

# 10.7 Write and Graph Equations of Circles



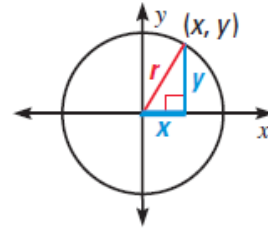
- Before** You wrote equations of lines in the coordinate plane.
- Now** You will write equations of circles in the coordinate plane.
- Why?** So you can determine zones of a commuter system, as in Ex. 36.

Let  $(x, y)$  represent any point on a circle with center at the origin and radius  $r$ .

By the Pythagorean Theorem,

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

This is the equation of a circle with radius "r" that is centered at the origin.

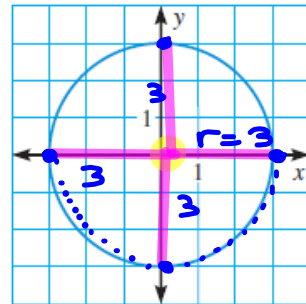


**EXAMPLE 1** Write an equation of the circle.

$$r = 3$$

$$x^2 + y^2 = 3^2$$

$$x^2 + y^2 = 9$$



For circles that are NOT centered at the origin, the equation is as follows:

## Standard Equation of a Circle

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

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

**EXAMPLE 2** Write the standard equation of a circle with the center  $(2, -9)$  and radius 4.

$$(x - 2)^2 + (y - -9)^2 = 4^2$$

$$(x - 2)^2 + (y + 9)^2 = 16$$

$$(x - 2)^2 + (y + 9)^2 = 16$$

1. Center  $(0, 0)$ , radius 5

$$(x - 0)^2 + (y - 0)^2 = 5^2$$

$$x^2 + y^2 = 25$$

2. Center  $(-2, 5)$ , radius 7

opp ↓      opposite 2 ↓

$$(x + 2)^2 + (y - 5)^2 = 49$$

**EXAMPLE 3**

The point  $(-5, 6)$  is on a circle with center  $(-1, 3)$ .

$r = 5$   
 $(x + 1)^2 + (y - 3)^2 = 25$

Write the standard equation of the circle.

#1

$d = \sqrt{(-5 - (-1))^2 + (6 - 3)^2}$

$d = \sqrt{(-4)^2 + (3)^2}$

$d = \sqrt{16 + 9}$

$d = \sqrt{25}$

$d = 5$

#2

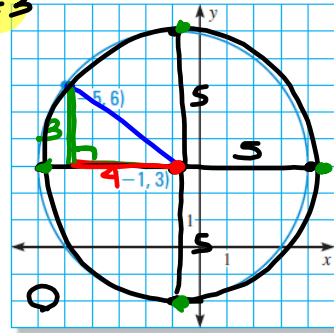
$3^2 + 4^2 = c^2$

$9 + 16 = c^2$

$\sqrt{25} = c$

$5 = c$

#3



3. The point  $(3, 4)$  is on a circle whose center is  $(1, 4)$ .

Write the standard equation of the circle.

$d = \sqrt{(3 - 1)^2 + (4 - 4)^2}$

$d = \sqrt{4}$

$d = 2$

4. The point  $(-1, 2)$  is on a circle whose center is  $(2, 6)$ .

Write the standard equation of the circle.

$r = 5$   
 $(x - 2)^2 + (y - 6)^2 = 25$

$d = \sqrt{(-1 - 2)^2 + (2 - 6)^2}$

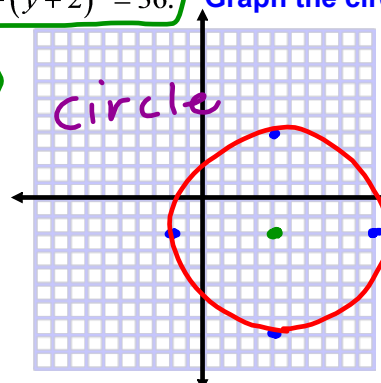
$\sqrt{(-3)^2 + (-4)^2} = \sqrt{9 + 16} = \sqrt{25} = 5$

**EXAMPLE 4**

The equation of a circle is  $(x - 4)^2 + (y + 2)^2 = 36$ .

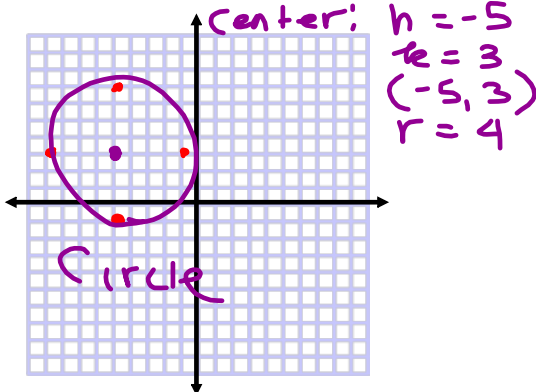
Graph the circle.

$h = 4$   
 $k = -2$   
 $r = 6$   
 center:  $(4, -2)$



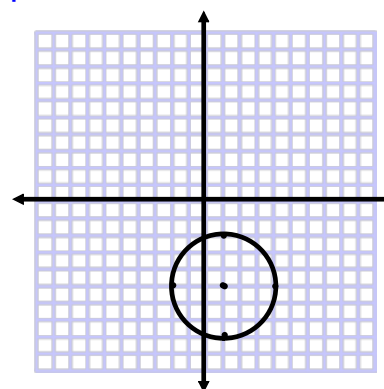
5. The equation of a circle is  $(x + 5)^2 + (y - 3)^2 = 16$ .

Graph the circle.



6. The equation of a circle is  $(x - 1)^2 + (y + 5)^2 = 9$ .

Graph the circle.



CP HW: 10.7 A - 1, 3, 5, 9, 13, 16, 20, 31, 35, 36

Honors HW: 10.7B - 2, 4, 5, 9, 11, 14, 18, 22, 23, 25