

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).



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

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

The center of the circle is  $a^{t}(h, k)$ .

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 enter 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.



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:

$$(x - -2)^2 + (y - 5)^2 = 6^2$$

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

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:

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

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



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.

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Group x terms and a place Group y terms and a place to complete the square to complete the square 
$$x^2 + 6x + 9 + y^2 - 4y + 4 = +3 + 9 + 4$$

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!!!