Math and Science Pumpkins

Description:

Pumpkins are a great manipulative for math and science exploration. These activities are ideal to follow up on field trips and make the most of the natural connections between pumpkins and math and science.

Grade Level: 2-5

Essential Skills: 3, 4, 5

NGSS: 2-LS4-1, 3-LS4-2, 2-PS1-2, 2-PS1-3, K-2-ETS1-2, 3-LS3-2, 3-5 ETS1-1

CCSS: W.2.7, W.2.8, W.3.8, MP.2, 2.MD.D.10, 3.MD.B.3, SL.3.4

Math: MD.2, G.2, MD.3, G.3, OA.3, MD.4, G.4, OA.4, MD.5, G.5, OA.5, MP.4

Time: 2-3 Class periods

Materials:
Pumpkins of different sizes
Ruler
String
Bathroom scale
Paper and pencils
Tub with water
Paper Towels
Modeling Clay

AITC Library Resources:

Books:
From Seed to Pumpkin;
It's a Fruit, It's a Vegetable, It's a Pumpkin
Pumpkin Circle (English and Spanish)
Kids' Pumpkin Projects
Project Seasons

More Lessons:
Pumpkin Pie in a Bag

Part I: Pumpkin Predictions & Measurements

Students will use pumpkins to make predictions and explore different ways to measure objects - weight, circumference, diameter and volume - then graph and record findings.

1. Divide your class into groups of 3-4 students. Provide each group with a pumpkin. (Pumpkins should be quite different from one another.)

2. Ask students to look around at the other pumpkins and predict which group has the largest pumpkin. Which one do they think weighs the most? Do they think the largest pumpkin will weigh the most? Will the smallest weigh the least? Students should record their predictions. These predictions and actual measurements can be recorded on a class-wide graph.

3. Students then weigh the pumpkins and compare findings with prediction. **Consider**: Weigh one pumpkin in front of the class before the students make predictions about their group's pumpkin. This base knowledge can change predictions into estimations.

4. Repeat this prediction process for finding the circumference, radius, diameter, and height of students' pumpkins. **Note:** To find the circumference, measure around the widest part of the pumpkin. Unlike perfect circles, pumpkins are, at-best flattened spheres, so these measuring techniques will likely not be 100% accurate.

5. Students record the actual measurements next to their predictions on the attached handout. Create a classroom graph based on these measurements. Do the findings match the predictions? What conclusions can students draw about the relationship between weight and circumference? Are there other relationships that can be made?

6. Challenges: a) Have students organize the classroom findings to show averages, mean and median using the pumpkin data. b) Demonstrate the **water displacement method** to measure the volume of an irregularly shaped object.
c) Show students how to find pi with the information they have gathered on the radius and circumference.

Part II: Do pumpkins float or sink? The Law of Buoyancy

1. Fill a large container (clear is best) with water.
2. Have students make a prediction about whether or not a pumpkin will float or sink in the water. Record the numbers for each (yes/no) on the board. Ideally, have pumpkins of different sizes and ask students to predict which ones will float or sink. Ask them why they think the different sized pumpkins will float or not. Students will likely say the smaller pumpkins will float and the larger ones will sink. (Pumpkins, no matter their size, float.)
3. Place the pumpkins in the tub of water and watch what happens. What else floats or sinks? Why?

What's Happening:

Why do the pumpkins float? People have been wondering why things float or sink for centuries. ***The Law of Buoyancy***, called ***Archimedes' Principle***, states that a body floating in a fluid is supported (or buoyed up) by a force equal to the weight of the fluid it displaces.

In simpler terms for this experiment, a pumpkin will float if it displaces as much water as it weighs. When a pumpkin is immersed in water it experiences a force known as the buoyancy force. This force is equal to the weight of the water displaced by the pumpkin.

Here is another example: A lump of steel will sink because it is unable to displace water that equals its weight. But steel of the same weight, shaped as a bowl, will float. This is because the weight gets distributed over a larger area and the steel in this form is able to displace water equal to its weight.

As a result, a heavily laden ship floats because its total weight is exactly equal to the weight of the water it displaces. It is this weight that exerts the buoyant force supporting the ship.

Test This Concept:

1)Take a piece of modeling clay and shape it into roughly a cubic centimeter ball. Next, put it in a glass of water to see if it floats. It should sink. A cubic centimeter of water weighs 1 gram by definition. A gallon of water weighs 8.34 pounds. So, in order to float, an item that weighs 1 gram must displace more than a cubic centimeter of water. An item that weighs 8.34 pounds must displace more than a gallon of water to float.
2) Challenge students to partner up and create a shape that will allow the piece of modeling clay to float.
Note: If students flatten out the clay and make a boat shape using a flat bottom with a lip around the edge it will float. Have students test their shape out once they complete it. Although the weight of the clay didn't change, the amount of water displaced did change.

Clay in a ball shape sinks, but in a boat shape floats.

Part III: Predicting & Counting Seeds

1. Use three different sized pumpkins for this activity. Begin by having students predict and record which pumpkin, the largest or smallest, has the most seeds on their worksheet.
2. Next, slice the pumpkins in half **lengthwise** and then examine them. Have students examine the size of the cavities, seed density, and how seeds are attached along the ribs.
3. Place a newspaper under the pumpkins. Have students scoop out the seeds, remove the seeds from the fleshy fiber and dry them on a paper towel.
4. Students then count the seeds in each pumpkin. Chart the students' predictions and the actual numbers. Are the seeds in each pumpkin the same size or different? Do students notice any difference in the seeds of the small and large pumpkin?
5. Next, have students count the ribs on the middle-sized pumpkin. Based on what they observed in the small and large pumpkin, have them predict how many seeds will be in the mid-sized pumpkin.
6. Cut the mid-sized pumpkin lengthwise and count the seeds. Were their predictions accurate? Did the larger pumpkins have more seeds than the smaller ones? How many ribs did it have? Did ribs have an influence on the number of seeds?

Tasty Fun: Pumpkin seeds are tasty and highly nutritious snacks. They contain zinc and other important minerals. Save the seeds from the pumpkins and roast them in an oven to make a classroom treat. Add in a little math by having the students divide the pumpkin seeds by the number of students and determine how class members can get equal portions.
For Younger Grades: Pumpkins are ideal for discussing **life cycles** and **sequencing**. The book, *The Pumpkin Circle* and others can be checked out from AITC's Lending Library.
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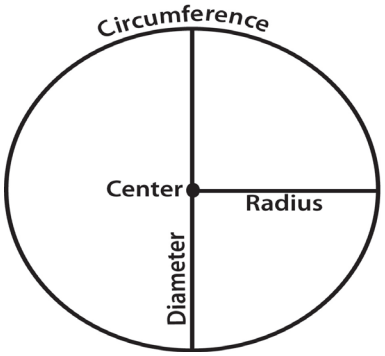
Activity Page

Math & Science Pumpkins Worksheet

Student Name: _____

Part I: Pumpkin Predictions & Measurements



Predictions:
Which group's pumpkin do you think will weight the most? Why?

Will the largest pumpkin weigh the most?

Will the smallest pumpkin weigh the least?

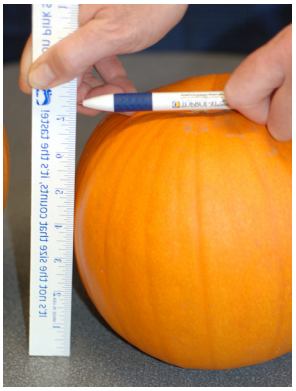
Measurements:

1. Predict what the measurements will be for your pumpkin and record them in the predictions column on the chart below. Use the reference picture at the top of the page as a reminder of what each measurement is.

2. Using a piece of string, wrap the string around the pumpkin and mark with your fingers where the end of the strings meets. Then, keeping a hold of the string with your fingers, measure the string on a ruler to determine the circumference of the pumpkin. Record the circumference of your pumpkin in the chart on the back of this page under the Actual Column.

3. Using the ruler, measure from the center of the pumpkin to the outside of the pumpkin to determine the radius. Record the radius in the chart on the back of this page.

4. Calculate the diameter of the pumpkin by using the following formula:
Diameter= 2 x Radius, record your calculation in the chart.



5. Measure the height of the pumpkin using a ruler that starts at the base of the pumpkin and measure to the top of the body of the pumpkin (not the top of the stem). Record the information in the chart.

6. Weigh your pumpkin using a scale. Record the weight of your pumpkin on the chart.

Record your measurements on the chart on the back of this page.

Measurement	Prediction	Actual
Circumference- The distance around your pumpkin. Measure at the widest spot using a string.		
Radius- Distance from the center to a point on the outer edge. It is half of the diameter.		
Diameter- Any straight line that passes through the center of the circle and goes to the edge of the circle. Diameters = radius x 2.		
Weight		
Height		

Part II: The Law of Buoyancy

Prediction: Will your pumpkin float? Why?

After Testing: Did your pumpkin float? Explain.

Using the modeling clay your teacher provides you, mold the clay into a shape that will allow it to float using what you know about buoyancy and the displacement of water. Answer the following questions after you have tested your design to determine whether or not it floats.

1) Did your design float?

2) If yes, how did you determine what shape to mold your clay in to make it float. If no, what do you think you could have done differently to make your clay float? If your shape didn't float and you have time, try adapting your design and retesting it.

Part III: Predicting and Counting Seeds
Looking at all of the pumpkins in the classroom, make a prediction of which one will have the most seeds and why.

Prediction:

Counting Seeds: Your teacher will cut your pumpkin open, with your groups members count the number of seeds your pumpkin has.

1) After cutting your pumpkin open, how many seeds did it have?

2) Was you prediction correct about the pumpkin you choose having the most amount of seeds?