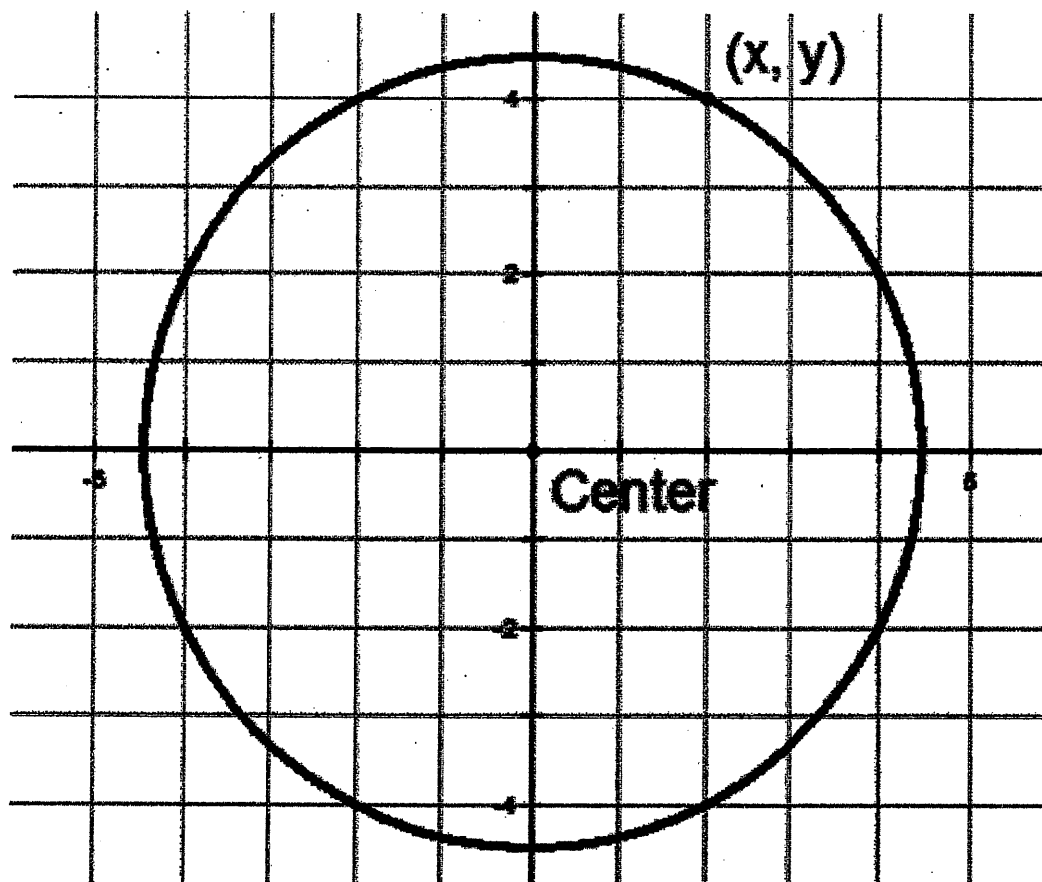


### Part 1: Finding the Radius

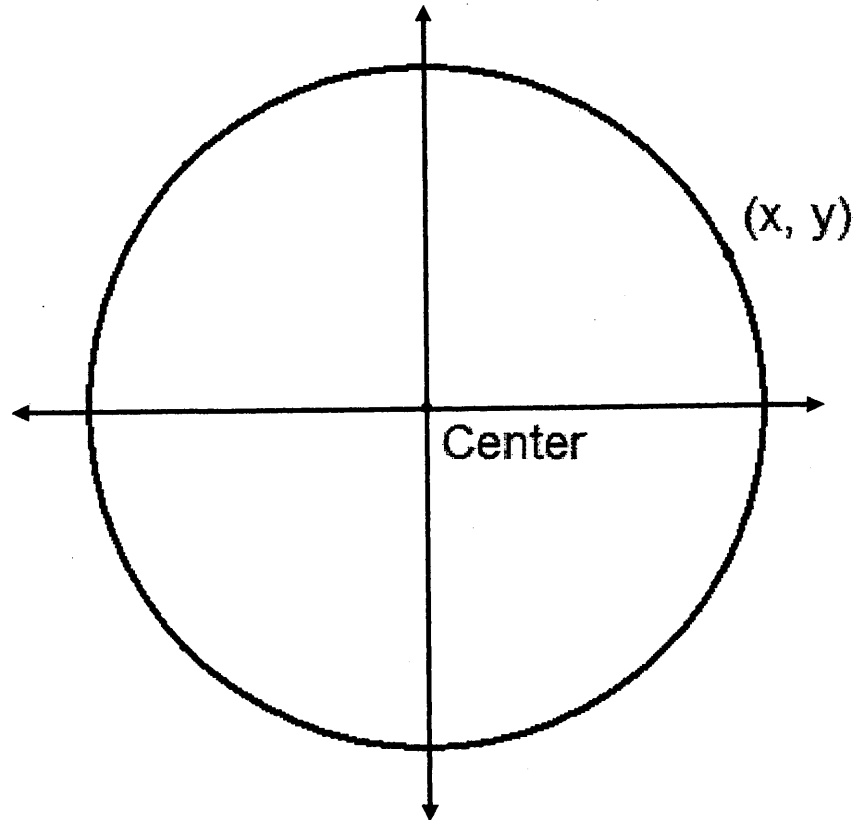
Consider the circle below. Notice the center is at the origin and a point is on the circle  $(x, y)$ .



1. Construct a line segment from the center to the point  $(x, y)$  on the circle and label it " $r$ ". What is this line segment called?
2. Construct a right triangle with  $r$  as the hypotenuse. What are the coordinates of the point  $(x, y)$ ?
3. What is the measure of  $r$ ? Explain your method for calculating it.

**Part 2: Circles Centered at the Origin.**

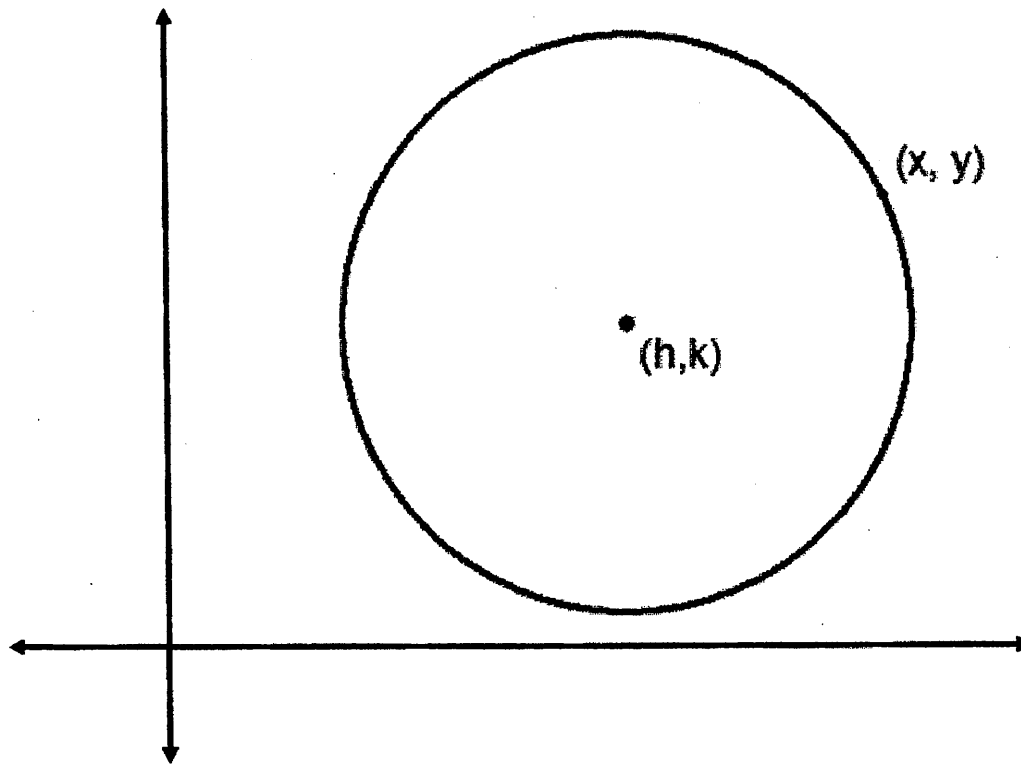
Consider the circle below. The center is located at the origin.



1. Construct a radius from the center to the point  $(x, y)$ . Label it " $r$ ".
2. Construct a right triangle with  $r$  as the hypotenuse. What are the coordinates of the point where the legs meet?
3. Write an expression for the distance from the center to the point from #2. Label the triangle accordingly.
4. Write an expression for the distance from  $(x, y)$  to the point from #2. Label the triangle accordingly.
5. Now use your method from part one to write an expression for  $r^2$

### Part 3: Circles centered anywhere!

In the previous section, you found that  $x^2 + y^2 = r^2$ . This is the general equation for a circle centered at the origin. However, circles are not always centered at the origin. Use the following circle and directions to find the general equation for a circle centered anywhere.



1. Construct a radius between (h, k) and (x, y). Then create a right triangle with the radius as the hypotenuse. Find the coordinates for the point where the legs meet.
2. Write an expression for the distance between (x, y) and the point from #1. Label the triangle.
3. Write an expression for the distance between (h, k) and the point from #1. Label the triangle.
4. Now write an expression for  $r^2$ .

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

$r =$

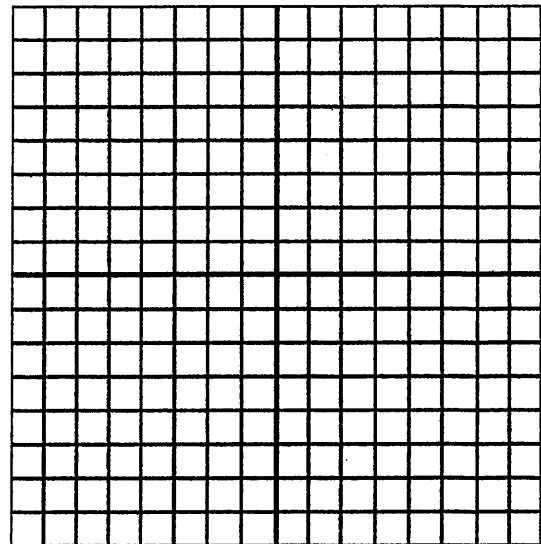
$(h,k) =$

$(x,y)$

**Ex 1: Write the standard equation of a circle with center  $(-3,6)$  and a radius of 7.**

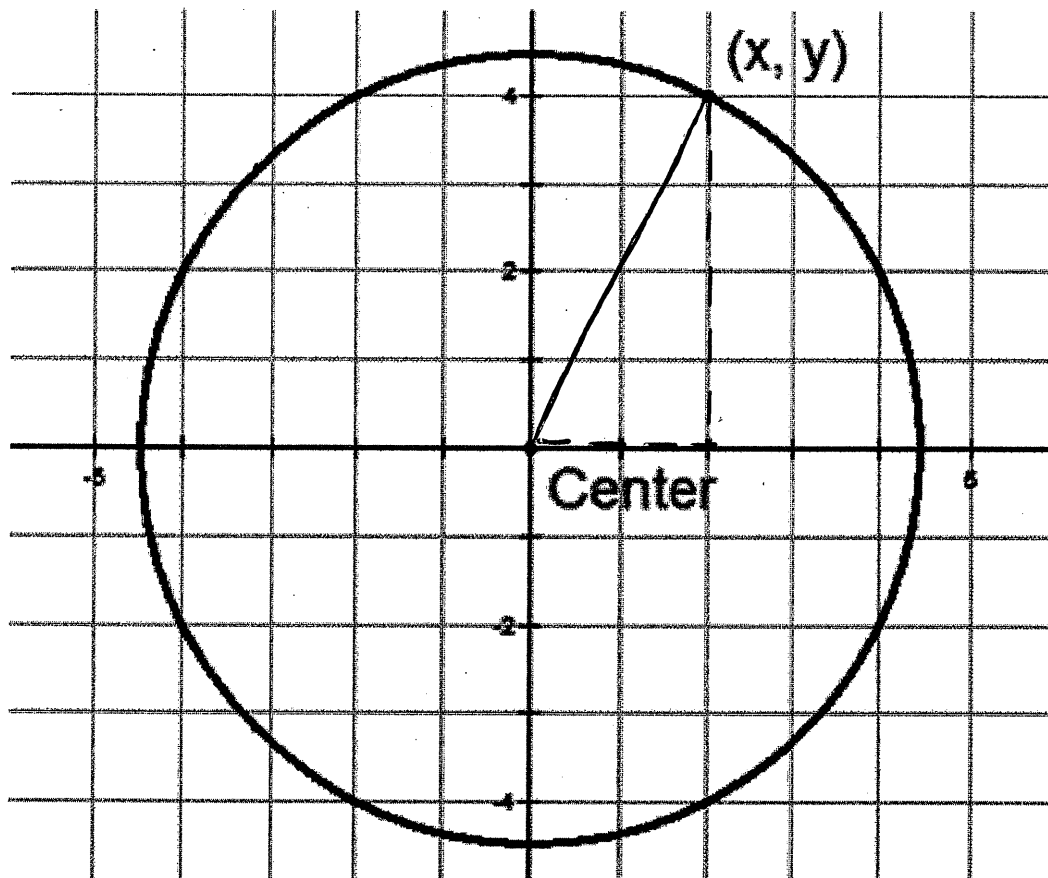
**Ex 2: Write the standard equation of a circle with center  $(-5,0)$  and a radius of 4.8.**

**Ex 3: State the center and radius of  $(x + 2)^2 + (y - 3)^2 = 4$ . Graph the circle.**



### Part 1: Finding the Radius

Consider the circle below. Notice the center is at the origin and a point is on the circle  $(x, y)$ .

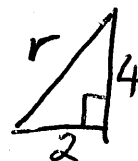


1. Construct a line segment from the center to the point  $(x, y)$  on the circle and label it "r". What is this line segment called?

radius

2. Construct a right triangle with  $r$  as the hypotenuse. What are the coordinates of the point  $(x, y)$ ?

(2, 4)



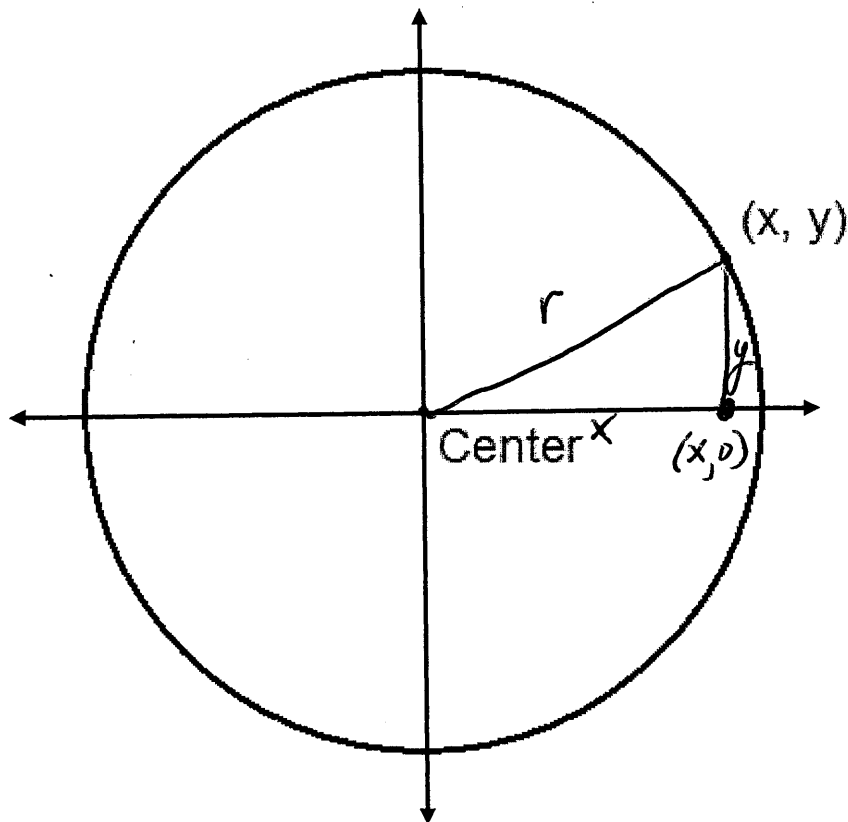
3. What is the measure of  $r$ ? Explain your method for calculating it.

$$\begin{aligned} 2^2 + 4^2 &= r^2 \\ 4 + 16 &= r^2 \\ 20 &= r^2 \end{aligned}$$

$$\begin{aligned} r &= \sqrt{20} \\ r &= 2\sqrt{5} \end{aligned}$$

Part 2: Circles Centered at the Origin.

Consider the circle below. The center is located at the origin.



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

1. Construct a radius from the center to the point  $(x, y)$ . Label it "r".
2. Construct a right triangle with  $r$  as the hypotenuse. What are the coordinates of the point where the legs meet?  $(x, y)$

3. Write an expression for the distance from the center to the point from #2. Label the triangle accordingly.

$$r = \sqrt{x^2 + y^2}$$

4. Write an expression for the distance from  $(x, y)$  to the point from #2. Label the triangle accordingly.

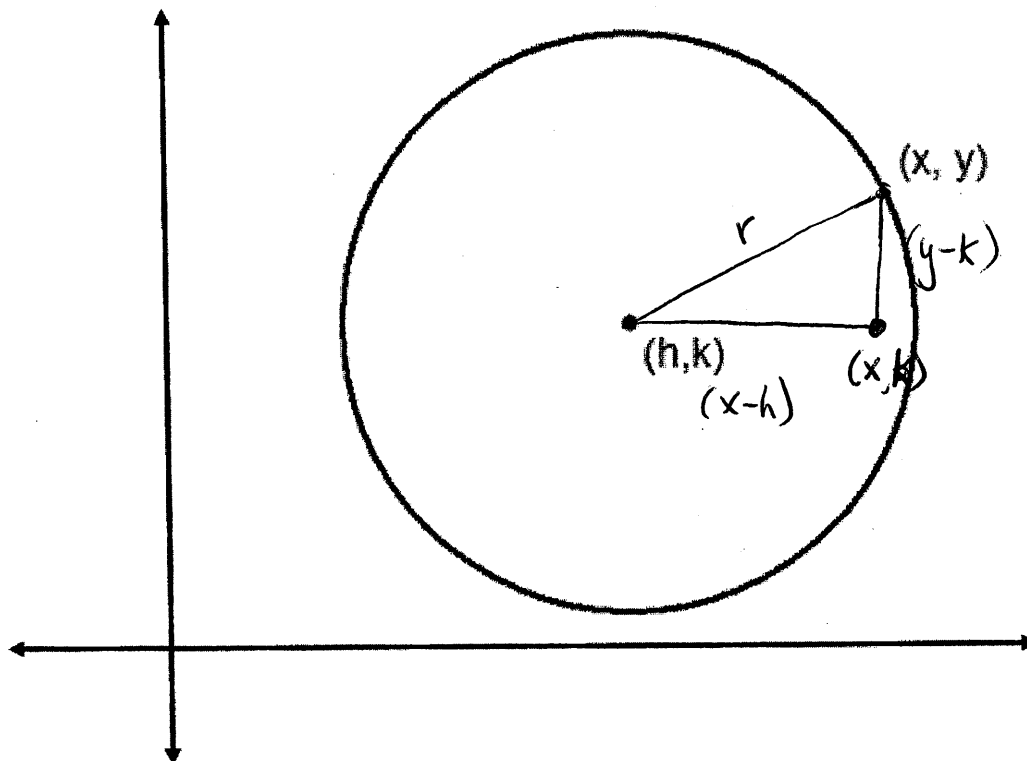
$$\sqrt{(x-x)^2 + (y-y)^2} = y$$

5. Now use your method from part one to write an expression for  $r^2$

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

### Part 3: Circles centered anywhere!

In the previous section, you found that  $x^2 + y^2 = r^2$ . This is the general equation for a circle centered at the origin. However, circles are not always centered at the origin. Use the following circle and directions to find the general equation for a circle centered anywhere.



1. Construct a radius between  $(h, k)$  and  $(x, y)$ . Then create a right triangle with the radius as the hypotenuse. Find the coordinates for the point where the legs meet.

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

2. Write an expression for the distance between  $(x, y)$  and the point from #1. Label the triangle.
3. Write an expression for the distance between  $(h, k)$  and the point from #1. Label the triangle.
4. Now write an expression for  $r^2$ .

### Standard equation of a circle

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

$r =$  radius

$(h,k) =$  ~~pair~~ center of circle

$(x,y) =$  point on circle

Ex 1: Write the standard equation of a circle with center  $(-3,6)$  and a radius of 7.

$$(x+3)^2 + (y-6)^2 = 7^2$$

Ex 2: Write the standard equation of a circle with center  $(-5,0)$  and a radius of 4.8.

$$(x+5)^2 + (y-0)^2 = 4.8^2$$

Ex 3: State the center and radius of  $(x+2)^2 + (y-3)^2 = 4$ . Graph the circle.

center:  $(-2, 3)$

$r = 2$

