Math: Geometry
Equations of Circles

Objectives
Students will be able to:
• Define circle and radius.
• Sketch a circle given its radius and center.
• Write an equation of a circle given its radius and center.
• Match a circle to its equation.

Warm-Up
What are the mathematical characteristics that describe a circle? (diameter, radius, area, circumference, chord, etc.)

Lesson
• What is a circle? Give the definition.
• The equation of a circle in the coordinate plane is $(x - h)^2 + (y - k)^2 = r^2$, where $r$ is the radius and $(h, k)$ is the center of the circle.
• Have a student give you any $h$, $k$, and $r$ and show the circle in W|A.
Equation:

\[(x - 3)^2 + (y - 6)^2 = 4\]

Properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>diameter</td>
<td>4</td>
</tr>
<tr>
<td>chord length</td>
<td>0</td>
</tr>
<tr>
<td>area</td>
<td>(4 \pi \approx 12.5664)</td>
</tr>
<tr>
<td>perimeter</td>
<td>(4 \pi \approx 12.5664)</td>
</tr>
<tr>
<td>angle</td>
<td>(360^\circ \approx 6.283) rad</td>
</tr>
</tbody>
</table>
• Given the radius and center of the circle, write its equation.
  ◦ Example: If the radius is 5 and the center is (-2, 1), check the solution in W|A.

![WolframAlpha](equation of circle radius 5 center (-2,1))

- Given the equation of a circle, sketch it in the coordinate plane.
  ◦ Example: 
    \[(x - 7)^2 + (y + 5)^2 - 9 = 0.\]
  What is the radius and the center?
Student activity: Find the equation of a circle with a diameter of 10 that lies in the second quadrant of the coordinate plane. You may use W|A as a resource.

\((x-7)^2 + (y+5)^2 - 9 = 0\)

- **Mathematica form**

- **Geometric figure:** circle

- **Implicit plot:**

- **Properties:**
  - center: \((7, -5)\)
  - radius: 3
  - diameter: 6
  - chord length: 0
  - area: \(9 \pi \approx 28.2743\)
  - perimeter: \(6 \pi \approx 18.8495\)
  - angle: \(360^\circ \approx 6.283 \text{ rad}\)
Closing

Ticket to leave: What two pieces of data do you need in order to write the equation on a circle?

Demonstrations

Geometric Elements of a Circle