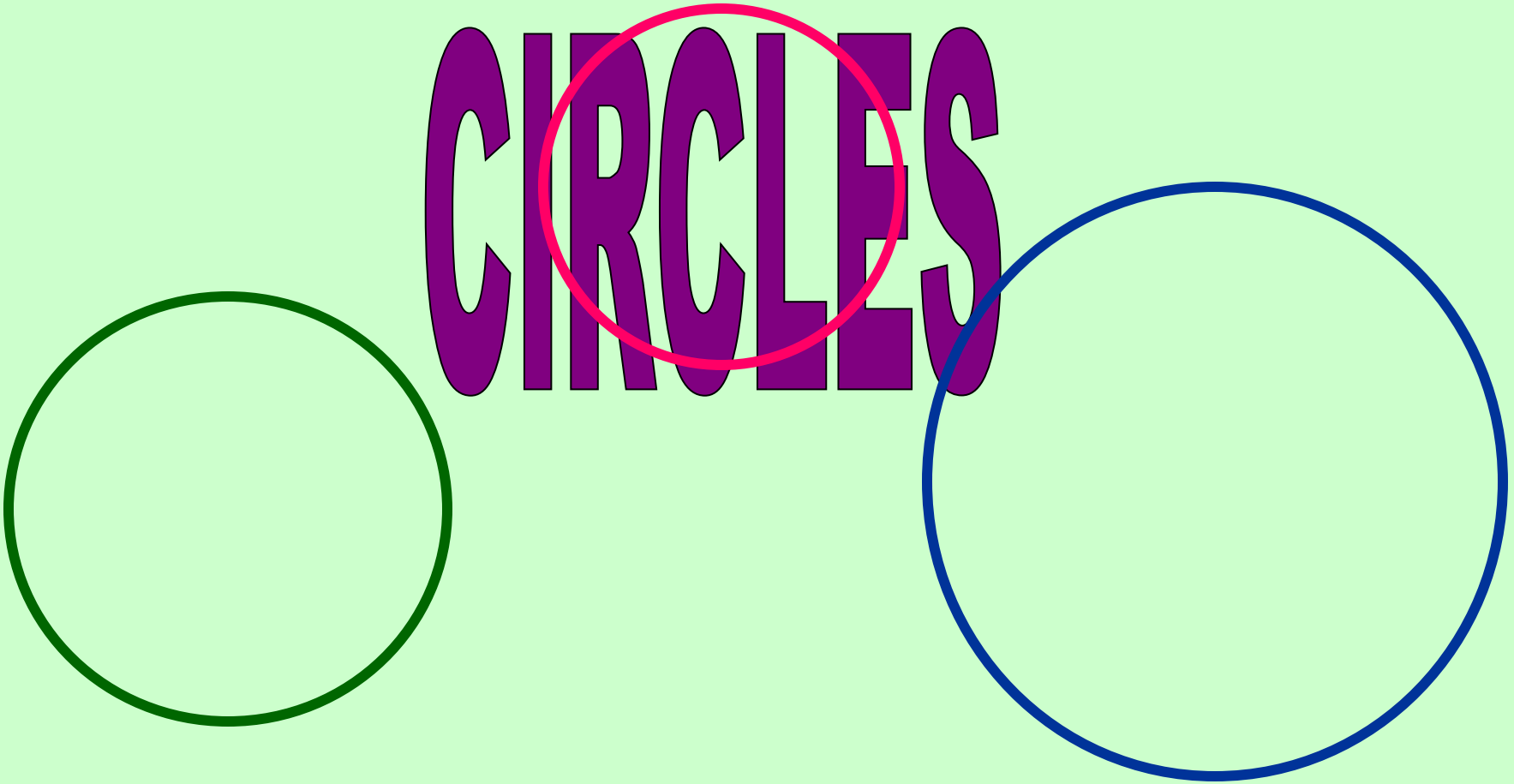
CIRCLES



The standard form of the equation of a circle with its center at the origin is

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

r is the radius of the circle so if we take the square root of the right hand side, we'll know how big the radius is.

Notice that both the *x* and *y* terms are squared. Linear equations don't have either the *x* or *y* terms squared. Parabolas have only the *x* term was squared (or only the *y* term, but NOT both).

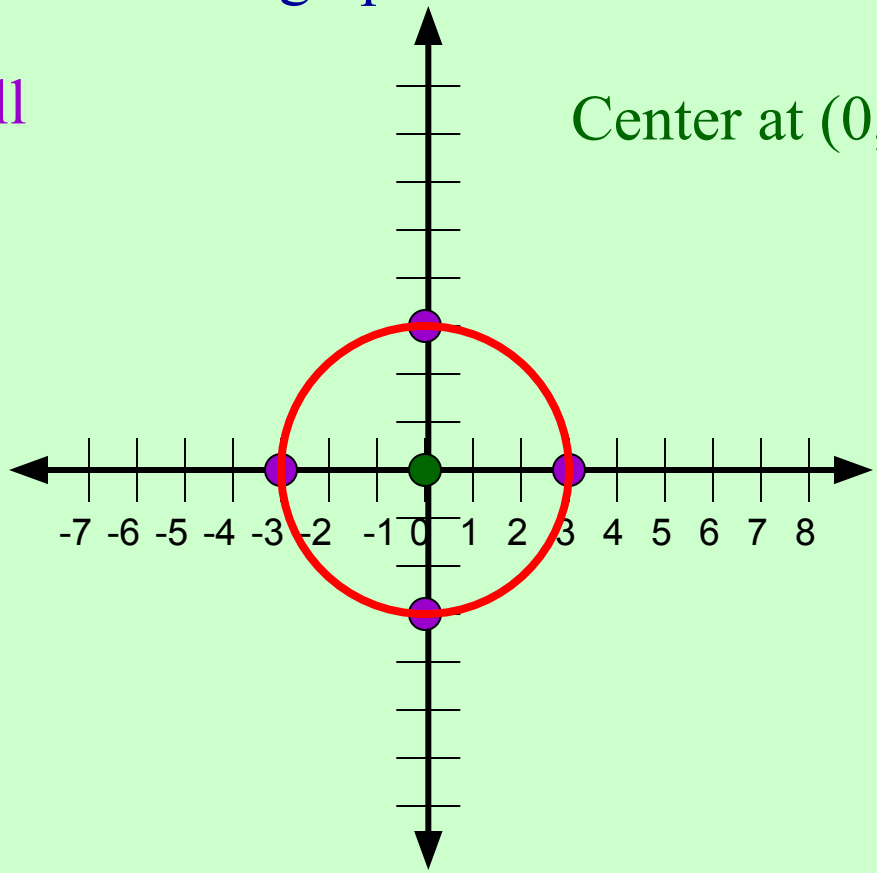
Let's look at the equation $x^2 + y^2 = 9$

This is r^2 so $r = 3$

The center of the circle is at the origin and the radius is 3.
Let's graph this circle.

Count out 3 in all directions since that is the radius

Center at (0, 0)



If the center of the circle is NOT at the origin then the equation for the standard form of a circle looks like this:

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

The center of the circle is at (*h*, *k*).

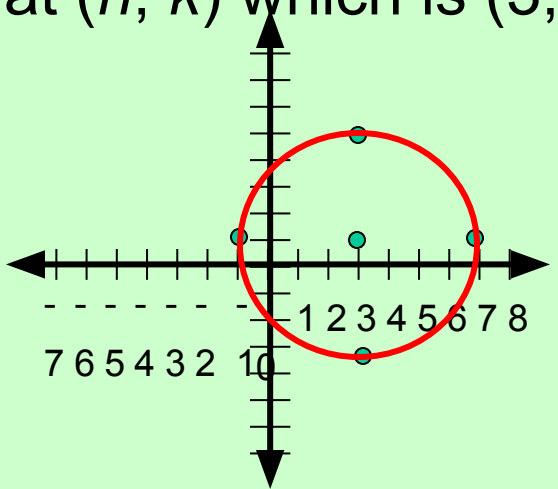
This is r^2 so $r = 4$

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

Find the center and radius and graph this circle.

The center of the circle is at (*h*, *k*) which is (3,1).

The radius is 4



If you take the equation of a circle in standard form for example:

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

This is r^2 so $r = 2$

(x - (-2))

Remember center is at (h, k) with $(x - h)$ and $(y - k)$ since the x is plus something and not minus, $(x + 2)$ can be written as $(x - (-2))$

You can find the center and radius easily.
The center is at (-2, 4) and the radius is 2.

But what if it was not in standard form but multiplied out (FOILED)

$$x^2+4x+4+y^2-8y+16=4$$

Moving everything to one side in descending order and combining like terms we'd have:

$$x^2+y^2+4x-8y+16=0$$

$$x^2 + y^2 + 4x - 8y + 16 = 0$$

If we'd have started with it like this, we'd have to complete the square on both the *x*'s and *y*'s to get in standard form.

Group *x* terms and a place to complete the square

Group *y* terms and a place to complete the square

Move constant to the other side

$$x^2 + 4x + \underline{\quad 4 \quad} + y^2 - 8y + \underline{\quad 16 \quad} = -16 + \underline{\quad 4 \quad} + \underline{\quad 16 \quad}$$

Complete the square

Write factored and wahlah! back in standard form.

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

Now let's work some examples:

Find an equation of the circle with center at (0, 0) and radius 7.

Let's sub in center and radius values in the standard form

$$(x-0)^2+(y-0)^2=7^2$$

$$x^2+y^2=49$$

Find an equation of the circle with center at (0, 0) that passes through the point (-1, -4).

Since the center is at (0, 0) we'll have

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

The point (-1, -4) is on the circle so should work when we plug it in the equation:

$$(-1)^2 + (-4)^2 = r^2 = 1 + 16 = 17$$

Subbing this in for r^2 we have:

$$x^2 + y^2 = 17$$

Find an equation of the circle with center at (-2, 5) and radius 6

Subbing in the values in standard form we have:

$$(x - \text{-2})^2 + (y - 5)^2 = 6^2$$

$$(x + 2)^2 + (y - 5)^2 = 36$$

Find an equation of the circle with center at (8, 2) and passes through the point (8, 0).

Subbing in the center values in standard form we have:

$$(x-8)^2+(y-2)^2=r^2$$

Since it passes through the point (8, 0) we can plug this point in for x and y to find r^2.

$$(8-8)^2+(0-2)^2=r^2=4$$

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

Identify the center and radius and sketch the graph:

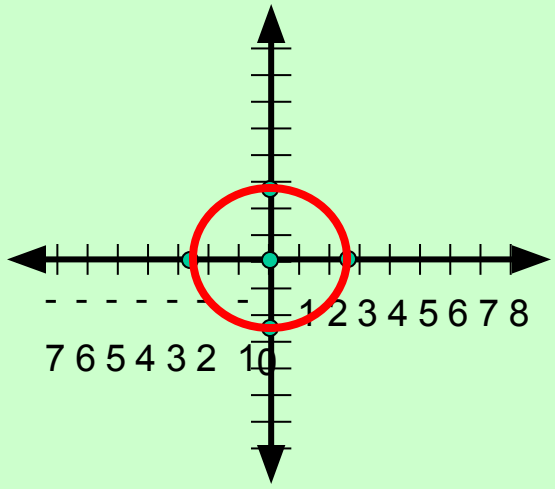
$$\frac{9x^2}{9} + \frac{9y^2}{9} = \frac{64}{9}$$

To get in standard form we don't want coefficients on the squared terms so let's divide everything by 9.

$$x^2 + y^2 = \frac{64}{9}$$

Remember to square root this to get the radius.

So the center is at (0, 0) and the radius is 8/3.

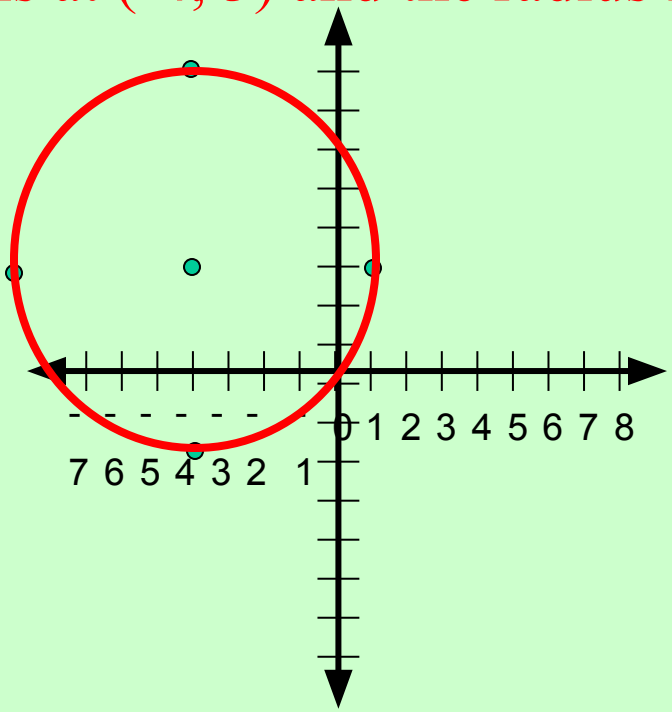


Identify the center and radius and sketch the graph:

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

Remember the center values end up being the opposite sign of what is with the *x* and *y* and the right hand side is the radius squared.

So the center is at (-4, 3) and the radius is 5.



Find the center and radius of the circle:

$$x^2 + y^2 + 6x - 4y - 3 = 0$$

We have to complete the square on both the *x*'s and *y*'s to get in standard form.

Group *x* terms and a place to complete the square

Group *y* terms and a place to complete the square

Move constant to the other side

$$x^2 + 6x + \underline{9} + y^2 - 4y + \underline{4} = +3 + \underline{9} + \underline{4}$$

Write factored for standard form.

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

So the center is at (-3, 2) and the radius is 4.

Thank you for your attention!!!