Math Unit 1
Introduction to the Garden and Garden Maps

This lesson will provide students with a detailed map of their school garden, one that will be useful for all lessons held in the garden and in the classroom. Students will also be introduced to the metric layout of the garden and useful units of measurement. A major goal for this lesson—and ultimately this unit—is for students to become familiar and comfortable using the metric system.

Standards:
5.NBT.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
5.NBT.3 Read, write and compare decimals to the thousandths place.
5.NBT.3b Compare two decimals to thousandths based on meanings of the digits in each place using >, =, and < symbols to record results of comparisons.
5.NBT.4 Use place value understandings to round decimals to any place.

Objectives:
SWBAT identify the meter as the base metric unit for measurement of length
SWBAT express non-integer measurements as decimals up to the thousandths place
SWBAT create a detailed and scaled map of the school garden for use in further lessons

Materials
Graphing paper (¼'' x ¼'')
Pencil and Eraser
Student checklist of various structures to measure
Meter stick
Enough string/twine to measure the longest side of your school garden
Something hard to write on

Key Points:
Knowledge
- A garden is an area of land where plants are grown, it is a geometric shape.
- Some important garden vocabulary words are:
    - Bed
    - Perimeter
    - Soil
    - Mulch/Gravel
    - Square meter
- The garden is an extension of our classroom, it is a place for learning. We can use the garden to learn math and see why math is important in the real world
- A well organized garden requires sharp math skills. Gardeners and farmers must perform accurate measurements and calculations in order to reduce costs and maximize profits.

- A well detailed map allows us to remember parts of the garden once we're back in the classroom.

Skills

- Teamwork is essential when making large measurements. In order to work cooperatively and attain accurate results, students will need to communicate respectfully and effectively with one and other.

Essential Questions

How do we measure length?
How are the (raised)-beds organized and measured?
How big is our garden? How much growing space is there?

Introduction to New Material (10 min)

Introduce students to the garden. Point out certain features like (raised)-beds, gravel/mulched open-space, garden perimeter, compost area etc.,. Take a moment and point out what direction is North, what direction is South and the directions East and West. Then use a meter stick to try and measure the height of a student volunteer. In all likelihood you'll have a student who is 1.*X* meters tall, which requires you to use a decimal. For practicality purposes, round to the hundredths place (centimeters). Demonstrate again, with the same student, how you might use a piece of string to first measure the student and then measure the string with the meter stick.

Guided Practice (25 min)

Students are free to measure about the garden, using the checklist of structures for completion. The checklist should go from largest structure (perimeter) to smallest, this way students have an idea of where to start with their maps. Mapping the perimeter using string will require multiple students. If time is up and students have not completed all measurements, have them collaborate with others to get the ones they missed. Remind students that they need to measure not just the macro features, but also the distance of one object to another. For example, how far are the raised bed from the perimeter.

Independent Practice (15 min)

Once all measurements are taken, maps can either be drawn in the garden or back in the classroom. Instruct students to start by first mapping out the perimeter and using an appropriate scale for the size of your garden (eg., 1 meter in the garden equals 1 box on graph paper, or ¼'').

Addendum: *To be done perfectly, this lesson would most likely take closer to 90 minutes. You could easily split this into two days, doing just measurements on day one and mapping on day two. Some classes may not be at a level ready to map abstractly and so you could provide a crude map of all garden features and have students simply find measurements listed. This lesson provides a great opportunity to review rounding.*

Conclusion: Administer Student Exit Slip

Name:____

Introduction to the Garden

Today you are going to create a map of our school garden. It is important that you make this as detailed as possible so that you may use it to help remind you where everything is.

1.) First, circle the **unit** you are going to measure in: **in** **m** **cm** **ft** **yd**

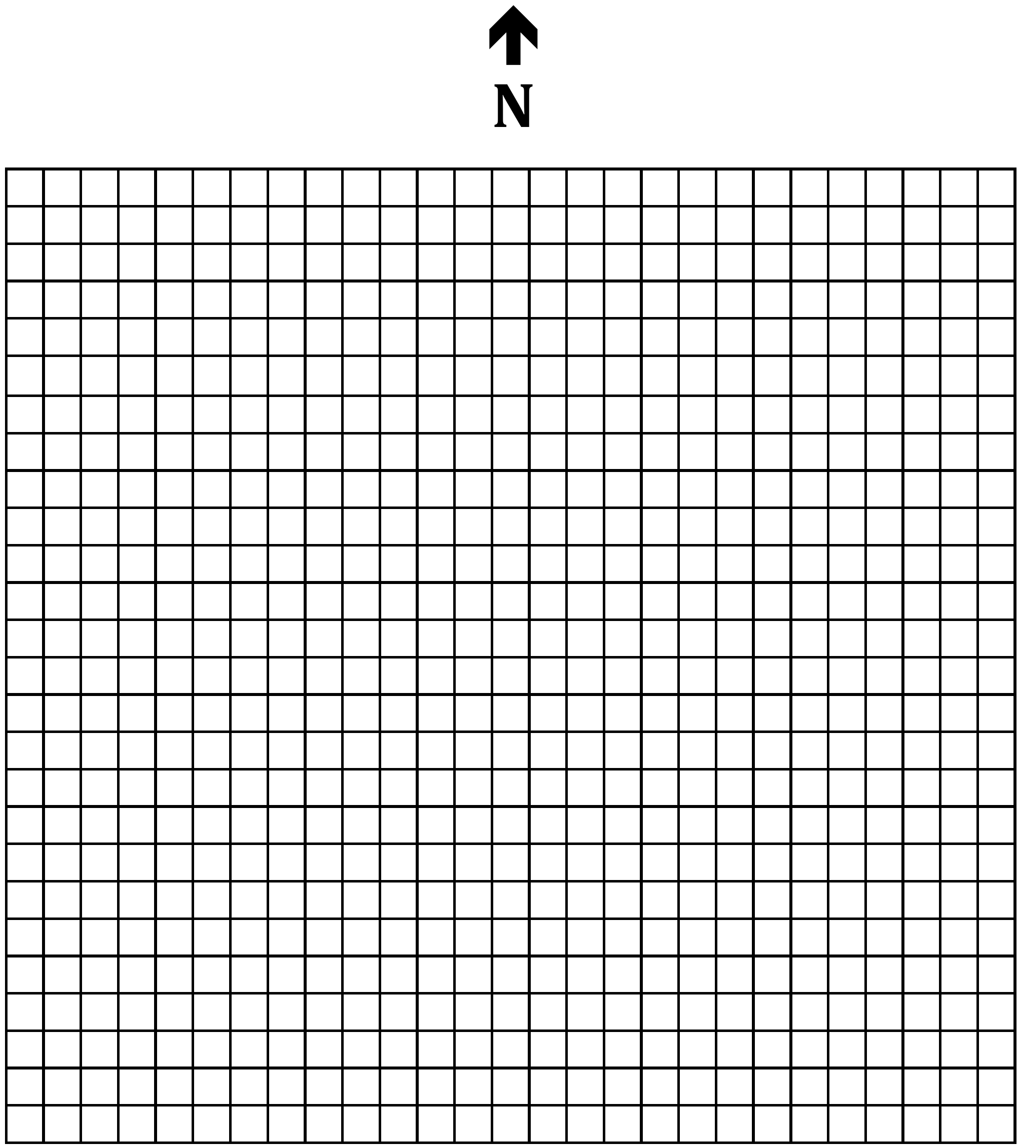
2.) Determine what direction is **North** (your teacher should help you with this) and then decide what directions are **South, East and West**.

3.) Now, decide what major structures you want to map out and measure. What pieces of the garden do you think are important? List them here:

- **Ex. Garden Beds (8.0 ft x 3.5 ft)**
-
-
-
-
-
-
-
-
-

Remember to use appropriate rounding skills! Your teacher will tell you what value place you should round to.

Instructor notes: You'll need to decide on a scale for students to use (e.g., 1 square on the grid equals 1 meter in the garden).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Name:____

Introduction to the Garden Exit Slip

1.) What unit did you use when measuring the garden today?

2.) What was the largest feature you measured in the garden? What were it's dimensions? Which side is the longest side?

3.) What was the smallest feature you measured in the garden? What were it's dimensions? Which side is the shortest side?

4.) How would you round 4.46 yds if you were rounding to the tens place?

5.) How many millimeters are in one centimeter?

6.) How many times larger is 50 meters compared to 50 centimeters?

7.) What has a larger area, a 2 x 3 **ft** section of dirt or a 2 x 3 **yd** section of dirt?

8.) What was the **southern** most feature in the garden?

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Math Unit 2
Square Unit Gardening

This lesson will provide students with a hands-on measurement of area and volume as well as introduce students to coordinate planes. With some beforehand preparation, fall planting can be performed in the garden using the established coordinates. This lesson requires that a square meter lattice network already be implemented in the gardening beds.

Standards:
5.NF.4b Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fractions side lengths and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas.
5.NF.5a Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication
5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers called its coordinates. Understand that the first number indicates how far to travel from the origin in the directions on one axis and the second umber indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinates, y-axis and y-coordinate).

Objectives:
SWBAT determine area of a gardening bed by counting the number of square meters in the bed
SWBAT determine the area of a gardening bed by multiplying the side lengths
SWBAT students will be able to compare the relative areas of gardening beds (>, <) based on one side measurement alone
SWBAT identify a given region on a coordinate plane

Materials
Student Worksheet and planting assignment
Maps from Week 1
Pencil and Eraser
Something hard to write on

Key Points
Knowledge
- Square unit gardening is an intensive, yet effective method of growing many different fruits and vegetables
- Plants grow best in certain groups or concentrations, so gardeners often use a square unit to keep track of what needs to be planted next to what
- Some important garden vocabulary words are:
  - Square meter
  - Concentration
  - Coordinate
  - X-axis, Y-axis

Skills

- Planting seeds and seedlings needs to be done gently and with care. Students/teachers need to keep track of what is planted where to ensure proper care of the growing plants.

Essential Questions

Why divide a bed into square units? What purpose does this serve?'
How might we determine the area of a bed if we didn't have a meter stick?
How might we compare the relative area of one gardening bed to another without a meter stick?

Introduction to New Material (10 min)

Reacquaint students with the garden and share the day's objectives. Square meters should already be measured out and lattices strung above the beds and labeled from 1 → 10. Explain that this is a square meter gardening system and how it is used to foster intensively planted gardens. Show how you can use the labeled axes in the beds to locate a particular square-unit. Then demonstrate how you would look at a planting assignment and properly plant a seed or seedling.

Guided Practice (20 min)

The student worksheet should guide students towards calculating the area of every bed in the garden. It should also include a section that has students evaluate the relative size of one bed to another (i.e., Bed A is [<.>,=] Bed B).

Independent Practice (20 min)

Have students then transpose the same coordinate lines that are in all the beds onto their maps from Week 1. Students should then color in or label where their planting assignment is on their maps. Once maps are complete, allow students to proceed in planting their respective seeds/seedlings in their assigned areas. It would be a good idea to not allow students to actually plant until they properly identify their planting location on their maps.

Addendum: *This lesson packs a lot of material into just one gardening assignment, planting. As with Week 1, this lesson could easily be expanded to cover a 90 min period or two days. This lesson relies on students already having been introduced to coordinate system nomenclature as well as area formulas. It might be a good idea to have a large data-board displaying all coordinate planes in the garden.*

Name:____

Square Gardening Worksheet

Use this worksheet to help guide you in the planting activity today. Remember to use your garden map from "Introduction to the Garden" to help you remember where different things are in the garden and what some of their dimensions are.

What is your planting assignment today?

What gardening bed are you planting in?

What are the dimensions of your gardening bed? Remember to include units.

What coordinates were you assigned to plant in?: **x:___________** **y:____________**

Label the **Origin (0,0)** and **x-axis** and **y-axis.** Number the coordinate as they already are in the gardening bed.

Now, indicate where different types of plants are being planted in your garden.

Instructor Notes: The student worksheet will need to be adjusted to fit the dimensions of beds in your individual garden. A large coordinate plane where examples can be shown would be beneficial. Try to have multiple students working in the same bed so that they can plot multiple points. If this is not feasible you include multiple coordinate grids on the student worksheet.

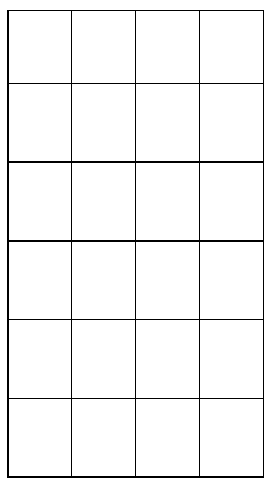
Student Exit Slip Name:____

1.) What were the dimensions of the garden bed you planted in? Remember to include units.

2.) John planted carrots at point (2,3). How many units did John move along the x-axis?

3.) Suzy planted okra at point (1,4). How many units up the y-axis did Suzy have to move?

4.) Micah planted broccoli at (1, 5), lettuce at (2, 4), eggplant at (3, 5) and radishes at (3, 4). Graph these points and label them. The bottom left-hand corner is the **origin.**



5.) What has a larger area, a 2 x 3 ft. bed or a 3 x 4 ft. bed?

6.) What can you say about a 4 x 8 ft bed and an 8 x 4 ft bed?

Math Unit 3
Half of a Half of My Garden Plot

This lesson will provide students with a physical example of working with fractions in the garden. Students can perform this skill when doing any sort of activity in raised beds be it planting, weeding, watering or harvesting.

Standards:

5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm
5.NF.3 Interpret a fraction as division of the numerator by the denominator.
5.NF.6 Solve real world problems involving multiplication of fractions and mixed numbers
5.MD.1 Convert among different-sized standard measurement units within a given system

Objectives:

SWBAT divide a rectangular prism into half and calculate the side lengths
SWBAT multiply multi-digit numbers to calculate area
SWBAT determine the appropriate metric scale for different sized fractions in the garden

Materials

Graphing paper (¼'' x ¼'')
Pencil and Eraser
Meter stick and enough string/twine to measure the longest side of a raised bed
Nail/Pushpins/Tape—to secure string/twine across the bed
Large tongue depressors
Something hard to write on
Scissors

Key Points:

Knowledge

- A raised bed is used to grow all different types of plants and vegetables
- Some important garden vocabulary words are:
    - Raised bed
    - Lattice/Square-unit
    - Square meter/foot
    - Midpoint
- Plants need individual space to grow, if they're too close they have to compete for nutrients and water
- Dividing a bed into smaller fractions is a great way to help plant seed/seedlings
- **WHY:** Fractions help gardeners decide how to divvy up their beds

Skills

- Making measurements in the garden using the desired unit of measurement
- Working together to make large measurements
- Communicating with peers to help form lattice structures over the beds

Essential Questions
How do we measure length?
How are the (raised)-beds organized and measured?
How much space does each type of plant need to grow

Introduction to New Material (10 min)
Set up a mock garden bed using string and sticks on a large flat area—make it the same size as the beds the students will be using. Explain the reason for dividing the bed into small single-plant spaces and why this is important. Using volunteers, use a meter stick to determine the midpoint of one of the sides of the bed—have another student volunteer do the same on the opposite side length. String the two midpoints together and repeat on the opposite side. Then repeat with one quadrant and again with quadrants until you reach the smallest square area needed for a single plant; you should end with a square unit roughly 1' x 1'. Be sure to demonstrate tying off string and using tongue depressors as stakes in the bed to help elevate the lattice structure.

If you are pairing this lesson with a specific gardening activity, be sure to demonstrate that as well (e.g., weeding, planting, thinning).

Guided Practice (35 min)
Students should be able to work through this exercise without the guidance of a worksheet, however, the demonstration should be left as an example. Students are to work in small groups, dividing each half into another half until they reach a square unit containing a single plant. For guidance, leave the mock garden bed lattice structure in tact so that students may reference it for an example.

Students should then measure the area of that unit using the area formula and appropriate units. This can be done at various times of the season, the activity just needs to be adjusted for plant growth. If doing this activity prior to planting, students should be given a final square area to end with.

Independent Practice (5 min)
Have students record their finds and sketch the resulting lattice structure. More time can be allocated to yield more specific measurement-based illustrations. Math worksheets with various fraction problems can also accompany students as they work through this exercise.

Example:

How many 0.5 m x 0.5 m square units are there in the planting bed? How many have something growing in them? How could you express this as a fraction?

If 20 of the 40 squares have plants growing in them, what is a simplified fraction I can use to explain how much of the bed is planted?

If you plant 3 squares worth of peas and 1 square worth of cucumbers, what fraction expresses the ratio of cucumbers to peas in that area?

Closure (5 min)

Have students critique the garden beds of their peers. Ask if they recognize or see a pattern? Do they see anything that was done incorrectly? How might they do it differently next time?

Addendum: *A good idea is to pair this exercise with a certain garden task, such as weeding, in order to expand on standard practice. Say you're discussing the importance of weeding that week, this activity could then be done to the point of isolating individual plants and then having students record weed numbers per unit are. When done correctly, this activity provides a perfect lattice/coordinate-plane for data collection (e.g., weeds, plants, fruits, water, insects etc.,). Encourage students to use different metric prefixes to build on NBT standards and remember that this can be done in non-rectangular beds if measured appropriately.*

Student Exit Ticket Name:____

Half of a Half Activity

1.) What were the dimensions of your garden bed? Based on those dimensions, what area did you determine for your garden bed?

2.) After you divided your bed in half, what happened to the area of one side of the garden?

3.) Victoria is weeding in a 4 x 8 foot gardening bed. If she divides the garden in half along the 8 ft side, what are the new dimensions? What is the are of one half of the garden?

4.) How many times do you need to divide a garden in half before you get 8 equal pieces?

5.) Jason divided his garden bed into 16 equal parts. He then harvested ¼ lb of tomatoes from each part. How many pounds of tomatoes total did Jason harvest?

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Math Unit 4
Area and Perimeter of Leaves

This lesson provides students with experience measuring perimeter and area in two different ways. Students will apply these skills when measuring a variety of leaves in the garden. Students can also compare and analyze the two different types of measurement.

Standards:

5.G.2 Represent real world and mathematical problems by graphing points
5.MD.1 Convert among different-sized standard measurement units within a given system
5.OA.2 Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them

Objectives:

SWBAT determine the perimeter of an irregular shape using a piece of string
SWBAT determine the area of an irregular shape using a grid system
SWBAT perform multi-digit multiplication

Materials

Graphing paper (1cm x 1 cm)
Pencil and Eraser
30-centimeter piece of string
Something to work on
Scissors
Ruler with centimeters

Key Points:

Knowledge

- Perimeter is the distance around a closed shape
- Area is the space inside a closed shape
- Some important vocabulary words are:
    - Area
    - Perimeter
    - Centimeter
- Area is a very important measurement used in the garden; it's used to measure just about everything from garden sized to leaf sized
- Perimeter is also important, especially when ordering garden materials
- Irregular shapes don't have simple equations for area and perimeter because they don't have equal sides

Skills

- Gathering a variety of leaves to measure
- Constructing data tables for keeping track of area and perimeter data
- Critiquing peer work and calculations

Essential Questions
How do we measure perimeter?
How do we measure area?
How might these measurements be important for gardeners to know?
Why can't I multiply base times height to determine the area of a leaf?

Introduction to New Material (10 min)
Be sure that there are adequate sized leaves in your garden—if there is not, you may want to try and find other samples or buy some. Instruct students to only pick the bottom leaves off of live plants so as not to hamper photosynthetic needs. Ask students what the outer line of the leaf is (perimeter) and what the inner part of the leaf shape is (area). Demonstrate for students how to measure perimeter using a piece of string to first measure the perimeter of the leaf and then measuring said length against a ruler or meter stick. Then demonstrate how tracing leaf over a piece of grid paper transposes the leaf shape. Have a volunteer then count the number of enclosed whole units. Explain that a good estimation is one that also includes half of the partial units.

Guided Practice (30 min)
Have students pick leaves of their choice, perhaps encouraging them to gather an assortment from different plants or different parts of the same plant. Have students then measure perimeter and area as demonstrated. Students should record finding in a journal or on scratch paper. For guidance, keep a worked example of the steps for determining perimeter and area.

Independent Practice (10 min)
Have students compare calculations and encourage them to check each others work. Is your partner calculating area correctly? Did they round to the nearest unit as directed?

Closing (5 min)
The end result of this activity is great for display if the leaves and calculations are secured to a piece of cardstock or poster board. Administer Student Exit Ticket.

Addendum: *This lesson can be expanded to investigate trends in perimeter and area. Generally speaking, plants suitable for growing in less than full light will have larger leaves than those needing full light. Why do students think this is?*

Name:____

Area and Perimeter of Leaves

1.) What is the equation for perimeter? How do you determine perimeter if your object doesn't have a base or height?

2.) A rectangular garden bed has a base of 3 ft and a length of 8 ft. Write an expression that could be evaluated to determine perimeter.

3.) Paul is measuring the perimeter of a leaf and creates the following expression: 8 + 4 +5 + 4 +2
What can be said about two sides of the leaf?

4.) A leaf with a perimeter of 12.3 cm would have a perimeter of _____________mm

5.) When measuring a perfectly rectangular garden bed, how could you write an expression using parentheses to simply your math? Give an example.

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Math Unit 5
Bud, Flower and Fruit Data[1]

Students follow an established algorithm counting the number of stems on a developing plant in order to estimate the number of flowers, buds and fruits that will be produced. This activity can be expanded over multiple dates in order to compare data as plants grow.

Standards:
5.OA.1 Use parentheses, brackets or braces in numerical expressions and evaluate expressions with these symbols
5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms

Objectives:
SWBAT estimate future fruit production of a single plant by counting the number of buds
SWBAT use parentheses and possibly brackets to perform multi-step multiplication estimation problems
SWBAT construct data plots showing the number of identified plant parts

Materials
Graphing paper (1cm x 1 cm)
Pencil and Eraser
Data Table
Flower study steps
Ruler

Key Points:
Knowledge
- Estimation is an important skill by which we make educated guesses about statistical outcomes
- Different parts of a developing flower can give us a good idea of how much fruit the plant will produce
- Some important vocabulary words are:
    - Bud
    - Flower
    - Fruit
- Flowers are very important in the garden not just because they look nice but because they attract pollinators like bees
- Estimating is a great tool to have when you need to count a large number of things

Skills
- Identifying different parts of growing plant
- Counting different parts of a plant
- Analyzing plant data for mean

[1] Adapted from *Math in the Garden: Hands-On Activities That Bring Math to Life*. University of California Botanical Garden and Lawrence Hall of Science. National Gardening Association, 2006.

Essential Questions
How can we formulate a good guess as to how much fruit a plant will yield?
What's the importance of flowers?
What is an average? How do you calculate it?

Introduction to New Material (10 min)

Use a part of your school garden with well-defined, good-sized fruit. Choose one plant to demonstrate on and point out the different part (flower, bud, fruit). Show students how they should count and fill in their tables with the numbers of various parts. Explain why a farmer might look at one plant to estimate the yield of all his plants.

Example: Count how many fruit/vegetables are growing in a 1 m x 1 m unit square. How many unit squares are growing that exact same type of fruit/vegetable? What two numbers could you multiply to get an idea of how many total fruit/vegetables are in the garden? Would this number be exact or an estimation?

Guided Practice (20 min)

Prior to entering the garden, provide students with a rough outline of data you are looking for. They should be recording the type of plant, number of flowers, number of buds, number of fruits, total stem growth (flowers+buds+fruit) and numbers of stems.

Have students find the average fruit yield per unit area and predict what they might harvest later in the season. Depending on math content progress, students might be supplied with a useful equation for determining average. The guiding element to this part of the activity rests in the students being assigned a particular part or species to count, plan ahead accordingly based on what is available in the garden.

Example: Have students calculate average two different ways. First, have students count the number of fruit/vegetables in a unit square and multiply by the number of unit squares with that particular crop (as done above). Then have students pick the square they think has the most fruit/vegetables (of one varietal) and a the square with the least. Add those two numbers together and divide by two. How does this compare to the average found when multiplying? Which one do students think is more accurate?

Independent Practice (20 min)

Students should consult with peers to compile further data. Once a student completes her count for one plant, she could ask a peer for a count on the same species but different plants. Have students compare averages across the same plant varietals and against different types of crops.

Conclusion (5 min) Have students compare and record data for the entire garden. Calculate class averages and pass out Student Exit Ticket.

Addendum:

This lesson can easily be expanded to cover two periods if the first day is spent in the garden and the second doing data analysis. Worked examples of averages and concentrations should be provided if appropriate. This lesson can also be expanded to include the graphing of data.

Name:_______________________________

Bud, Flower and Fruit

1.) What part of the plant were you tasked with counting? What does this part of the plant do?

2.) Evaluate the expression 3 (9+1)

3.) Write an expression to represent the sum of three garden beds with 12, 8 and 11 fruits respectively.

4.) How many different types of fruits did you count?

5.) Write a single expression for the following total harvest:
    - 4 lettuce beds: 1 with 10 plants, 2 with 8 plants and 1 with 4 plants
    - 8 tomato plants: 4 with 8 fruit, 4 with 10 fruit
    - 3 zucchini plants: all three with 4 fruits each

6.) Ms. Smith's class harvested 20 pounds of produce their first month in the garden, 30 pounds the second month and 40 pounds in the third month. How much produce do you anticipate Ms. Smith's class harvesting next month?

7.) Mr. Boyer's class planted 80 seeds and then harvested 20 plants that fall. They then doubled the number of seeds planted in the spring. How many plants do you expect Mr. Boyer's class to harvest after the spring planting?

Math Unit 6
Plant Growth

*This activity can be formatted to either one class period or as a course during the growing season. In this activity, students track the growth of a particular plant and measure its progress using a unified system of measurement. * If using the metric system, this lesson can be a good practice of tens-based exponents.*

Standards:

5.NBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10 and explain patterns in the placement of the decimal point.
5.NBT.4 Use place value understanding to round decimals to any place.
5.MD.1 Convert among different-sized standard measurement units within a given measurement system

Objectives:

SWBAT take measurements to a stated degree of precision
SWBAT measure an object with both metric and imperial units
SWBAT move a decimal to the left or right to change metric unit measurement

Materials

1 to 2 meters of string
Pencil and Eraser
Ruler and/or meter stick
Data worksheet or blank paper for recording measurements

Key Points:

Knowledge

- There are multiple ways of expressing the measurement of length
- The metric system is based on units of ten
- Some important vocabulary words are:
    - Meter, centimeter, millimeter
    - Yard, foot, inch
    - Precision
- Plants grow and change throughout the season, they do this at different rates during different times of year

Skills

- Selecting an appropriate unit of measurement
- Working with a partner to measure large lengths and communicating with math fluently
- Identifying trends in growth data
- Plant drawings

Essential Questions

How do we know what unit of measurement is correct/appropriate?
When do plants grow the most? When do they grow the least?
How do we express a measurement taken in metric as imperial and vice versus?

Introduction to New Material (10 min)

Select a large plant to first demonstrate on (sunflowers are perfect if available). Start by pointing out different features for measurement and explain how students should first sketch the plant and then measure and record measurements on their drawings.

Guided Practice (10 min)

Demonstrate for students how to round to the most defined unit. For example, if a stem measures 35.45 centimeters, on a meter stick it will most likely look like 35.4, but you can round the ten-thousandth to 5. Also discuss with students the different systems of measurement (imperial and metric) and decide on using just one for the day.

Independent Practice (30 min)

Encourage students to pick their favorite plants to measure and draw. Have students first sketch the plant and then measure various parts using the string and meter stick. Have students practice rounding by giving them a specific place of precision that they must round to.

Later, in the classroom, have students pair and share their work. This would be interesting if students used different units of measure and had to then convert to the other so as to allow collaboration and comparison.

Conclusion (5 min)

If using activity over the duration of a growing season, have students save work for later measurements. Assess activity objectives with Student Exit Ticket.

Addendum:

Worksheets practicing various math standards could certainly accompany this activity, instructing students to manipulate their measurements any number of ways. This exercise emphasizes the above standards best when done over an entire growing system as the plant growth is rapid enough to demonstrate the powers of ten in the metric system (e.g., a seedling first measured in millimeters can then be measured in centimeters and eventually decimeters and possibly even meters).

Name:______________________________________

Plant Growth

1.) What plant did you measure today? What is one observation you made about your plant?

2.) How tall was your plant? How wide was your plant? What was the largest part of your plant?

3.) What unit did you use when making your measurements? Why did you choose to use this unit?

4.) Whitney measured the stalk of her sunflower to be 3.45 centimeters. How many millimeters is this?

5.) Two months later, Whitney's sunflower is 1.8 meters high. How many centimeters is this?

6.) What is larger, a 2.45 decimeter tomato plant or a 145 millimeter bean plant?

Math Unit 7
Cross Cut Snacks

In this activity students are encouraged to try and sample new fruits and vegetables. Students will first be exploring geometric shapes and patterns in fruit/vegetable structure and then eating their creations.

Standards:

5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category
5.G.4 Classify two-dimensional figures in a hierarchy based on properties

Objectives:

SWBAT identify geometric shapes based on attributes
SWBAT group together similar shapes
SWBAT predict internal geometric shapes based on external observations

Materials

Paper plates
Journal
Pencil and eraser, colored pencils
Illustrations or examples of geometric shapes
Plastic cutlery or kid-safe knives

Key Points:

Knowledge

- Geometric shapes are found all over the garden; some are natural, others are man-made
- Some important vocabulary words are:
    - Sphere, hemisphere
    - Cylinder, circle, oval
    - Half-circle
    - Square, rectangle
    - Polygon
- External shapes can help predict internal shapes

Skills

- Shape identification
- Fruit/Vegetable selection and identification
- Safe knife handling
- Drawing various geometric shapes

Essential Questions

How do we group together similar shapes and figures?
Why is it important to try new foods?
How did your prediction of inner geometry shape out?

Introduction to New Material (10 min)

Depending on desires for safety, either go ahead and pre-slice all fruit or plan on demonstrating safe cutting techniques. First, go through various shape examples with students, pointing out major features like faces, plane and angles. Ask volunteers to name and point to examples of shapes they recognize in the garden. With a sample, identify the outer shape, predict the inner geometric shape, cut open and discuss your findings. Show for students how to record their findings (how many triangles they've eaten, how many squares etc.,.) and model positive eating behavior.

Guided Practice (10 min)

Students should work in pairs to investigate various shapes in the garden. A data board listing all possible shapes and allowing for students to record the number of shapes they encounter is a good idea.

Independent Practice (30 min)

Students work around the garden trying new fruits and recording their findings. Collaboratively, students should be answering questions like:

"What shapes are we using?"

"How do shapes change depending on how you are looking at them or how you cut them?

" What new foods did we try?"

Conclusion (5 min)

Have student volunteers share their journal entries with the class. Hand out Student Exit Ticket Assessment.

Addendum:

Pattern exercises can also stem from this lesson. Have students construct patterns with geometric shapes and then have partners either mirror or modify. Students can also construct complex shapes from simpler shapes, for example a rhombus out of two triangles.

Data analysis can also take place if class data is compiled on eating preferences. Look for the fruits most people liked, most people didn't like, fractions of the class that liked certain things and not others etc.,.

Name:______________________________________

Cross Cut Snacks Activity

1.) What was your favorite snack today? Why was this your favorite?

2.) What was your least favorite snack? What was it your least favorite?

3.) What is an example of a fruit with a circular cross-section?

4.) What is an example of a fruit with two different shapes based on which way you cut it?

5.) What shape that you saw in this activity had the most sides?

6.) What was the simplest shape you saw in the garden?

7.) Sarah designed a pattern out of crops she harvested in the garden. In her pattern she had cross-sections of squash, tomatoes, cucumbers and raspberries. Draw a pattern using these possible crops that follows the pattern simplest shape → most complex shape.

DELTA FRESH FOODS
FARM TO SCHOOL

Math Unit 8
Project: SNAP Challenge

In this activity students work on multi-digit number manipulation while investigating the Supplemental Nutrition Assistance Program (SNAP). Students are challenged to create a healthy diet on a limited budget and must perform math operations in order to calculate their nutritional needs verses financial means.

Standards:

5.NBT.6 Find whole-number quotients of numbers with up to four-digit dividends and low-digit divisors, using strategies based on place value, the properties of operations and/or the relationship between multiplication and division.
5.NBT.7 Add, subtract, multiply and divide decimals to hundredths using concrete models or drawings and strategies based on place value, properties of operation and/or the relationship between addition and subtraction

Objectives:

SWBAT catalog what they eat in an average day and perform necessary operations to calculate average nutrient intake
SWBAT analyze daily intake to determine what can be given up
SWBAT reformulate a diet based on only $4 per day

Materials

Paper
Pencil and eraser
Colored Pencils
Nutrient Information table (see, Teaching the Food System website at Johns Hopkins Center for a Sustainable Future teacher resources)

Key Points:

Knowledge

- Many foods are more healthy for you than others because of the nutrients they have in them
- Unfortunately, most food that is not healthy for you is also the cheapest
- When you evaluate foods based on nutrient content per dollar, it becomes more obvious that it's better to buy the good stuff and avoid the bad stuff
- Being able to divide multi-digit numbers quickly in your head using rounding and place value strategies is a valuable tool to be able to use when buying groceries

Skills

- Healthy Eating
- Food Budgeting

Essential Questions

Why is it important to budget for healthy eating?
Why is are some foods healthier than others?
How do you determine nutrition per dollar?

Introduction to New Material (10 min)

Discuss with students the SNAP program and why some people try to demonstrate how hard it is to subsist under this program by "SNAP dieting" for short periods of time. Ask volunteers to explain how they might determine if one food is healthier than another. Then introduce the ANDI scoring system and go through various examples, both nutritious and non-nutritious ones.

Be sure to discuss what serving size is and how the values for nutrient density and cost are expressed in uniform serving sizes. Share with students what a healthy diet looks like and what sort of ANDI score they should be shooting for.

Guided Practice (10 min)

First, start by showing students how you would record a weekly diet. Ask for volunteers to share a typical daily diet and keep track of this on a white board or chalkboard.

Then walk through the steps of calculating the relative nutritional benefit of a food item by dividing the ANDI score by the dollar amount per serving. Use integers or decimals depending on where you are in your math curriculum. A standard algorithm for guidance should be shown.

Independent Practice (30 min)

Students should work independently or in small groups to first write out an average weekly diet, that is, what they would *like* to eat. Students then calculate the total cost of that diet using the given prices. Students should also calculate the ANDI score of their desired diet.

Have students then compare their diets with peers and find the average for the class.

Students should then try and design a diet that falls under the SNAP benefit guidelines. This will require them to recalculate their old diets using multiplication and division or design a completely new diet following the same steps as before.

Conclusion (5 min) Have students reflect on what they learned in this activity. Do they think they could live very comfortably this way? Pass out Student Exit Ticket.

Addendum:

It is critical that this lesson be adapted for whatever level of math proficiency your students are at. A completely worked example of the steps would be beneficial. This lesson also has a lot of potential to be manipulated to utilize different iterations of numbers, meaning decimals, fractions, integers…whichever you're trying to practice.

Name:____
SNAP Challenge Activity

1.) What is food insecurity?

2.) What is generally cheaper, healthy food or unhealthy food?

3.) If Jenny has $1,040 to spend on food for an entire year, how many dollars can Jenny spend per week? (There are 52 weeks in one year).

4.) John needs help deciding how to eat healthy with just $5. Based on the following ANDI scores, what would you buy to maximize John's nutrition? Explain your choice(s).
    - $5 dollar hamburger (40 ANDI points)
    - $3 turkey sandwich (25 ANDI points)
    - $1 carrot sticks (20 ANDI points)
    - $2 soda (1 ANDI point)
    - $1 juice (5 ANDI points)

5.) About how many times healthier is kale (ANDI score of 1000) compared to a cheeseburger (ANDI score of 50)? Explain your reasoning.

DELTA FRESH FOODS
FARM TO SCHOOL

Standards for Mathematical Practices

The Common Core State Standards for Mathematical Practice are integrated wherever possible in this "School-to-Garden" curriculum. Below are a few examples of how these Practices may be integrated into tasks that students complete.

Mathematic Practices	Explanations and Examples
1.) Make sense of problems and persevere in solving them	Mathematically proficient students in 5^{th} grade should be familiar and comfortable working with integers, decimals, fractions and mixed numbers. These numbers will be encountered in the garden when tabulating crop harvest, measuring landscape features, utilizing the square-meter gardening method and when planting/ordering seeds.
2.) Reason abstractly and quantitatively	Students will be introduced to the garden as very much a "tool" to foster their learning. Their continuation of learning in the classroom, however, will be stimulated abstractly. For example, if a student is asked to find the area of a raised bed in the garden, they will do so with a meter stick. If back in the classroom, a student would take given measurements and utilize the same algorithm as they did in the garden.
3.) Construct viable arguments and critique the reasoning of others	A school garden provided the perfect opportunity for critiquing the reasoning of others, as there is a communal need for cooperation. When projects or activities in the garden are constructed around the pursuit of an appropriate method (i.e., "we can't move onto step 2 unless everyone has done step 1 correctly") then there exists an obvious incentive for the sharing of information.
4.) Model with mathematics	Students will have ample exposure to real geometric shapes and figures. The use of a square-meter gardening method creates a natural coordinate plane and contextualizes the modeling of fractions and partial areas.
5.) Use appropriate tools strategically	Math "tools" in the garden will come very much in the form of algorithm short-cuts and an improved sense of numeracy and rounding.
6.) Attend to precision	So much math that takes place in gardening is done mentally and results in financially significant decisions—attention to detail is of the utmost importance when trying to limit waste.
7.) Look for and make use of structure	Students will recognize mathematical "shortcuts" used in the garden, such as unit squares for determining volume and area. Students will also be able to identify patterns and proofs for different geometric and mathematic processes in the garden.
8.) Look for and express regularity in repeated reasoning	Many gardening practices require redundant calculations—such as area—in order to determine yield, watering, coverage etc.,. The constant practice of these calculations will help to reinforce patterns and objective practice.