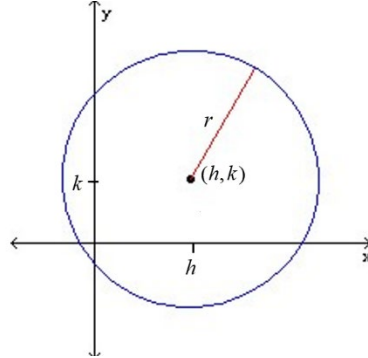# Section 2.2 Circles

A **circle** is the set of all points (x, y) in the Cartesian plane that are a fixed distance r from a fixed point (h, k). The fixed distance r is called the **radius** of the circle and the fixed point (h, k) is called the **center** of the circle. To derive the equation of a circle, we use the distance formula that was discussed in the previous section.

The **standard form of an equation of a circle** with center (h, k) and radius r is

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

The standard form of an equation of a circle centered at the origin with radius r is $x^2 + y^2 = r^2$.

Objective 1: Writing the Standard Form of an Equation of a Circle

Note that when given the diameter of a circle, we can use the midpoint formula to determine the center and the distance formula to find the radius.

Objective 2: Sketching the Graph of a Circle

Once we know the center and radius of a circle, we can easily graph the circle. For additional points, find any intercepts and plot the points.

Note that the *y*-coordinate of the center of the circle $(x-1)^2 + (y+2)^2 = 9$ is $k = -2$ because $(y+2)^2 = (y-(-2))^2$.

Objective 3: Converting the General Form of a Circle into Standard Form

The **general form of the equation of a circle** is $Ax^2 + By^2 + Cx + Dy + E = 0$ where $A,\ B, C, D,$ and E are real numbers, $A = B$, $A \neq 0$, and $B \neq 0$.

By completing the square, the equation of a circle can be rewritten from general form to standard form.