Geometry: Human Circles

Strand: Measurement and Geometry

Topic: Identifying and describing parts of a circle and the relationship between the parts.

Primary SOL: 5.10 The student will identify and describe the diameter, radius, chord, and circumference of a circle.

Materials

- VDOE Vocabulary Cards for radius, diameter, center, circumference, and chord
- Large index cards labeled "A," "B," "C," "D," "E," "F," "G", and "H," and tape or string for students to wear the cards
- Paper for foldables
- Measuring tape
- String or yarn
- Scissors

Vocabulary

center, chord, circle, circumference, diameter, equidistant, line segment, radius/radii

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Gather students to form a circle. Ask, *"What makes this a circle? Is it really a circle? How do you know?"* Allow students to share their thoughts, and record their ideas on the board.
2. Have one student sit in the center of the circle wearing the point A card. Ask, *"How can we use Point A to describe our circle?"* Allow students to adjust their definitions of circles.
3. Share with students the formal definition of a *circle*: a set of points on a flat surface (plane) with every point equidistant (an equal distance) from a given point called the *center*. Tell students each of them represents a point on our circle.
4. Instruct students to use a measuring tape to measure the distance from the center to four points (students) on the outside edge (circumference) of the circle. Record the distances on the board and, without moving the center point, adjust their positions so each point is equidistant. Next, explain that a line segment from the center of the circle to any point on the circle is called the *radius* of the circle. Ask students whether they can think of any examples of *radii* (plural of radius) in the real world (such as the spokes of a bicycle tire and the spokes of a ship's wheel).
5. Select another student from the circle to be point B and one to be point C. Pass a rope or piece of string from point B to point C, and tell students that they are forming a chord. A *chord* is a line segment connecting any two points on a circle. Select other students to be points D and E to create another chord.

6. Select a student from the circle to be point F. Pass the string from point F through the center to a student on the opposite side of the center from point F, and call this student point G. Measure the distance from point F to point G, and record. Ask, *"What do you notice about the lengths of all the radii, and the distance from point F to point G?"* Students should notice that the length of segment FG is twice the length of the radius. Explain that this is called the *diameter*, a special chord that goes through the center of a circle, and that two radii end-to-end form a diameter of a circle.
7. Compare chord/diameter: Ask, *"Is a diameter also a chord?" "Is a chord also a diameter? Why, or why not?"* Allow students to discuss this. Students should be able to explain that a diameter is a chord because it connects two points on a circle. However, not all chords are diameters; only chords that pass through the center are diameters.
8. Have one student stand up and run around the outside, or perimeter, of the circle. Explain that this distance around the circle is the *circumference* of the circle. In polygons, the distance around the outside is called the perimeter.
9. Review and switch students so each has a chance to become each part of the circle.
10. Select one student to be point H, and have that student hold the end of a string. Walk around the outside of the circle, keeping the string taught as it touches all of the students forming the circle. Once the string reaches student H, have him or her take the other end of the string to form a complete circle. Trim the end of the string.
11. Lay the string on straight along the chalk tray or floor. Ask, *"Who would like to predict how long this string is?"* Record predictions on the board. Then use the measuring tape to find the exact measure of the string. Ask, *"How does the length of this string, or the circumference of our circle, compare to the length of a radius of our circle?"* Ideally, the circumference will be approximately six times as long as the radius. Emphasize that this is an approximation and is not the actual numerical relationship between the radius and the circumference.
12. Say, *"Our circumference is about 6 times the length of our radius. How does the circumference compare to the diameter?"* Allow students to discuss with elbow partners or in small groups. Students should notice that because the radius is exactly half the diameter, then the circumference will be about half as many diameters. In other words, the circumference is *about* three times as long as the diameter. Emphasize that this is an approximation and is not the actual numerical relationship between the diameter and the circumference.
13. Have students return to their desks. Distribute paper and have students draw a picture of a circle and label its parts. Below the drawing, list each part and its definition (circumference, diameter, radius, and chord).
14. Finally, have students write comparisons of the following: a) diameter and chord; b) diameter and radius; c) radius and circumference; and d) diameter and circumference. Comparisons should include:
    - A diameter is a special chord that crosses from a point on the circle through the center of the circle to another point on the circle.

- A diameter is exactly twice the length of a radius. A radius is exactly half the length of a diameter.
- The circumference of a circle is about, or close to, six times the length of its radius.
- The circumference of a circle is about or close to 3 times the lengths of its diameter.

Assessment

- **Questions**
  - What is the difference between a radius and a diameter?
  - What is the difference between a chord and a diameter?
  - What is the relationship between the circumference and the diameter of a circle?
  - What is the relationship between the circumference and the radius of a circle?
- **Journal/writing prompts**
  - Describe to a friend how to draw a perfect circle, its radius, its diameter, and a chord.
  - Where might you find circles, centers of circles, a radius or radii, diameters, chords, and circumferences in the real world?
  - Compare a circle and a square.
- **Other Assessments**
  - Draw a circle and label the important parts (e.g., points, segments, etc.) associated with the circle.
  - Draw examples of how a radius and a chord, a chord and a diameter, a circumference and a radius, and a circumference and a diameter are related.
  - Make a flip book with pictures of the different parts of a circle and label the parts.
  - Research or go outside and use a camera or camera phone to snap photos of circles that include one or more of its parts (center, diameter, radius, and/or chord) and mount the pictures on a poster and label the parts of the circle captured in each picture.

Extensions and Connections (for all students)

- Cut oranges in half. Have students measure the circumference, diameter, and radius in millimeters. Fill in each of the three measurements and then use a calculator to compare the indicated measurements.
- Provide students with a collection of four or five circular objects (e.g., lid, flying disc, roll of tape, etc.), a piece of string, and a ruler. Ask students to write in the name of their objects and measure the parts of each circle and complete the table. When the students finish the table, ask them to look at the comparisons and discuss their discoveries and questions.

Name of Object	Circumference	Diameter	Radius	$\frac{\text{Diameter}}{\text{Radius}}$	$\frac{\text{Circumference}}{\text{Diameter}}$	$\frac{\text{Circumference}}{\text{Radius}}$

- Pour a small amount of bubble solution on each student's desk. Have each student stick a straw in the solution and blow a bubble until it breaks. When the bubble breaks, it will form a perfect circle. Have students measure the diameter, radius, circumference, and a chord.

Strategies for Differentiation

- Have students sit in a circle with one person representing the center point. Have students toss a beanbag to the person across from them to represent a diameter, to the center to show a radius, and to anyone on the circle to show a chord.
- Provide a circle drawing for students to label.
- Create a sort to match the definition with the picture.
- Create stickers with each vocabulary word. Have students place the sticker beside each definition.
- Challenge students to create a mathematical formula to compare circumference and radius or circumference and diameter.
- Give students one measurement and they find the measurement of other parts of the circle.

The following pages are intended for classroom use for students as a visual aid to learning.