**What is a circle?** It is geometrically defined by a set of points or locus of points that are equidistant from a point (the **center**). Consider the circle at the right. What is the length of every segment drawn from center O to a point on the edge of the circle?

They appear to all have a length of 5 units.

How would you find the length of segment OB? We could use the distance formula or the Pythagorean theorem.

\[ 4^2 + 3^2 = c^2 \]
\[ 25 = c^2 \]
\[ 5 = c \]

1. **Basic Circles** Graph the following:

   A. \[ x^2 + y^2 = 4 \]
   B. \[ x^2 + y^2 = 36 \]
   C. \[ x^2 + y^2 = 20 \]

   ![Graphs of basic circles](image)

2. **Translated Circles** Graph the following:

   A. \[ (x - 4)^2 + (y + 2)^2 = 9 \]
   B. \[ (x + 3)^2 + (y + 1)^2 = 25 \]
   C. \[ (x + 2)^2 + (y - 3)^2 = 18 \]

   ![Graphs of translated circles](image)
3. **Equations of Circles** Find the equation of each of the following:

![Equation of Circles](image1)

a. \((x - 5)^2 + (y - 3)^2 = 9\)  
b. \((x + 2)^2 + (y + 1)^2 = 25\)

4. **Equations of Circles** The following design is composed of 3 full circles and 2 semi-circles. Can you find the equations of each and put them in your calculator?

![Equation of Circles](image2)

a. \((x + 0)^2 + (y + 0)^2 = 16\)  
b. \((x - 2)^2 + (y + 0)^2 = 25\)  
c. \((x + 2)^2 + (y + 0)^2 = 25\)  
d. \((x + 2)^2 + (y + 0)^2 = 4\)  
e. \((x - 2)^2 + (y + 0)^2 = 4\)

** When you put these in your TI-83/84 calculator you will have to solve for \(y\) using the square root method you may have to use two equations to describe a complete circle. For example if you wanted to graph the complete circle \((x - 4)^2 + (y + 2)^2 = 9\). It would require that you use two equations \(y_1 = \sqrt{9 - (x - 4)^2} - 2\) and \(y_2 = -\sqrt{9 - (x - 4)^2} - 2\).
5. Finding Standard form of circles. Put the following circles in standard form and graph them.

A. \( x^2 + y^2 - 10y + 9 = 0 \)
\[
\begin{align*}
x^2 + y^2 - 2y + 8 & = -9 + 2y \\
(x - 0)^2 + (y - 4)^2 & = 16
\end{align*}
\]

B. \( x^2 + y^2 - 2x + 8y = -8 \)
\[
\begin{align*}
x^2 - 2x + 1 + y^2 + 8y + 16 & = -8 + 1 + 16 \\
(x - 1)^2 + (y + 4)^2 & = 9
\end{align*}
\]

C. \( x^2 + y^2 - 6y - 2x = 15 \)
\[
\begin{align*}
x^2 - 2x + 1 + y^2 - 6y + 9 & = 15 + 1 + 9 \\
(x - 1)^2 + (y - 3)^2 & = 25
\end{align*}
\]

D. \( 2x^2 + 2y^2 - 8x + 12y = 6 \)
\[
\begin{align*}
x^2 - 4x + 4 + y^2 + 6y + 9 & = 3 + 4 + 9 \\
(x - 2)^2 + (y + 3)^2 & = 16
\end{align*}
\]