connections: *How does the lesson connect to, or build on the knowledge, practices, or experiences of children and families? On community contexts??*

Some students may have experiences growing vegetables in a garden. Family members may have a garden or they may know of a community garden. Other students may only understand how vegetables grow by learning about plants in school. If your school or community has a garden you could visit it or have someone come and talk about the garden and how to access community garden shares.

Compost and composting may be familiar to students. Some communities encourage or require households to make compost out of organic matter such as vegetable waste. This can be done in the home or through community collection of these materials. In this task we are purchasing commercially made compost and spreading it over the garden.

Teachers or students may have knowledge of plants that can be planted together or plants that grow in particular seasons (depending on where you live)

- Vocabulary:
 - Square garden
 - Compost, composting a garden

TASK VARIATIONS:

Opening Routines: What do you notice? Wonder?

- Use initial slides to connect to students' knowledge and experiences with gardens and gardening
- What do you notice? What does this picture make you wonder about? Brief class discussion.
- Some gardens are planted in rows and some in squares. Some plants are close together and some farther apart. Elicit questions related to -> What are the differences between the row and square gardens? Why are some plants close together and others farther apart? How many plants can you grow in each square/row?.

Part 1: Planning your Garden Task

Your school's garden has an empty plot. The size of the plot is 4 feet by 8 feet. Your class wants to plant vegetables in the plot.

- Decide which vegetables to plant and how many of each vegetable will fit in the plot.
- Use the Planting a Square Foot Garden Table to help you.
- Draw a picture or diagram to show your garden plan.

Part 2: Preparing the Soil Square foot gardens need compost to enrich the soil.

Before we plant we need to spread compost over our garden to help the vegetables grow.

- What do you notice?
- What do you wonder?
- What assumptions can you make regarding composting a garden?
- Figure out how much compost you will need for the 4 foot by 8 foot garden plot.
- How much will the compost cost?

Part 3: Fencing your garden

- You want to build a fence around the 4 foot by 8 foot garden plot to protect the vegetables from small animals.
- You will use stakes and fencing material to make the fence. Use the task card to help you. You need to decide what kind of stakes to use, how far apart to place the stakes, and how many stakes you need. You also need to decide what type of fence material to use. You want the garden fence to be strong and stable, but also cost effective.
- Make a plan for your garden fence.
- Draw a picture or diagram of your plan. Show where you will place the stakes.
- Estimate how much the fence will cost. Include the cost of stakes and fencing material.

Part 4: Applying for Funding

- Your class is going to apply for a grant to purchase the materials for your 4 foot by 8 foot garden plot.
- You need to purchase the compost, and the fencing materials.
- Convince the funder that you have a good plan for your garden, including your garden fence. Be sure to list and justify any assumptions you are making.
- Tell the funder how much money your plan will cost.

PLANNING A GARDEN TASK: ANTICIPATED STUDENT STRATEGIES:

Relevant considerations that should come out during the initial discussion of this task (some information might be available, some will need to be assumed):

Student may:

Part 1:

- Notice in square foot gardens, some squares have several plants, while others have only one plant.
- May use perimeter instead of area to calculate the number of 1ft squares in their garden. Modeling the garden with color tiles will allow students to see the multiplicative connection to area. If you have square tiles on the classroom floor this could be used to model as well.
- Assume they must plant all of the plants in the Vegetable Spacing Table or that they may only select the vegetables they like.
- May multiply the dimensions (length and width) to find the area in square feet
- May decide to leave some square feet unplanted to easier access for watering

Part 2:

- Assume the number bags of compost they will need. They could say 1 bag per square foot. Looking at the picture, they may assume 1 bag for the whole garden.
- Assume they need to spread a little compost for each square. Ex. 1in-deep/square. Each bag holds 1 cu.ft. of compost or 12in-deep X 1 square ft. or 12in-deep X12inX12in. They could determine that 1 bag would cover 12 squares.
- Assume they need more than 1in-deep of compost to cover the garden. Ex. 3in-deep /square. If one bag covers 12 squares at 1 in-deep/square, then one bag would cover 4 squares at 3in-deep/square.
- May use dirt or dirt substitute to explore covering a square foot. 1 bag/square foot. Compost is 12 in-deep. 1 bag covers two squares at 6 in-deep. Etc.

Part 3:

- Assume they can put posts only at the corners (4 posts).
- Assume they will need posts at the corners and in between corners every 4 feet.
- Be confused by perimeter and area when determining the fencing. Fencing is 2-dimensional and is priced using linear measure.

Part 4:

- In the funding application, students may not indicate the vegetables they expect to grow. The funder will want to know what outcomes can be expected from money they have been asked to donate.

- In the funding application, students may not explain and justify the assumptions they made. An assumptions and justification chart can help students write the application.
- In the funding application, students may not show their calculations, but focus only on the final appoint. The funder will want to know how the money will be spent.

Materials

Color Tiles to model garden

Chart paper/Markers

Planning a Garden_Student Task

Planning a Garden_Lesson Slides

Planning a Square-Foot Garden Table Handout

Dirt (Sand/Small beads) optional

Measuring tools (optional)