

FOR TEACHERS

MAKER LESSON PLAN: Exploring Measurement with a Circle Drawing Machine

Essential Questions:

- How can one part of a circle help determine the measure of another part?
- How can you estimate, measure, and change customary units of length?

Lesson Objectives:

Students will:

- use a ruler to make and compare standard unit measurements
- solve problems involving measurement
- understand the relationship between the radius and diameter of a circle

Materials:

- Circle Drawing Machine Instructable: <http://www.instructables.com/id/Circle-Drawing-Machine/>
- Materials needed to build multiple Circle Drawing Machines
- Additional ruler for each student
- Math Notebooks, data collection sheets, or notebook paper

Video Resources:

- https://www.youtube.com/watch?v=_1r7WVh2Zgc
- https://www.youtube.com/watch?v=cC0fZ_lkFpQ&t=278s

Getting Started: After building the Circle Drawing Machines, students will select a starting point on the ruler to set their marker and draw a circle. Teachers may want to have all students start at the same measurement, so the first circle is the same for every student. After creating the first circle, students can move the 3D printed pen holder and marker to a different location on the ruler. This can be repeated a few more times to allow students to create a variety of circles to explore and measure.

1: Exploring Measurement: After creating a variety of different sized circles (3-5), students should label each circle so they can use the label when recording measurement data in their math notebooks or a data collection sheet (e.g. Circle A, B, C...). After the circles have been labeled, it is time to break out the extra ruler and start measuring. Give students a few minutes to use the ruler to measure their circles and make any general comparisons they see between their circles. NOTE: This is a time of exploration, and nothing should be recorded by students during this time. Be sure to walk around and ask questions to determine if there are any gaps in information about measurement that you can fill in before moving on. This will also help you determine if modeling of each step should be done on a Doc Cam as students work through the measurement activities.

2: Start with the Center (Radius): Students should find the center of their circles and mark it with a dot. Once the center is marked, have students align the zero tick on the ruler with their center mark and measure to the edge of their first circle (Circle A). Have students record this measurement as the radius for circle A. Explain that the radius of a circle is the distance from the center of the circle to its outer rim. Have students repeat this step to measure and record the radius for each of their remaining circles.

3: Measuring Across the Circle (Diameter): Start by explaining that the diameter of a circle is a line segment that passes through the center of the circle, and the length of a diameter is two times the length of a radius. Have students measure and record the diameter for 3 of their circles and compare their measurements to the radius to determine that the diameter is two times the radius. Have students decide if they want to calculate the diameter for the remaining circles or measure them and then record their data. Take time to discuss any "AH-HA" moments students had and ask if they feel confident that they could explain the difference between the radius and diameter of a circle. Have students draw a circle in their math notebook or on their recording sheet, find and mark the center point, and draw the line segments and label the radius and diameter.

4: Extensions: To extend this activity further, students can measure their circles based on different measurement criteria (e.g., measure to the nearest $\frac{1}{4}$ or $\frac{1}{2}$ inch) Students could also estimate measurements on new circles using classroom materials like a paperclip or coin.

5: Share - We can't wait to see the Circle Drawing Machines and all the circles your students MAKE and measure! Feel free to email us at teachers@instructables.com or share with us on Twitter and Instagram @instructables. We would love to send your class a gift for showing off their hard work!