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| **Lesson Title** | Pi Pie |
| **Length of Lesson** | 50 minutes |
| **Created By** | Emily Burtnett |
| **Subject** | Geometry |
| **Grade Level** | High School |
| **State Standards** | 4a |
| **DOK Level** | 2 |
| **DOK Application** | Demonstrate and apply various formulas in problem-solving situations. Solve real-world problems involving formulas for perimeter, area, distance, and rate. |
| **National Standards** | Specify locations and describe spatial relationships using coordinate geometry and other representational systems; investigate conjectures and solve problems using two- and three- dimensional objects represented with Cartesian coordinates. Use the language of mathematics to express mathematical ideas precisely. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. Organize and consolidate their mathematical thinking through communication. |
| **Graduate Research Element** | Geometry of circles, measuring size of water droplets in experiments to enter into computer for computational simulations |

**Student Learning Goal:**
Students will learn to measure the circumference and diameter of circular objects. Students will calculate the ratio of circumference to diameter and learn the formula for the circumference of a circle.

**Materials Needed (supplies, hand-outs, resources):**
Pictures of circular water droplets used in graduate research, string cut to 48 inches, other circular objects to be measured, rulers, activity sheet, calculators, rulers

**Lesson Performance Task/Assessment:**
Students will be asked to select a random round object and a piece of string. Students will be asked what units should be used to measure and why. Students will be asked what the distance outside of a polygon is (perimeter) and what we call the distance outside a circle (circumference). Review the formula and reiterate the value and definition of pi. Students will work in groups of three or four, depending on class size, to measure their round objects and fill in the Apple Pi activity sheet. They will measure around and the across

the object. The string will be used to find the center of the object by wrapping it around the object and measuring the string. Students will be handed out graph paper and coordinate points of a water droplet from graduate students' research and asked to measure the diameter and circumference. The activity sheet will be completed including the ratio of circumference to diameter. If time allows, a class discussion will allow students to describe their findings of each object.

**Lesson Relevance to Performance Task and Students:**
Students will recognize how measuring the circumference is important in upper level research, as well as see applications in their day-to-day lives. Students will be given coordinates that they will have to plot, which will form a water droplet. Students will be told that for their job, they need to input this data into a computer for a simulation, but they can only enter in the diameter and circumference of the shape, not the coordinate points. This will show students how experimental data may need to be translated to be entered into a computer. They will see how ratios can demonstrate a relationship between two measured values.

**Anticipatory Set/Capture Interest:**
Apple Pie or Pi Pie. Without knowing what the activity will be, students will be asked to pick a round object. Students may be more apt to select a unique object over the simple ones since they won't know what they will be doing with the object - that will create a greater challenge for them.

**Guided Practice:**
Teacher will demonstrate how to find the diameter of an object with a string and explain the activity sheet. Instructor will walk around the classroom during the work time assisting students as needed.

**Independent Practice:**
Students will work in groups to complete the activity sheet for at least two objects. They will also work together to plot the coordinate points of the water droplet to measure the circumference and diameter.

**Remediation and/or Enrichment:**
Remediation can be provided by demonstrating how to measure several objects and input the data into the activity sheet. Individual IEPs will be supported.

For enrichment, students will not be given the circumference formula but will be asked to find or develop the formula as they do the activity.

**Check(s) for Understanding:**
Teacher will assess the students' understanding by looking over their activity sheets and encouraging them to share their findings and results.

**Closure:**
For a special treat, and if permitted in the classroom, the students can be rewarded with either a Pie coupon at a local restaurant, or a Pi Pie cookie or an Apple Pie (provided by the instructor). The students will measure the circumference and diameter as a group and enjoy their slice of pi…er, pie.

**Possible Alternate Subject Integrations:**
Within geometry, this lesson could be further developed to integrate area calculations.

**Teacher Notes:**