

**Equation of a Circle:**  $(x - h)^2 + (y - k)^2 = r^2$  **Radius:**  $r$   
 $\uparrow$   $\uparrow$  **Center:**  $(h, k)$   
 x-coordinate of the center      y-coordinate of the center  
 Point on the circle  $(x, y)$

Use the following information to write the equation of the circle.

1. Center:  $(6, 13)$   
 Radius:  $3$

$$(x - 6)^2 + (y - 13)^2 = 3^2$$

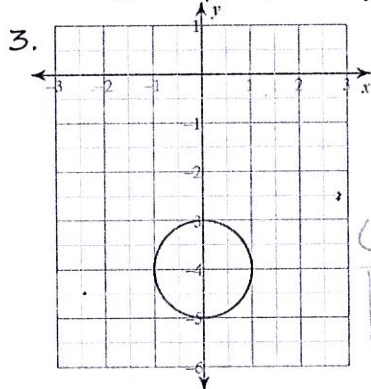
$$(x - 6)^2 + (y - 13)^2 = 9$$

2. Center:  $(15, -8)$   
 Radius:  $4$

$$(x - 15)^2 + (y - (-8))^2 = 4^2$$

$$(x - 15)^2 + (y + 8)^2 = 16$$

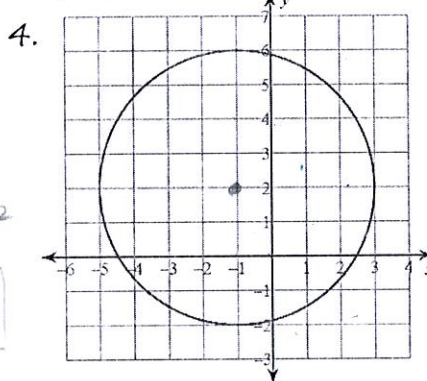
Write the equation of the circle from the graph.



center  $(0, -4)$   
 $r = 1$

$$(x - 0)^2 + (y - (-4))^2 = 1^2$$

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



center  $(-1, 2)$   
 $r = 4$

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

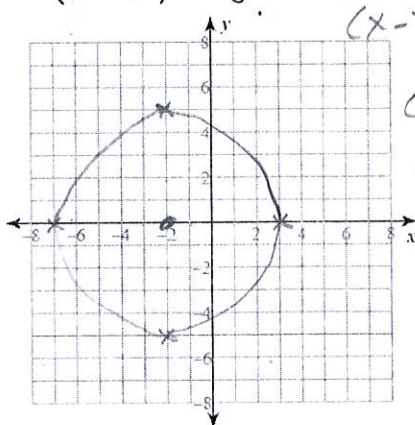
$$(x + 1)^2 + (y - 2)^2 = 16$$

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

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

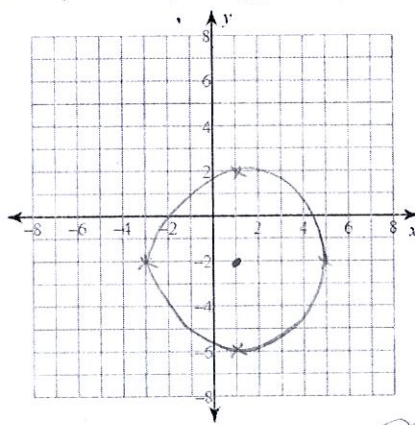
5.  $(x + 2)^2 + y^2 = 25$

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



center  $(-2, 0)$   
 $r = 5$

6.  $(x - 1)^2 + (y + 2)^2 = 16$



center:  $(1, -2)$   
 $r = 4$

Determine if the given point is inside, on, or outside the circle.

7.  $(x - 3)^2 + (y - 1)^2 = 8$

Point:  $(5, -1)$

$$(5 - 3)^2 + (-1 - 1)^2 = 8$$

$$(2)^2 + (-2)^2 = 8$$

$$4 + 4 = 8$$

$$8 = 8$$

$(5, -1)$  is ON the circle.

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

Point:  $(-2, 2)$

$$(-2 + 1)^2 + (2 + 1)^2 = 9$$

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

$$1 + 9 = 9$$

$$10 \neq 9$$

$(-2, 2)$  is outside circle

① Plug in point  $(x, y)$

② **inside**  $LS < RS$

**outside**  $LS > RS$

**ON**  $LS = RS$

DISTANCE FORMULA:  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

\* The distance between the center of the circle and a point on the circle is the radius.

1. Using the distance formula, write the equation of a circle whose center is (5, -3) and goes through (2, 5). ← Point on the circle

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

$$d = \sqrt{(-3)^2 + (8)^2}$$

$$d = \sqrt{9+64}$$

$$d = \sqrt{73}$$

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

$$(x-5)^2 + (y-(-3))^2 = (\sqrt{73})^2$$

$$(x-5)^2 + (y+3)^2 = 73$$

2. Using the distance formula, write the equation of a circle whose center is (4, -3) and goes through (1, 5).

$$d = \sqrt{(1-4)^2 + (5-(-3))^2}$$

$$d = \sqrt{(-3)^2 + (8)^2}$$

$$d = \sqrt{9+64}$$

$$d = \sqrt{73}$$

$$(x-4)^2 + (y-(-3))^2 = (\sqrt{73})^2$$

$$(x-4)^2 + (y+3)^2 = 73$$

3. If the center of a circle is at (1, -1) and the radius is 4, does the point (2, 3) lie on the circle?

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

$$(2-1)^2 + (3+1)^2 = 16$$

$$1^2 + 4^2 = 16$$

$$17 > 16$$

(2, 3) lies outside the circle.

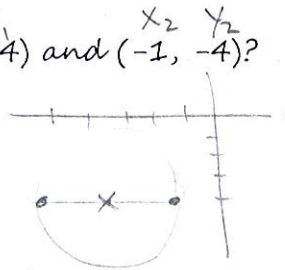
MIDPOINT FORMULA:  $M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

1. What is the center of a circle whose diameter has endpoints at (-5, -4) and (-1, -4)?

$$M = \left( \frac{-5 + (-1)}{2}, \frac{-4 + (-4)}{2} \right)$$

$$M = \left( \frac{-6}{2}, \frac{-8}{2} \right)$$

Center = (-3, -4)



2. Give the equation whose endpoints of a diameter are (-4, 1) and (4, -5).

① use midpoint formula to find center

$$M = \left( \frac{-4 + 4}{2}, \frac{1 + (-5)}{2} \right)$$

$$M = (0, -2) \Rightarrow \text{Center}$$

② use distance formula for radius

$$d = \sqrt{(0-4)^2 + (-2-1)^2}$$

$$d = \sqrt{16+9}$$

$$d = \sqrt{25} = 5$$

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

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

3. Give the equation whose endpoints of a diameter are (-3, 2) and (1, -5).

$$M = \left( \frac{-3 + 1}{2}, \frac{2 + (-5)}{2} \right) = (-1, -1.5)$$

$$d = \sqrt{(-1+3)^2 + (-1.5-2)^2}$$

$$d = \sqrt{4 + 12.25}$$

$$d = \sqrt{16.25}$$

Center (-1, -1.5)

radius =  $\sqrt{16.25}$

$$(x-(-1))^2 + (y-(-1.5))^2 = (\sqrt{16.25})^2$$

$$(x+1)^2 + (y+1.5)^2 = 16.25$$