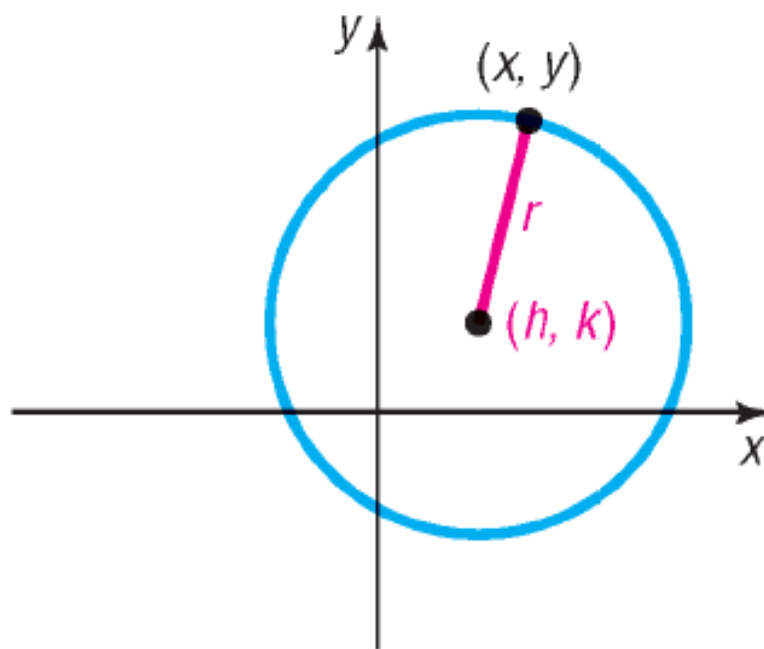# Section 2.4

Circles

✓ 1 Write the Standard Form of the Equation of a Circle

A **circle** is a set of points in the xy-plane that are a fixed distance r from a fixed point (h, k).

The fixed distance r is called the **radius**, and the fixed point (h, k) is called the **center** of the circle.

The **standard form of an equation of a circle** with radius r and center (h, k) is
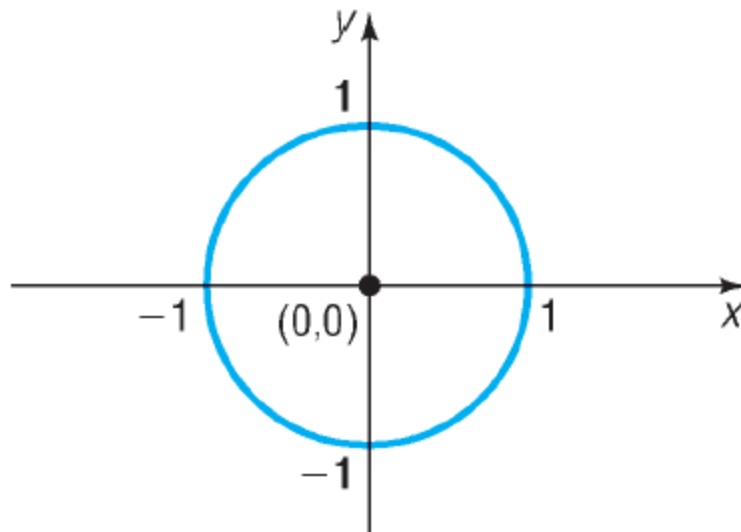
$$(x - h)^2 + (y - k)^2 = r^2$$

The standard form of an equation of a circle of radius r with center at the origin $(0, 0)$ is

$$x^2 + y^2 = r^2$$

If the radius $r = 1$, the circle whose center is at the origin is called the **unit circle** and has the equation

$$x^2 + y^2 = 1$$

Writing the Standard Form of the Equation of a Circle

Write the standard form of the equation of the circle with radius 4 and center $(2, -4)$.

$$(x - h)^2 + (y - k)^2 = r^2$$
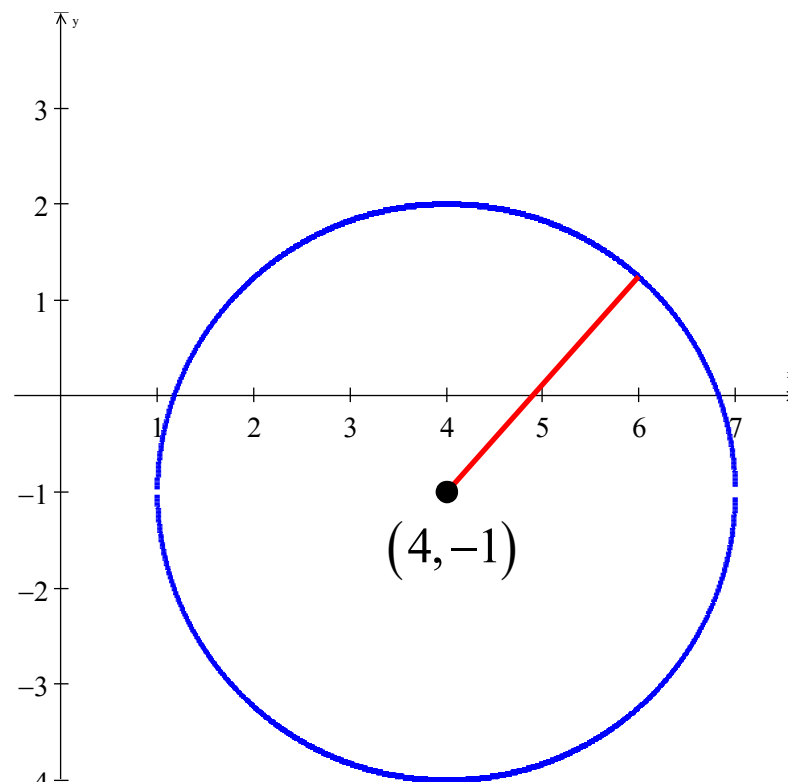
$$(x - 2)^2 + (y + 4)^2 = 16$$

✓ 2 Graph a Circle

Graph the equation: $(x-4)^2 + (y+1)^2 = 9$

$$(x-4)^2 + (y-(-1))^2 = 3^2$$

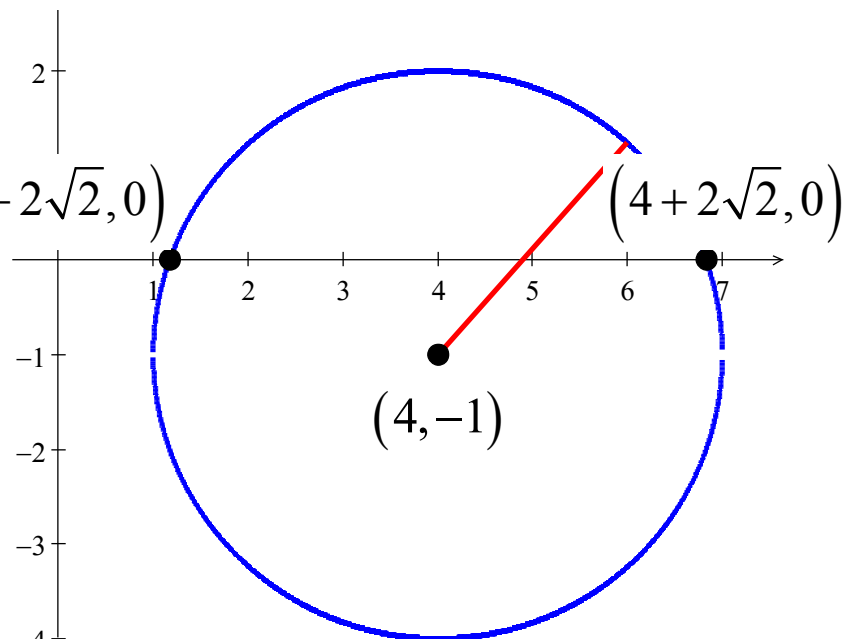$$(x-h)^2 + (y-k)^2 = r^2$$

Center: $(4,-1)$ Radius: 3

$(4,-1)$

Finding the Intercepts of a Circle

For the circle $(x-4)^2 + (y+1)^2 = 9,$ find the intercepts, if any, of its graph.

x-intercepts: $(x-4)^2 + (0+1)^2 = 9$

$(x-4)^2 = 8$ $x-4 = \pm\sqrt{8} = \pm2\sqrt{2}$

$x = 4 \pm 2\sqrt{2}$ $x \approx 6.83$ and $x \approx 1.17$

$\left(4-2\sqrt{2},0\right)$ $\left(4+2\sqrt{2},0\right)$

$(4,-1)$

y-intercepts: We can see looking at the graph that there are no y-intercepts. If we attempted to find them we'd get no real solutions.

3 **Work with the General Form of the Equation of a Circle**

General Form of the Equation of a Circle

$$x^2 + y^2 + ax + by + c = 0$$
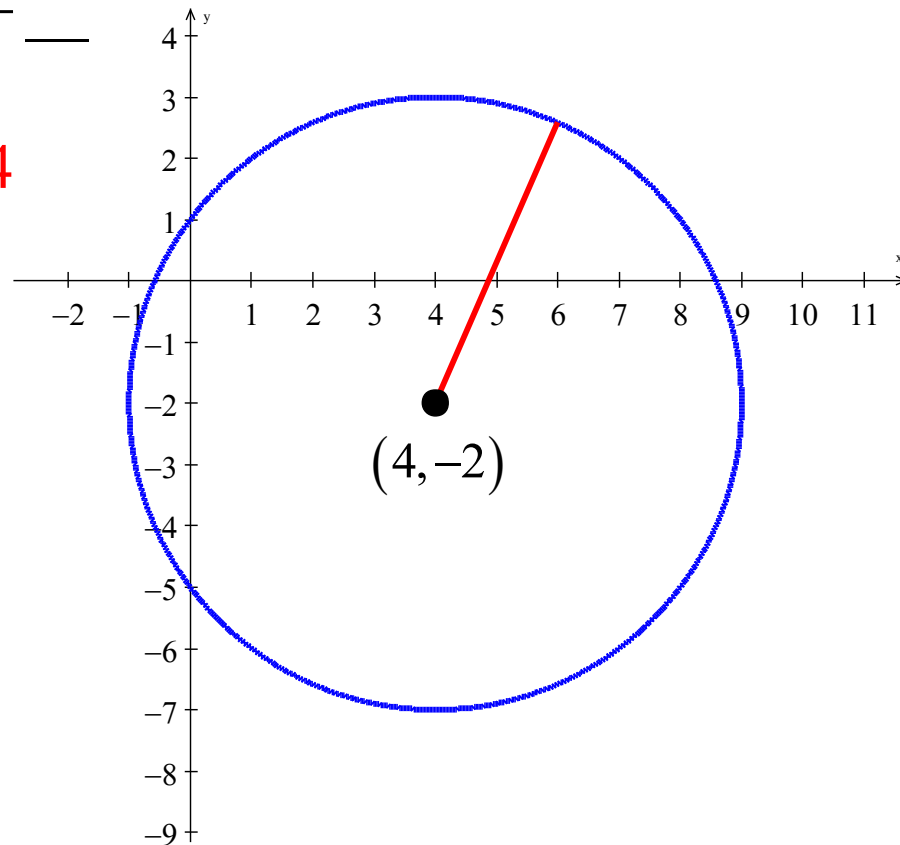
Graphing a Circle Whose Equation Is in General Form

Graph the equation: $x^2 + y^2 - 8x + 4y - 5 = 0$

$$x^2 - 8x + \_\_ + y^2 + 4y + \_\_ = 5 + \_\_ + \_\_$$

$$x^2 - 8x + 16 + y^2 + 4y + 4 = 5 + 16 + 4$$

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

Center: $(4, -2)$ Radius: 5

$(4, -2)$

Using a Graphing Utility to Graph a Circle

Graph the equation: $x^2 + y^2 = 4$

$$y^2 = 4 - x^2$$

$$y = \pm\sqrt{4 - x^2}$$

$Y_1 = \sqrt{4 - x^2}$

2

−3   3

−2

$Y_2 = -\sqrt{4 - x^2}$