

Learning Targets:

- Given an equation of a circle, I can identify the radius and center point.
- Given information about the circle, I can write the equation of that circle
- Given an equation or information about the circle, I can sketch a circle on a coordinate plane.

Investigation- Equations of a circle.

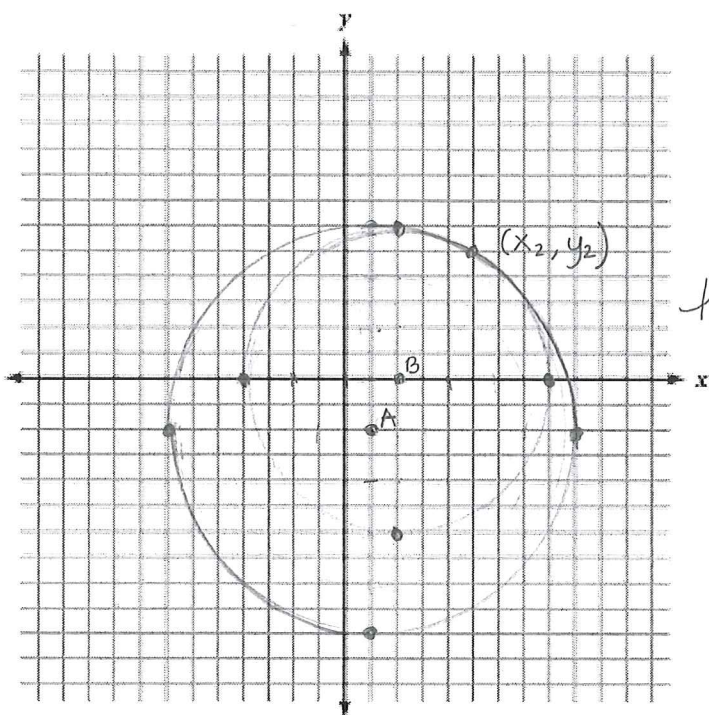
Materials: compass

The distance formula can also be used to find the equation of a circle. What is the equation of a circle with radius r and center (h, k) ? Use graph paper and compass to investigate and make a conjecture.

Step 1 Given its center and radius, graph each circle.

Circle A: center = $(1, -2)$, $r = 8$

Circle B: center = $(0, 2)$, $r = 6$



Step 2 For each circle, select any point and label it (x_2, y_2) .

Use the distance formula to write an equation for the distance from the center of the circle to (x_2, y_2) .

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

the distance = radius

Equation for circle A. Center = $(1, -2)$ $r = 8$

$$\text{or } d = \sqrt{(x_2 - 1)^2 + (y_2 + 2)^2}$$

$$8 = \sqrt{(x_2 - 1)^2 + (y_2 + 2)^2}$$

Equation for circle B. Center $(0, 2)$, $r = 6$

$$6 = \sqrt{(x_2 - 0)^2 + (y_2 - 2)^2}$$

Step 3 Using your equations from step 2, come up with a general equation that represents any circle.

EQUATION OF A CIRCLE: *the distance between the center and (x_2, y_2) is*

The equation of a circle with radius r and center (h, k) is: *the radius of the circle.*

$$r = \sqrt{(x_2 - \underline{h})^2 + (y_2 - \underline{k})^2}$$

OR

$$r^2 = (x_2 - h)^2 + (y_2 - k)^2$$

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

(h, k) is the center

$r =$ radius

Graphing Circles

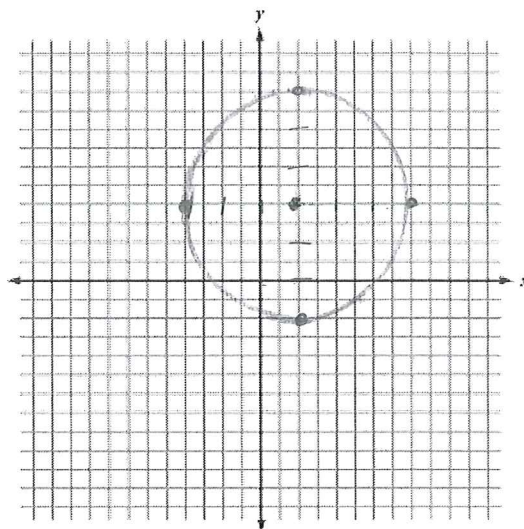
1.) Graph the circle with equation :

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

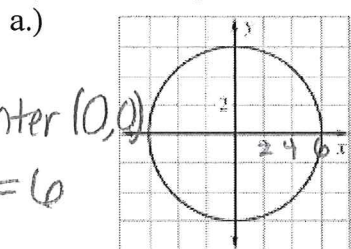
a.) Determine center: (2, -4)

b.) Radius is: $\sqrt{36} = 6$

c.) Draw point at center; mark radius units from center; draw circle freehand or with compass

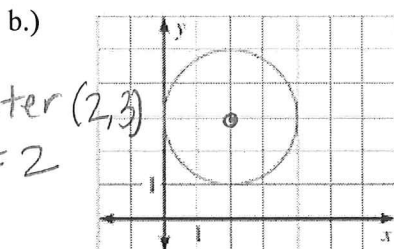


2.) Write an equation for the circles shown:



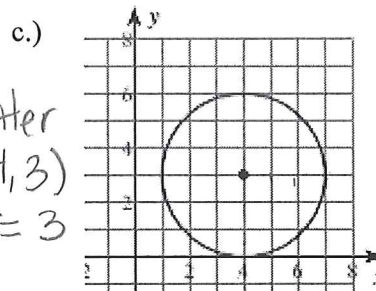
Center (0, 0)
 $r = 6$

$$\frac{(x-0)^2 + (y-0)^2 = 6^2}{x^2 + y^2 = 36}$$



Center (2, 3)
 $r = 2$

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



Center (4, 3)
 $r = 3$

$$\frac{(x-4)^2 + (y-3)^2 = 3^2}{(x-4)^2 + (y-3)^2 = 9}$$

3.) Write the standard equation of the circle with the given centers and radii:

a.) center: $(0, 0)$; radius = 3

$$\frac{(x-0)^2 + (y-0)^2 = 3^2}{x^2 + y^2 = 9}$$

b.) center: $(-4, 3)$; radius = 5

$$(x+4)^2 + (y-3)^2 = 25$$

c.) center: $(1, -5)$; radius = 3

$$(x-1)^2 + (y+5)^2 = 9$$

4.) Identify the center and radius of the following circles. Then graph each circle.

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

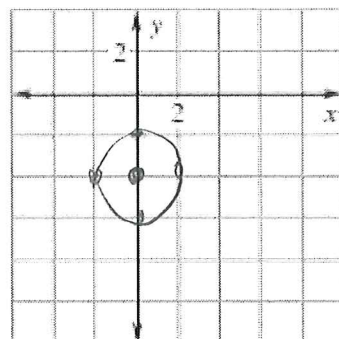
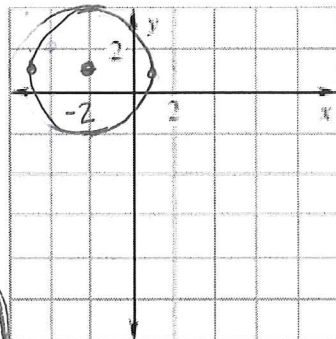
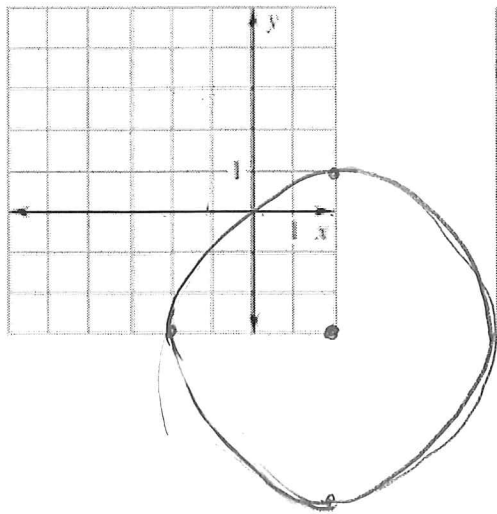
center: (2, -3) radius: 4

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

center: (-2, 1) radius: 3

c.) $x^2 + (y + 4)^2 = 4$

center: (0, -4) radius: 2



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Write an equation of a circle with the given radius and center.

1.) $r = 5$; center: $(12, 80)$

$$(x-12)^2 + (y-80)^2 = 25$$

2.) $r = 9$; center: $(6, 12)$

$$(x-6)^2 + (y-12)^2 = 81$$

3.) $r = 12$; center: $(-1, 15)$

$$(x+1)^2 + (y-15)^2 = 144$$

4.) $r = 4$; center: $(8, -7)$

$$(x-8)^2 + (y+7)^2 = 16$$

Identify the center and radius of the following circles.

5.) $(x-3)^2 + (y-1)^2 = 12$

Center: $(3, 1)$

Radius: $\sqrt{12} = 2\sqrt{3}$

6.) $(x+4)^2 + (y-7)^2 = 81$

Center: $(-4, 7)$

Radius: $\sqrt{81} = 9$

7.) $x^2 + (y+5)^2 = 144$

Center: $(0, -5)$

Radius: $\sqrt{144} = 12$

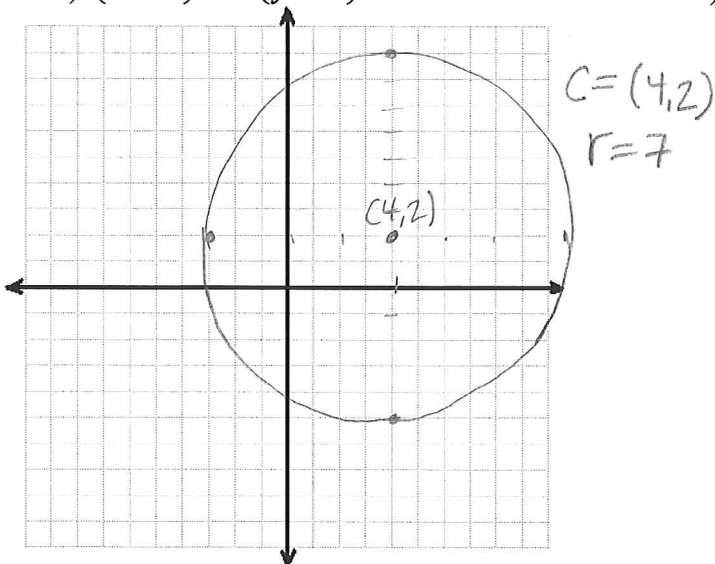
8.) $(x+1)^2 + y^2 = 49$

Center: $(-1, 0)$

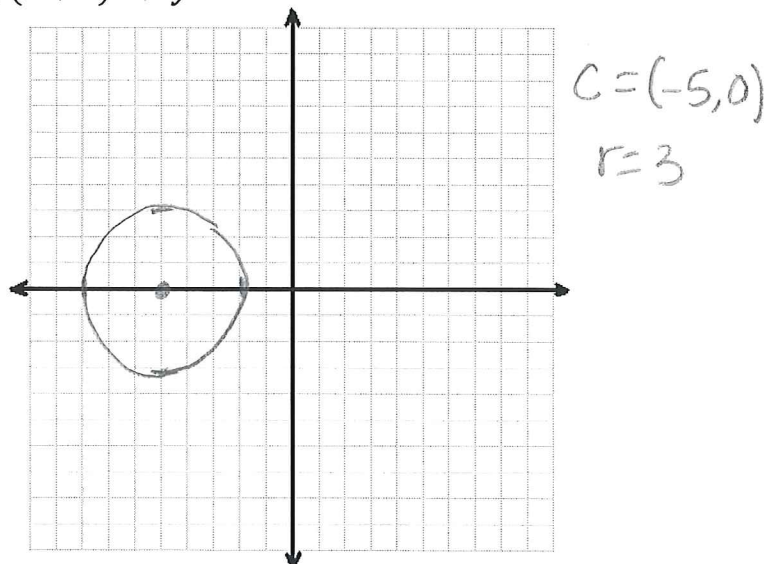
Radius: $\sqrt{49} = 7$

Graph the circles:

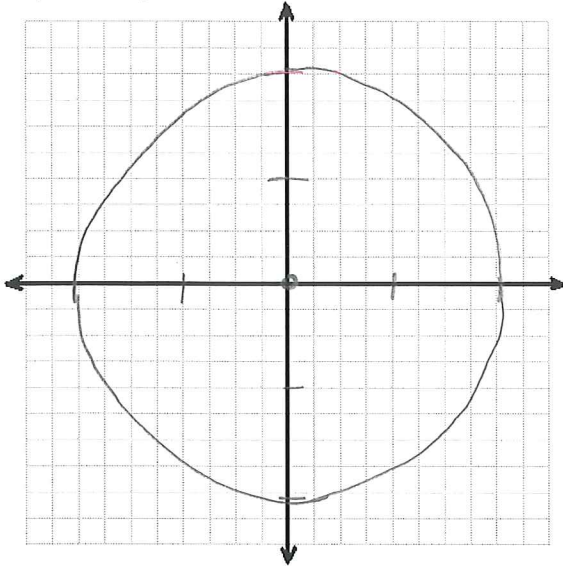
9.) $(x-4)^2 + (y-2)^2 = 49$



10.) $(x+5)^2 + y^2 = 9$

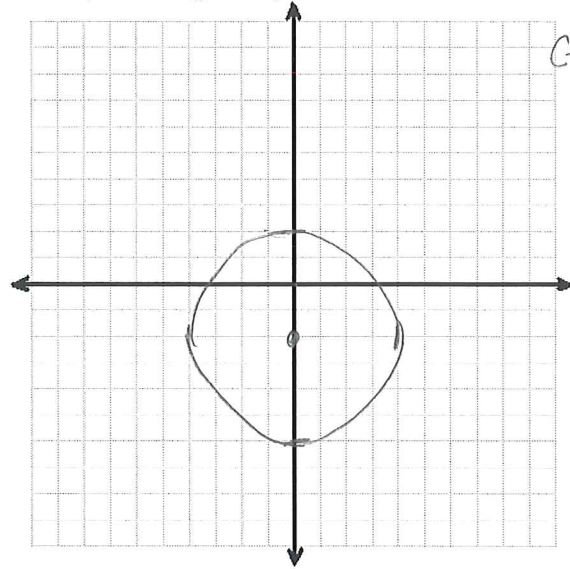


11.) $x^2 + y^2 = 64$



$C=(0,0)$
 $r=8$

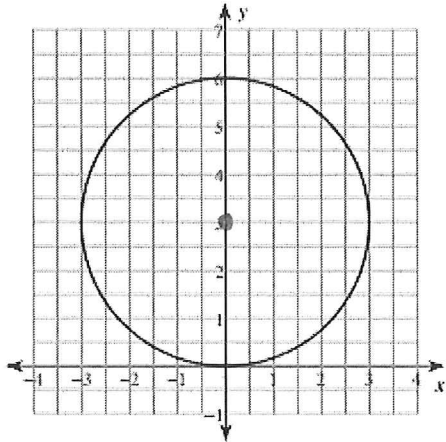
12.) $x^2 + (y + 2)^2 = 16$



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

Write an equation for the following circles.

13.)

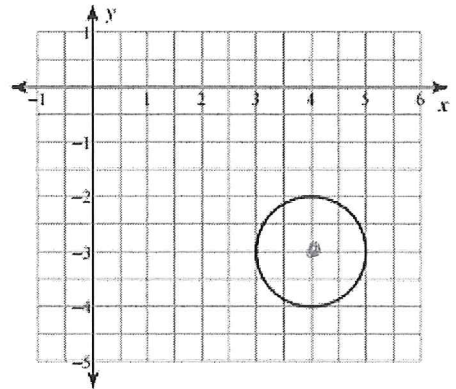


Center: $(0,3)$

Radius: 3

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

14.)



Center: $(4,-3)$

Radius: 1

Equation: $(x-4)^2 + (y+3)^2 = 1$