$$
0
$$

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


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


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:

$$
\begin{aligned}
& \text { example: }(x+2)^{2}+(y-4)^{2}=4 \\
& (\mathrm{x}-(-2)) \\
& \text { Remember center } \\
& \text { since the } x \text { is plus spmethin }(h, k) \text { with }(x-h) \text { and }(y-k) \\
& \text { can be written as }(x)(-2)) \\
& \text { You can find the }(x+2) \\
& \text { The center is at }(-2,4) \text { and radius easily. }
\end{aligned}
$$

can be written as $(x-(-2))$

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

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

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

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

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

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 Group $y$ terms and a place Move constant to the other side to complete the square to complete the square


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

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

$$
\begin{gathered}
(x-0)^{2}+(y-0)^{2}=7^{2} \\
x^{2}+y^{2}=49
\end{gathered}
$$

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:

$$
\begin{aligned}
& (x-2)^{2}+(y-5)^{2}=6^{2} \\
& (x+2)^{2}+(y-5)^{2}=36
\end{aligned}
$$

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 $r^{2}$.

$$
\begin{gathered}
(8-8)^{2}+(0-2)^{2}=r^{2}=4 \\
(x-8)^{2}+(y-2)^{2}=4
\end{gathered}
$$

Identify the center and radius and sketch the graph:

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

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

$$
x^{2}+y^{2}=\frac{64}{9} \text { at }(0,0) \text { and the radius is } 8 / 3 \text {. }
$$

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:

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

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

Move constant to the other side
Group $x$ terms and a place Group $y$ terms and a place to complete the square to complete the square


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!!!

