

MATH STANDARDS KEY		MATH STANDARDS*													
● = Key Content ● = Additional Content															
Math in the Garden		Number, Operations & Algebra	Measurement	Geometry & Pattern	Data Analysis	for Ages									
Page	Activity					5	6	7	8	9	10	11	12	13	
56	Centimeter by Centimeter	●	●												
31	Comparing the Area of Leaves	●		●											
122	Drawing Tree Observations		●	●											
19	Everything Counts in the Garden	●													
97	Geometric Windows			●	●										
23	Locating Garden Treasures	●													
75	Mud Shakes		●		●										
90	Shapes in the Garden			●											
86	Cross Cut Snacks			●	●										
127	Data Snacks				●										
135	Flowers: Graph & Graph Again	●			●										
60	Garden Harvest — Measuring Length		●		●										
93	The Great Triangle Hunt		●	●											
52	Hand Spans		●		●										
15	How Many Seeds in a Tomato?	●													
71	How Much Space Does it Take?		●	●	●										
131	Leaf Attributes				●										
68	Measuring with Steps		●												
110	Pattern Snacks			●											
144	Plant Predators — Sampling Evidence				●										
114	Symmetry — Find That Line			●											
118	Symmetry Inside Fruit			●											
139	What’s in Garden Soil?				●										
79	Weighing the Garden Harvest		●												
101	Angle Search		●	●											
35	Area & Perimeter of Leaves	●		●	●										
148	Bud, Flower, Fruit Data				●										
39	Half of a Half of My Garden Plot	●													
27	Inside the Coordinate Grid	●													
105	Planting in Circles			●											
64	Plant Study — Measuring Growth		●		●										
43	Ratios of Shoots and Roots	●			●										
153	Self-Similarity			●	●										
157	Shadows — Change Over Time		●		●										
47	Soil + Water Profile	●	●		●										

NATIONAL SCIENCE STANDARDS**														Math in the Garden
Science as Inquiry		Physical Science		Life Science		Earth & Space Science		Science & Technology		Science: Personal & Social Perspectives		History & Nature of Science		
K-4	5-8	K-4	5-8	K-4	5-8	K-4	5-8	K-4	5-8	K-4	5-8	K-4	5-8	
●				●				●						Centimeter by Centimeter
●				●				●						Comparing the Area of Leaves
●				●						●		●		Draw Tree Observations
●														Everything Counts in the Garden
●								●				●		Geometric Windows
●								●		●		●		Locating Garden Treasures
●		●				●		●		●				Mud Shakes
●								●						Shapes in the Garden
●				●						●				Cross Cut Snacks
●	●							●	●	●		●	●	Data Snacks
●	●			●	●			●	●			●		Flowers: Graph & Graph Again
●	●			●	●			●	●	●	●	●		Garden Harvest — Measuring Length
●								●	●					Great Triangle Hunt
●								●	●			●	●	Hand Spans
●				●	●			●	●	●		●	●	How Many Seeds in a Tomato?
●	●	●						●	●			●	●	How Much Space Does it Take?
●				●	●			●						Leaf Attributes
●								●	●			●		Measuring with Steps
●				●				●				●		Pattern Snacks
●	●			●	●			●	●	●	●	●	●	Plant Predators — Sampling Evidence
●				●	●									Symmetry — Find That Line
●				●	●									Symmetry Inside Fruit
●	●	●	●			●	●			●	●	●	●	What's in Garden Soil?
●	●	●	●					●	●	●	●	●	●	Weighing the Garden Harvest
●	●							●	●			●	●	Angle Search
●	●							●	●					Area & Perimeter of Leaves
●	●			●	●			●	●	●	●	●	●	Bud, Flower, Fruit Data
●								●	●			●	●	Half of a Half of My Garden Plot
●	●							●	●	●	●	●	●	Inside the Coordinate Grid
●								●	●					Planting in Circles
●	●			●	●			●	●			●	●	Plant Study — Measuring Growth
●	●			●	●			●	●			●	●	Ratios of Shoots and Roots
●				●	●			●	●			●	●	Self-Similarity
●	●	●	●					●	●			●	●	Shadows — Change Over Time
●	●	●	●			●	●	●	●	●	●	●	●	Soil + Water Profile

**National Academy of Sciences *National Standards for Science Education*

Hand Spans

Ages 5-13

Gardeners often use hand spans, paces, and other nonstandard measures to plant. In this activity, children use their hands and rulers to estimate and measure the length of objects in the garden.



This activity explores length using a hand span, a nonstandard and nonuniform unit of measurement. A **ruler** is a tool with a standard unit of measurement, such as an inch or centimeter, inscribed on it.

What You Need

For Each Pair

- ruler (inches or centimeters)
- journals
- pencils

For the Group

- databoard
- colored marking pens

Getting Ready

1. Walk through the garden and plan what objects and plants the children will measure using their hand spans.
2. Gather rulers that have a zero labeled at the starting point.
3. For younger children use rulers that show inches; for older children use a centimeter ruler. If your rulers show both measurement systems, tape over the side you don't want the children to use.



Here We Go

1. Tell the children they will learn methods that farmers have used for thousands of years to measure objects in the garden. Ask:
 - * What do you use to measure the length of an object?
 - * What kinds of things might you measure in the garden?
2. Using your hand, demonstrate the length of a hand span:
 - a. Spread your hand on the surface of the databoard, and mark the outer tips of your thumb and pinky finger.
 - b. Using a ruler, connect the two points with a straight line and label the length "My Hand Span."
3. Have children demonstrate their hand spans with a partner by holding up their hands (with fingers spread apart), palm to palm, fingers lined up. Do any children have the same hand span? (Some may; however, many will differ slightly in length.)
4. Model how to measure an object using your hand span. Ask a volunteer to measure a second object that is longer than one hand span. Remind the individual to have a fully extended hand span while measuring. As a group, determine how to count partial spans, such as "about half" a span or "a bit more" than a span.

Hand Span Hunt

1. Have the children go into the garden on a "Hand Span Hunt" to find three things that are approximately the same length as their hand spans.
2. Regather the group and have the children share what they measured. Ask them how their hand span measurements could help them in the garden.
3. If no one mentions it, point out that gardeners often use their hand spans as a quick way to estimate lengths of things in the garden, such as how much room to leave between plants, stepping stones, and garden beds.





Measuring a Hand Span

1. Tell the children they will measure the length of their own hand span with a ruler. Knowing their own hand span length will allow them to compare hand span measurements among their group.
2. Ask if anyone has used a ruler to measure things, and if they used inches or centimeters.
3. Distribute the rulers and ask the pairs to identify the “0” starting point. Depending on the age of your group, ask them to find the 1-inch mark (or 1-centimeter mark), the 6-inch mark (15-centimeter mark), and 12-inch mark (30-centimeter mark).
4. Have the children, with a partner’s help, trace their hand spans in their journals, measure their hand spans with the ruler, and record the results.
5. Ask children to report the lengths of their hand spans and compare hand span measurements among the group.

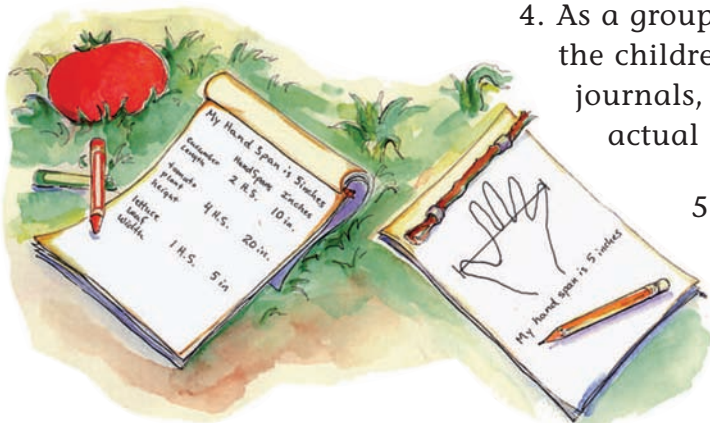


Hand spans vary, so if you know the length of your own hand you can make fairly accurate estimates when measuring.

Estimating and Measuring in the Garden

1. Have the pairs go on another hunt to measure three things using their hand spans. Ask them to draw the items in their journals and record the number of hand span lengths. For example: leaf = half a hand span, brick = 1 hand span.
2. Gather the group and have the pairs share what they measured. Show them how to determine the number of inches (or centimeters) for each item by converting their hand spans to the standard units.
3. To give children practice using their new hand span “measuring tool,” hold up an item from the garden, and ask them to estimate its length. Ask them to record their estimates in their journals in hand spans and in inches or centimeters.

4. As a group, measure the item with a ruler. Have the children record the actual measurement in their journals, and compare their estimates with the actual measurement.



5. Give additional objects to the pairs to measure with the rulers. Have them record their measurements in their journals. Encourage children to share and discuss their estimates and measurements.

6. Ask the group why knowing how to measure with your hand span is a useful skill. What are some things at home you could measure with your hand span? [dinner plate, television screen, pet, height of a stair, pillow]



The Hand Span Song

Lyrics by youth Kelsey Connolly

Children enjoy displaying their hand spans in time with this song that follows the tune of “If you’re happy and you know it, clap your hands.”

Refrain:

If you want to measure something, use your hand span!
If you want to measure something, use your hand span!
Thumb and pinkie open wide.
It’s an excellent measuring guide.
If you want to measure something, use your hand span!

If you want to plant some seeds in row, Go!
If you want to plant some seeds in row, Go!
Thumb and pinkie open wide,
with no ruler at your side.

You can use your hand span nicely in a row, Go!

Refrain

Do you see your green beans growing big and tall? Yea!
Do you see your green beans growing big and tall? Yea!
Use your handy measuring guide.
Thumb and pinkie open wide.
If you want to measure green beans, use your hands, Yea!

Refrain



More Math in the Garden

Brown Bag Secret Hide a long vegetable like a zucchini in a brown bag. Tell children that the mystery vegetable is safe to touch. Pass the bag around so that everyone has a chance to reach in and feel the object. When they touch it, they are not to say what it is, rather they are to silently estimate how long it is in inches. After everyone has had a chance to estimate its length, ask what they think is in the bag. Reveal the object and ask a pair of children to measure it. How close were they in their estimates?

Hand Span Planting Have the children use their hand spans to measure the length of a planting bed. Use hand spans to space the seedlings in the bed.

Data Snacks

Ages 5-13



This activity introduces data collection and interpretation, including the meaning of range.

Youth explore a variety of fresh fruit and vegetable snacks and analyze their food preferences. They predict which food will be eaten by the greatest number of people in the group and compute the actual results. This activity models methods that children can use in many areas of their lives to investigate questions that interest them.

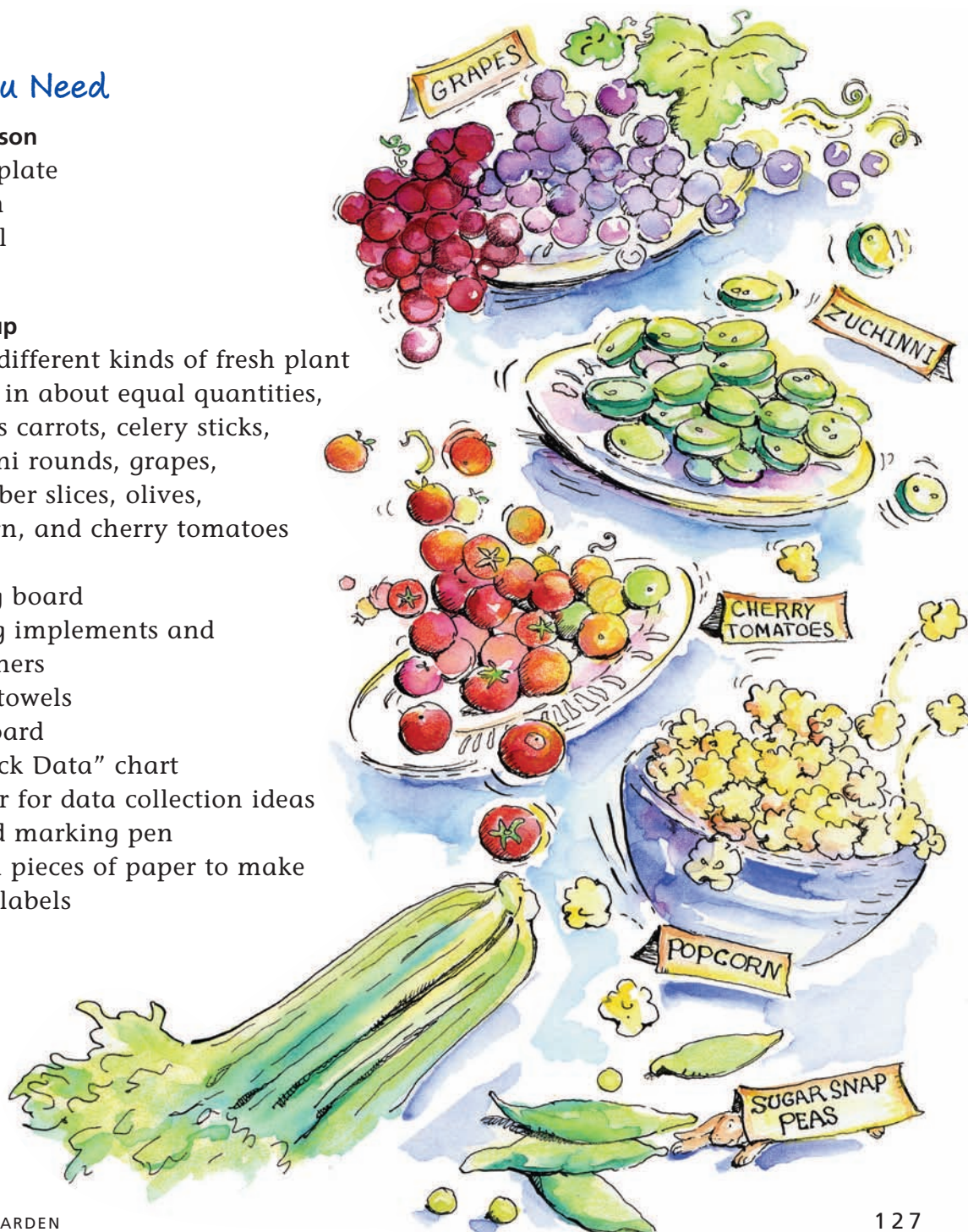
What You Need

For Each Person

- paper plate
- napkin
- journal
- pencil

For the Group

- 4 to 5 different kinds of fresh plant snacks in about equal quantities, such as carrots, celery sticks, zucchini rounds, grapes, cucumber slices, olives, popcorn, and cherry tomatoes
- knife
- cutting board
- serving implements and containers
- paper towels
- databoard
 - “Snack Data” chart
 - paper for data collection ideas
- colored marking pen
- several pieces of paper to make “tent” labels

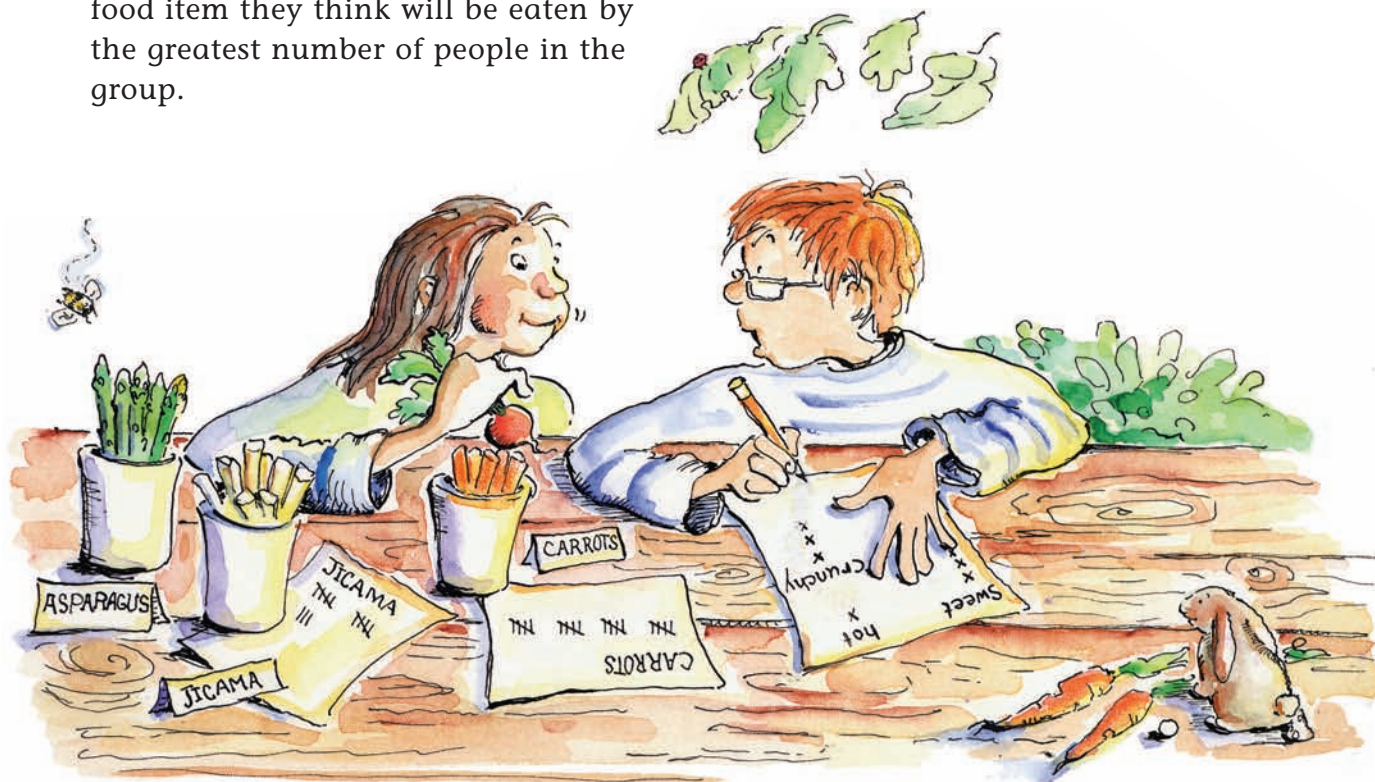


Getting Ready

1. Gather and prepare the food items to exhibit a variety of fruits and vegetables from the garden. Place each type of food in its own container.
2. On the picnic table, arrange the containers of food in a line that can be easily viewed by the group and sampled in a buffet style. To make sure that favorite foods are not taken before everyone gets a chance to sample, distribute them evenly along the line.
3. Cut the paper into strips and make “tent” labels for each snack item.
4. On the databoard, make a “Snack Data” chart listing the foods to be sampled.

Here We Go

1. Gather the group around a picnic table and show them the snack buffet and the “Snack Data” chart. Ask the youth to silently think about which of the various foods they have tasted. They can share this information later.
2. Tell them you want to find out more about what they like to eat and to let them taste some new foods. Explain that a goal of the snack experience is to increase the variety of fresh fruits and vegetables they have eaten.
3. Ask the youth to predict silently which food item they think will be eaten by the greatest number of people in the group.



4. Ask:

- ✿ What are some ways we can find out what snack will be eaten by the most people? List their ideas on the databoard and help them formulate data collection methods. [counting how many tried each snack; having each person record how many of each snack he or she ate; having people write their names on a card next to each snack as they take it]

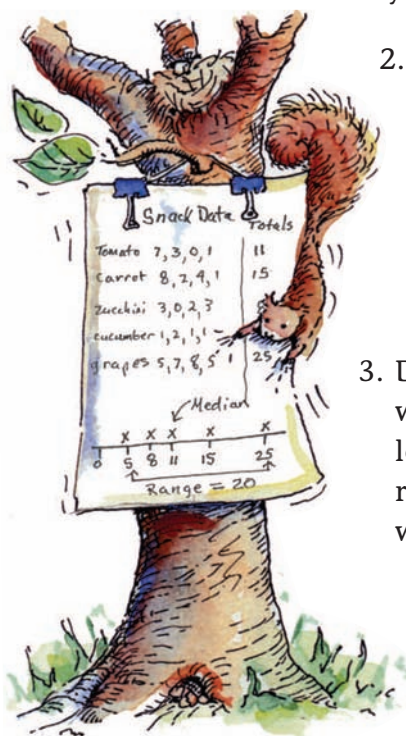
5. Tell them that today we are going to collect data by tally marks. In their journals they should tally the numbers for each item they eat. (If they eat 5 pieces of cucumber they will have 5 tally marks next to cucumber.)

6. Have the children suggest how they will share the food fairly, and post their guidelines. [take only one or two of the snacks until everyone has made their selection; if you touch a piece of food, you must eat it; ask the leader before taking seconds]

Counting, Eating, and Analyzing

1. Observe how the youth make their choices and what they talk about. Encourage them to taste something new or something they haven't eaten in a while. To help you assess their prior experience and stimulate discussion, ask:

- ✿ What new food did you try?
- ✿ How were you surprised by the taste of any of the snacks?
- ✿ What food would you recommend to a friend?
- ✿ Which food did you eat the largest quantity of?
- ✿ Which food did you eat the smallest quantity of?



2. After about 10 minutes, have the children count the tallies and record the total number next to each item listed in their journals. Remind them to record their data for each item on the group “Snack Data” chart, putting a zero next to an item if they did not eat any. For each food item have volunteers help you add the total number eaten by the group and record it on the chart.

3. Draw a line near the bottom of the “Snack Data” chart. This will become a numberline for plotting data. Put a “0” at the left-most end of the line, and put the highest total near the right-most end. Place the other totals along the number line with reasonable spacing according to their relative amount.

4. Plot the totals on the numberline. Have volunteers help analyze the data. Ask:

- ✿ What is the largest number to plot on our numberline?

✿ What is the smallest number to plot on our numberline?

5. Point out that the difference between the high and low numbers for the different foods is the range of data for food eaten by our group. [most-often eaten item and least-often eaten item] Invite volunteers to help you identify and record the range of data for the food consumed.



Range = difference between the largest number and smallest number in a data sample. (For example: The range of 25 grapes eaten and 5 cucumbers eaten is 20.)

6. Continue plotting totals until all of the numbers have been plotted on the numberline. Ask:

- ✿ What is the range of the data? [$25-5=20$]
- ✿ How can we tell which item was tasted by the greatest number of people? [The food item that has the fewest zeros entered for it on the “Snack Data” chart.]

7. Encourage youth to discuss the activity. Ask:

- ✿ What did you like about collecting data on snacks?
- ✿ How could you improve the data-collecting methods for the next time?
- ✿ What helped you decide to try a new food?
- ✿ What did you learn from the “Data Snacks” activity?



More Math in the Garden

Snack Preference Study Each time you have a snack, conduct another snack preference study. Older youth can total the data, compute final averages and percents, and graph results.

Geometric Snacks Have youth design snacks that display various geometric shapes and examples of symmetry.