Summer 2016

UTM Middle School STEM Workshop

**Workshop Facilitator**: Dr. Louis Kolitsch

**Subject/Grade**: The circumference of a circle. (Grades 6 and 7)

**Estimated time**: 1 hour

**Standard(s)**: TN Mathematics Standards

Grade 6: **6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems

(e.g., by reasoning about tables of equivalent ratios, tape diagrams,

 double number line diagrams, or equations).

Grade 7: **7.RP.A.2** Recognize and represent proportional relationships between quantities.

 **a**. Decide whether two quantities are in a proportional relationship (e.g., by

 testing for equivalent ratios in a table or graphing on a coordinate plane

 and observing whether the graph is a straight line through the origin).

 **7.G.B.3** Know the formulas for the area and circumference of a circle and use them

 to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

**Objective**: Use real world data gathered from measurements to show that the circumference of a circle is proportional to the length of the diameter of the circle.

* I can measure the circumference of a circle
* I can measure the diameter of a circle
* I can calculate the ratio of the circumference to the diameter of a circle

**Materials and Resources**: Tape measures, selection of circular objects of different sizes (e.g. bases of a variety of cylindrical cans, pre-drawn circles, etc.)

**Motivating Students/Anticipatory SET:**

If you could walk around the equator of the earth, how far would you walk?

Plotting the measured values on the *xy*-coordinate plane and determining the proportion is used in many different settings, such as the total cost of goods purchased, speed, and density.

**Instructional procedures**:

* Depending on the class size, give each student or pair of students a different circle to analyze.
* Have the students measure the circumference and the diameter of each circle to the nearest tenth of a centimeter.
* Have the students calculate the ratio of the circumference to the length of the diameter and record the answer to the nearest hundredth.
* Have the students report their ratios and observe that they are all approximately 3.14.
* Explain that if the measurements could be done with full accuracy, the ratio would be π leading to the formula C = πd where C is the circumference and d is the length of the diameter.
* Have the students report their circumferences and the lengths of their diameters.
* Plot the values in the xy-coordinate plane (x = length of diameter, y = circumference).
* Discuss why the graph indicates that the circumference of a circle is proportional to the length of its diameter.

**Questioning/Thinking/Problem Solving:**

* Would our ratio change if we used a different unit of measurement (inches, millimeters, etc.)?
* What was common to all of the objects that we measured?
* Notice that we gathered information from multiple sources (different students measured different objects.)
* If we extend this pattern, what would be the circumference of a circle marked out in a field by an irrigating arm that is 100 yards long?

**Follow-up Activities/Extensions**:

Measure the circumference and diameter of different sizes of balls (basketball, baseball, tennis ball, etc.) and determine the ratio of the circumference to the diameter. Do you get the same ratio?

**Accommodations/Adaptations:**

Use cylindrical cans instead of pre-drawn circles; the cans are easier to hold and measure than paper circles. Foam plates can also be used instead of paper circles.

Paper circles may also be placed on foam boards and pinned around the edges, then the tape measures can be looped around the pins.

**Closure:**

* Emphasize the formula you just derived for the circumference of a circle.
* Emphasize how you can use the graph to determine whether you have a proportional relationship.

**Assessment:**

Give students a different circle to measure and ask them to use different units. Do they get the same ratio?

Give another proportional relationship and graph it to find the proportion (e.g., cost of goods sold, miles per gallon, etc.).

**Teacher Reflection:**

To be completed once the activity has been conducted.