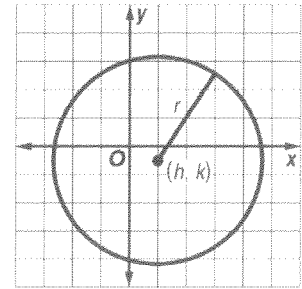


# 10-8 Equations of a Circle

Master E

- Equation of a Circle** A circle is the locus of points in a plane equidistant from a given point. You can use this definition to write an equation of a circle.

<b>Standard Equation of a Circle</b>	An equation for a circle with center at $(h, k)$ and a radius of $r$ units is $(x - h)^2 + (y - k)^2 = r^2$ .
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**Example:** Write an equation for a circle with center  $(-1, 3)$  and radius 6.

Use the formula  $(x - h)^2 + (y - k)^2 = r^2$  with  $h = -1$ ,  $k = 3$ , and  $r = 6$ .

$$\begin{aligned} (x - h)^2 + (y - k)^2 &= r^2 && \text{Equation of a circle} \\ (x - (-1))^2 + (y - 3)^2 &= 6^2 && \text{Substitution} \\ (x + 1)^2 + (y - 3)^2 &= 36 && \text{Simplify} \end{aligned}$$

**1-10:** Write the equation of each circle that has a ...

- center at  $(0, 0)$  and radius 8

$$x^2 + y^2 = 64$$

- center at  $(-2, -6)$  and diameter 8  $r = 4$

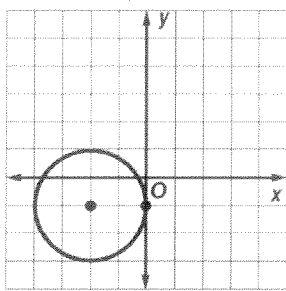
$$(x + 2)^2 + (y + 6)^2 = 16$$

- center at  $(3, -4)$  and passes through  $(-1, -4)$

$$(x - 3)^2 + (y + 4)^2 = 16$$

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

- 



$$C(-2, -1)$$

$$r = 2$$

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

- center at  $(-2, 3)$  and radius 5

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

- center at  $(-1, -4)$  and diameter 4  $r = 2$

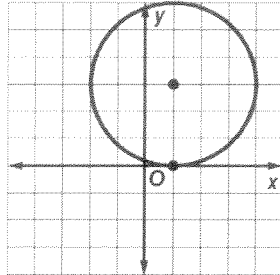
$$(x + 1)^2 + (y + 4)^2 = 4$$

- center at  $(0, 3)$  and passes through  $(2, 0)$

$$x^2 + (y - 3)^2 = 13$$

$$r = \sqrt{(2 - 0)^2 + (0 - 3)^2} = \sqrt{4 + 9} = \sqrt{13}$$

- 



$$C(1, 3)$$

$$r = 3$$

$$(x - 1)^2 + (y - 3)^2 = 9$$

- diameter with endpoints  $(-1, 5)$  and  $(7, 5)$

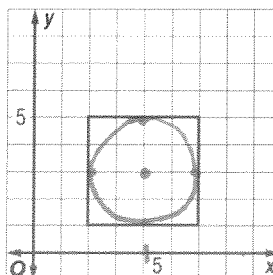
$$d = \sqrt{(7 - (-1))^2 + (5 - 5)^2} = \sqrt{8^2} = 8$$

$$r = 4$$

$$C = \left(-1 + \frac{7}{2}, \frac{5 + 5}{2}\right) = \left(\frac{6}{2}, \frac{10}{2}\right) = (3, 0)$$

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

- Arthur wants to write the equation of a circle that is inscribed in the square shown in the graph. What is the equation of the desired circle?



$$C(4, 3)$$

$$r = 2$$

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

**2. Graph Circles** If you are given an equation of a circle, you can find information to help you graph the circle.

**Example: Graph**  $(x + 3)^2 + (y - 1)^2 = 9$ .

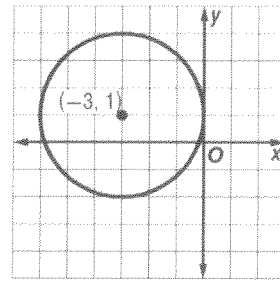
Use the parts of the equation to find  $(h, k)$  and  $r$ .

Rewrite  $(x + 3)^2 + (y - 1)^2 = 9$  to find the center and the radius.

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

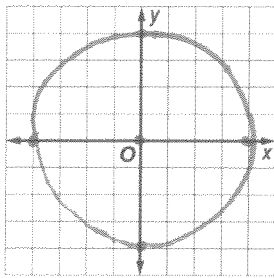
$$(x - h)^2 + (y - k)^2 = r^2$$

So  $h = -3$ ,  $k = 1$ , and  $r = 3$ . The center is at  $(-3, 1)$  and the radius is 3.



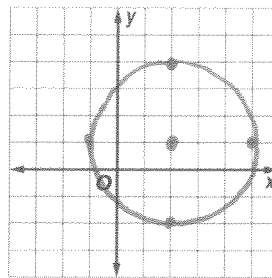
**11-14:** For each circle with the given equation, state the coordinates of the center and the measure of the radius. Then graph the equation.

11.  $x^2 + y^2 = 16$



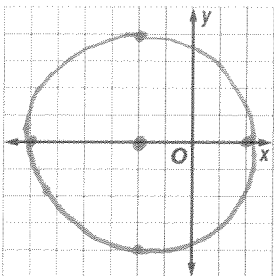
$C(0,0)$   
 $r=4$

12.  $(x - 2)^2 + (y - 1)^2 = 9$



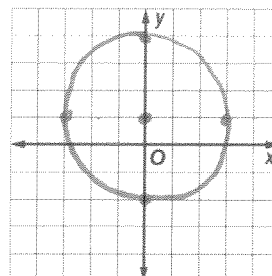
$C(2,1)$   
 $r=3$

13.  $(x + 2)^2 + y^2 = 16$



$C(-2,0)$   
 $r=4$

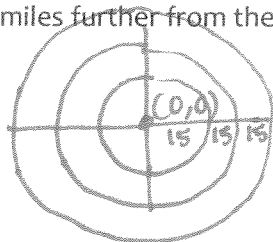
14.  $x^2 + (y - 1)^2 = 9$



$C(0,1)$   
 $r=3$

**15-16: Applications**

15. A Doppler radar screen shows concentric rings around a storm. If the center of the radar screen is the origin and each ring is 15 miles further from the center, what is the equation of the third ring?



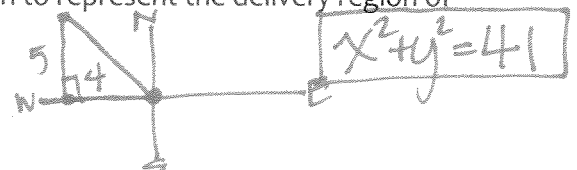
$C(0,0)$   
 $r=45$

$$x^2 + y^2 = 2025$$

16. Dominick's Pizza and Subs offers free delivery within a 6 mile radius of the restaurant. Consuela's house is located 4 miles west and 5 miles north of the restaurant.

a. If the restaurant is the origin of the situation, write an equation to represent the delivery region of Dominick's Pizza and Subs.

$$r = \sqrt{5^2 + 4^2} = \sqrt{41} = 6.40$$



b. Can Consuela get free delivery if she orders from Dominick's? Explain why or why not.

No - she is over 6 miles from Dominick's pizza & subs