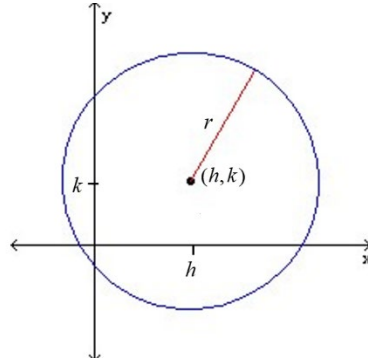


## Section 2.2 Circles

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.