

# Graphs

## 2.4 Circles

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## Definition: Circle

A **circle** is the set of all points in a plane that are a fixed distance from a point, the **center**.

## Equation of a Circle

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

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

## Unit Circle

A circle with radius 1 and center  $(0,0)$  is called the **unit circle**.

## Example 1

Identify the center and radius of the given circle and graph.

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

## Example 2

Identify the center and radius of the given circle and graph.

$$\left(x - \frac{1}{2}\right)^2 + \left(y + \frac{1}{3}\right)^2 = 20.$$

## Example 3

Find the equation of a circle with radius 5 and center  $(-2, 3)$ . Graph the circle.

## Equation of a Circle: General Form

The **general form** of the **equation of a circle** is

$$x^2 + y^2 + ax + by + c = 0.$$

### Example 4

The point (10, -4) lies on a circle centered at (7, -8). Find the equation of the circle in general form.

## Transforming Equations of Circles to the Standard Form by Completing the Square:

### Example 5

Find the center and radius of the circle with the equation:

$$x^2 - 8x + y^2 + 20y + 107 = 0$$