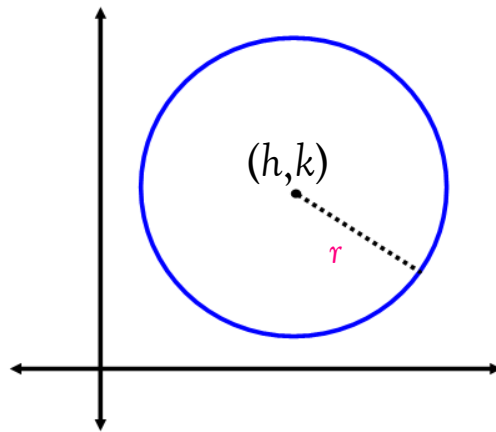# 9.3 CIRCLES

The standard equation for a circle
with its center at (h,k)
and a radius of r is
$(x - h)^2 + (y - k)^2 = r^2$.

Example 1

Write an equation for a circle with...

a) center (-5,2) and a radius of 3 units

$\quad$ h $\quad$ k

$$(x + 5)^2 + (y - 2)^2 = 9$$

b) center (1,-4) and a radius of 6 units

$\quad$ h $\quad$ k

$$(x - 1)^2 + (y + 4)^2 = 36$$

c) center (-8,0) and a diameter of 22 units

$\quad$ h $\quad$ k $\qquad \frac{22}{2} = 11 = r$

$$(x + 8)^2 + y^2 = 121$$

Example 2

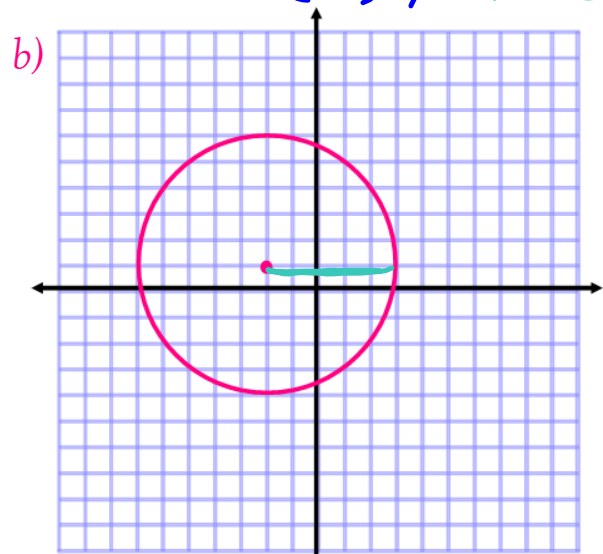Give the coordinates of the center and the length of the radius.
Then write an equation for the circle.

a)   center $(4,4)$ $r=3$
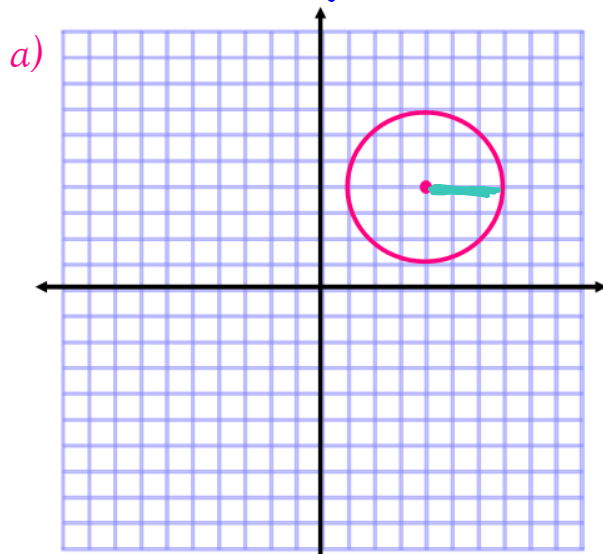
b)   center $(-2,1)$ $r=5$
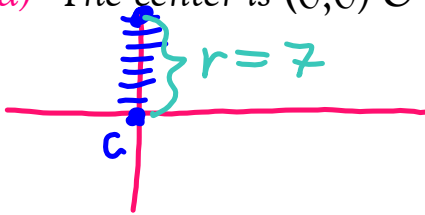
$(x-4)^2 + (y-4)^2 = 9$
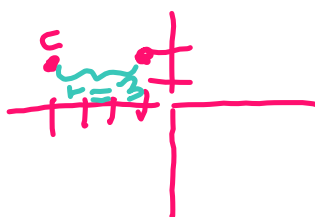
$(x+2)^2 + (y-1)^2 = 25$

Example 3

Use the given information to write the standard equation of the circle.

a) The center is $(0,0)$ & a point on the circle is $(0,7)$.

$r=7$

$x^2 + y^2 = 49$

b) The center is $(-4,2)$ & a point on the circle is $(-1,2)$.

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

Example 4

Use the given information to write the standard equation of the circle.

a) The center is (7,3) & a point on the circle is (7,⁻1).

$r = 4$

$$(x - 7)^2 + (y - 3)^2 = 16$$

b) The center is (⁻5,⁻1) & a point on the circle is (⁻5,⁻6).
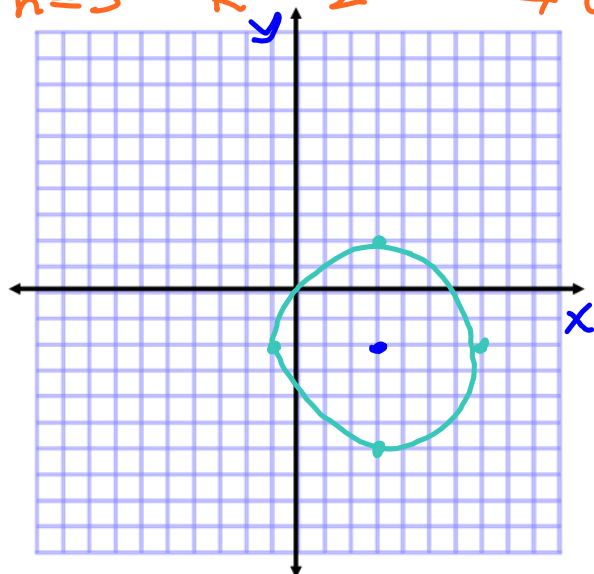
$r = 5$

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

Example 5

Give the center and radius of the circle. Then graph.

$(x - 3)^2 + (y + 2)^2 = 16$ $r = 4$
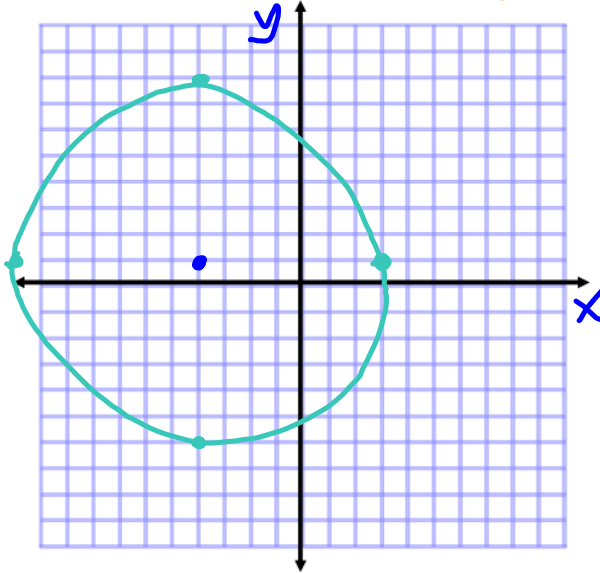
$h = 3$ $k = -2$ ⟶ center $(3, -2)$

Example 6

Give the center and radius of the circle. Then graph.

$(x + 4)^2 + (y - 1)^2 = 49$ $r = 7$

$h = -4$ $k = 1$ $\longrightarrow$ center $(-4, 1)$

Example 7

Write the standard equation for the circle $x^2 + y^2 + 4x - 6y - 3 = 0$.
State the coordinates of the center and give its radius. Then graph.
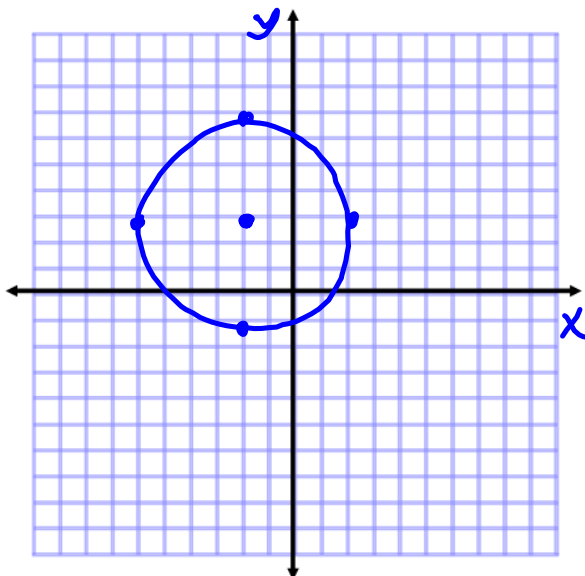
$x^2 + 4x + 4 \quad + y^2 - 6y + 9 = 3 + 4 + 9$

$\frac{1}{2}(4) = 2 \qquad \frac{1}{2}(-6) = -3$
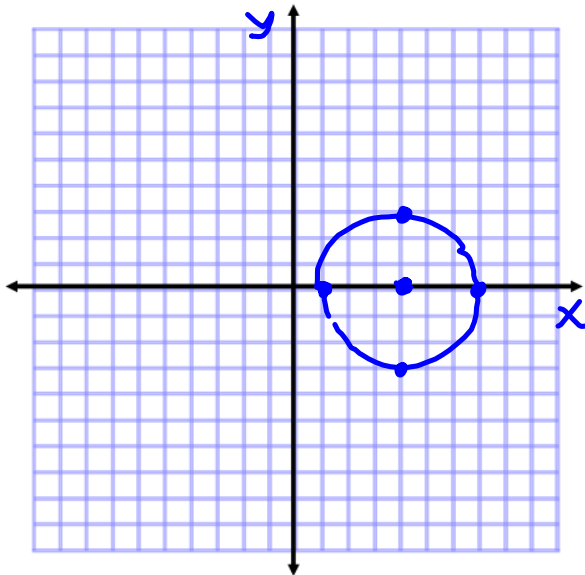
$(2)^2 = 4 \qquad (-3)^2 = 9$

$(x + 2)^2 + (y - 3)^2 = 16$

center $(-2, 3)$

$r = 4$

Example 8

Write the standard equation for the circle $x^2 + y^2 - 8x + 7 = 0$.
State the coordinates of the center and give its radius. Then graph.

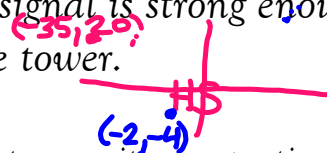$$x^2 - 8x + 16 + y^2 = -7 + 16$$
$$\tfrac{1}{2}(-8) = -4$$
$$(-4)^2 = 16$$

$$(x-4)^2 + y^2 = 9$$
$$\text{center } (4, 0)$$
$$r = 3$$

Example 9

A radio tower for a local station is located 20 miles north and 35 miles west of the town's high school. The radio signal is strong enough to reach locations within a 40-mile radius of the tower.

(-35, 20)

(-2, -4)

a) With the high school at the origin of a coordinate system, write an equation that represents all ground locations 40 miles from the radio tower.

$$(x+35)^2 + (y-20)^2 = 1600$$

b) Can someone who lives 2 miles west and 4 miles south of the high school receive the signal? Justify your answer.

no this
person
cannot
receive
the signal

$$(x + 35)^2 + (y - 20)^2 \leq 1600$$
$$(-2 + 35)^2 + (-4 - 20)^2 \overset{?}{\leq} 1600$$
$$(33)^2 + (-24)^2 \leq 1600$$
$$1089 + 576 \leq 1600$$
$$1665 \not\leq 1600$$

people
inside or
on circle
can receive
signal