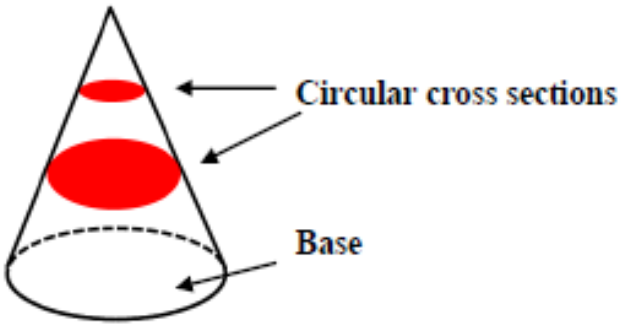
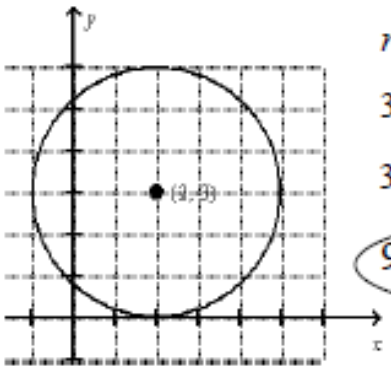
Circles in the Coordinate Plane

SOL G.12 (2009)

A circle is an example of a **conic section.** The base of a cone is a circle, as is every cross section of a cone that is parallel to the base.



By definition, a **circle** is the **locus** of points in a plane that are all equidistant from a center point. Suppose a circle has a center at (2, 3) and a radius of 3 units. Every point *on* the circle will be located exactly 3 units from the radius. Therefore, an equation representing the points on the circle can be written using the Distance Formula.



$$r = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$3 = \sqrt{(x-2)^2 + (y-3)^2}$$

$$3^2 = \left(\sqrt{(x-2)^2 + (y-3)^2}\right)^2$$

$$9 = (x-2)^2 + (y-3)^2$$

Equation for a circle:

Center: (h, k)

Radius = r units

$$r^2 = (x-h)^2 + (y-k)^2$$

Example 1: Write an equation for a circle with a radius of 6 and center at (3, 8).

$$r^2 = (x-h)^2 + (y-k)^2$$

$$6^2 = (x-3)^2 + (y-8)^2$$

$$36 = (x-3)^2 + (y-8)^2$$

1. **Formula for the equation of a circle.**
2. **Fill in the radius and center (h, k).**
3. **Simplify.**

Practice

Write an equation for each circle.

1. center at (4, -9), $r = 8$

2. center at (3, -2), $d = 18$

3. center at the origin, $r = 5$

4. center at (-1, 6), endpoints of the diameter at (-1, 9) and (-1, 3)

Example 2: Graphing the equation

$25 = (x-4)^2 + (y+3)^2$

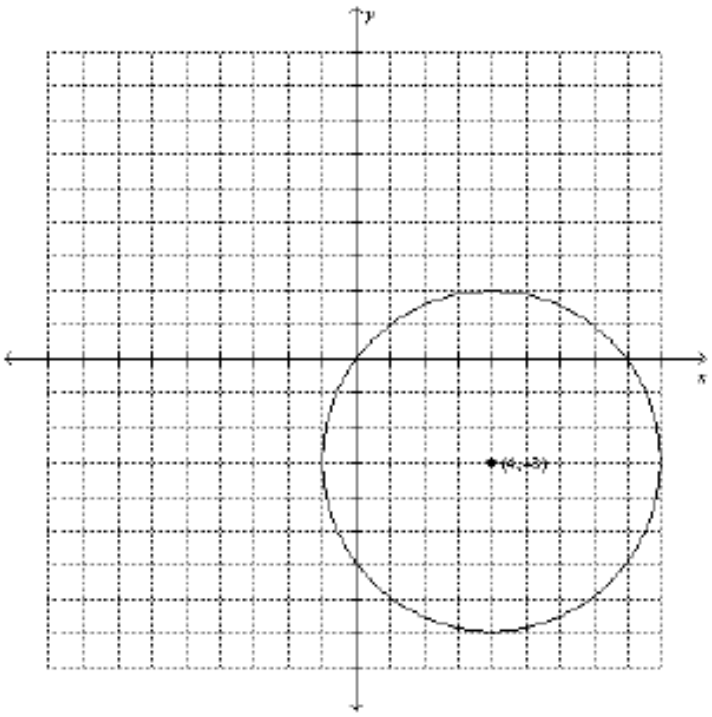
$r^2 = (x-h)^2 + (y-k)^2$

$r^2 = 25$

$r = 5$

$(h, k) \rightarrow (4, -3)$

1. **Begin with the formula for a circle.**
2. **Solve for r and (h, k).**
3. **Plot the center point at the graph.**
4. **Plot a second point r units away on the circle.**
5. **Use the compass to measure the distance between the two points.**
6. **Use the compass to draw the circle.**



5. The nearest Doppler weather radar is located at Sterling, Virginia, 113 miles away from Woodstock. If Sterling is designated as the origin, then Woodstock has the coordinates (112, 7.5). Write an equation to represent the circle of radar coverage from Sterling.

6. Graph the equation $36 = (x+3)^2 + (y-2)^2$