# Graphing circles

In this lesson we'll look at how the equation of a circle in standard form relates to its graph.

Remember that the equation of a circle in standard form is $(x - h)^2 + (y - k)^2 = r^2$, where (h, k) are the coordinates of the center of the circle and r is the radius.

As we can see in the figure, the center of a circle is a point, and the radius of a circle is the distance from the center of the circle to any point on its circumference.
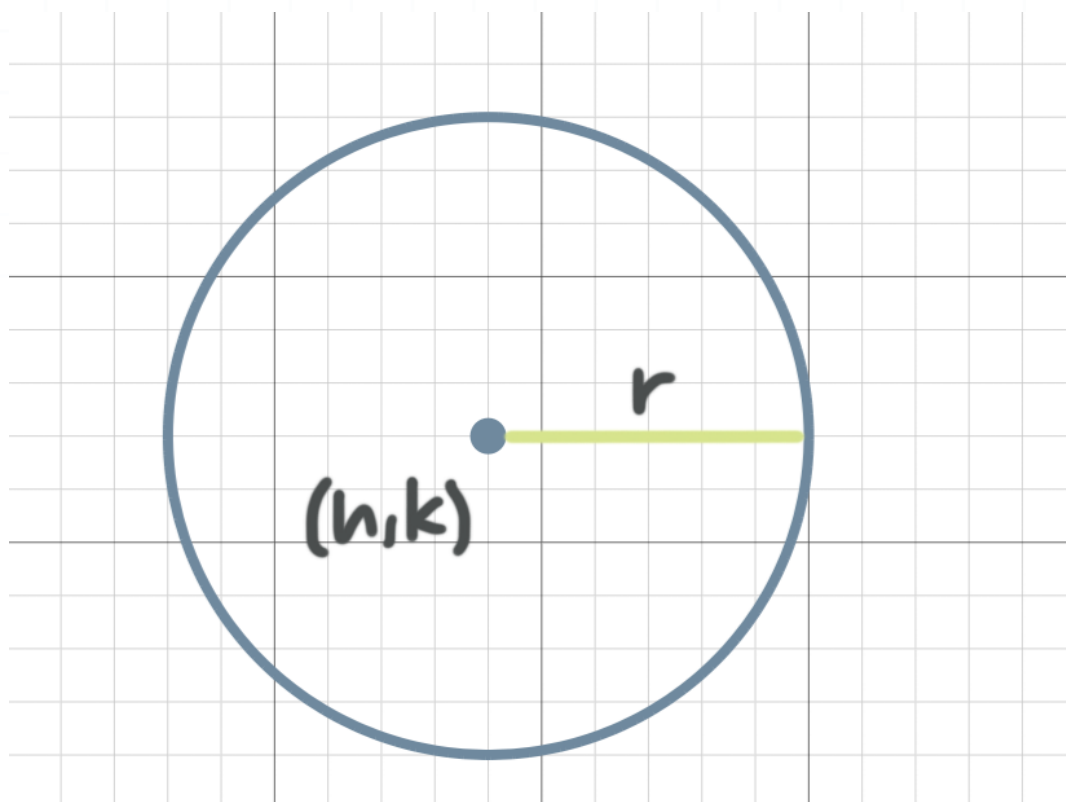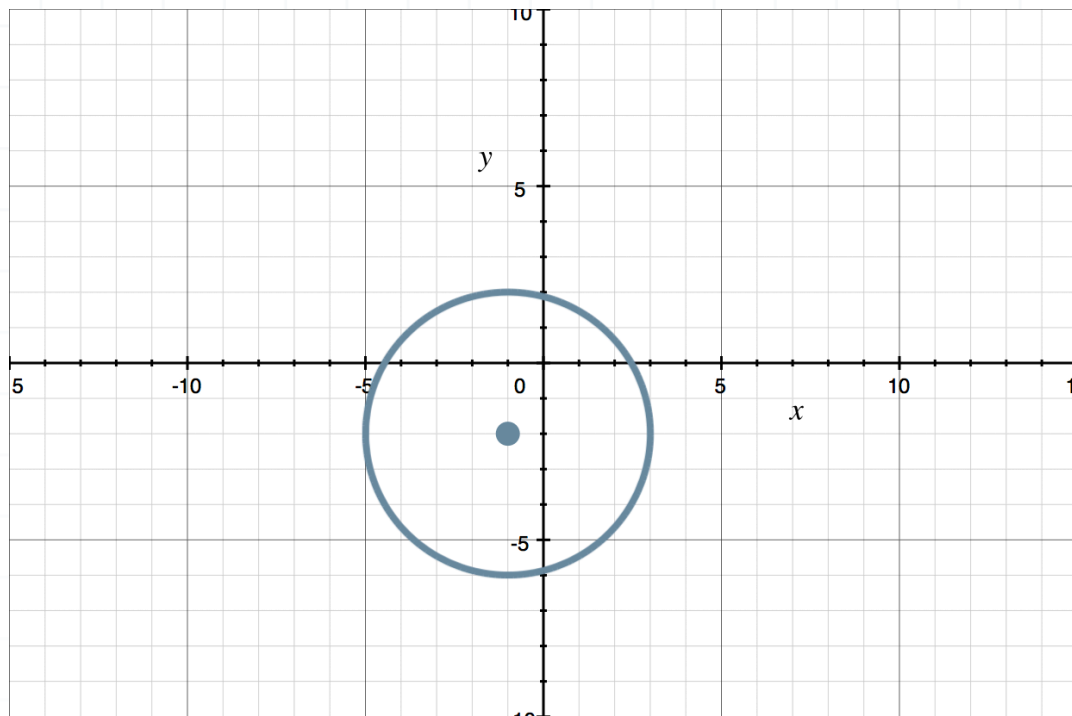

This means that if we have a graph of a circle, we can write its equation in standard form.
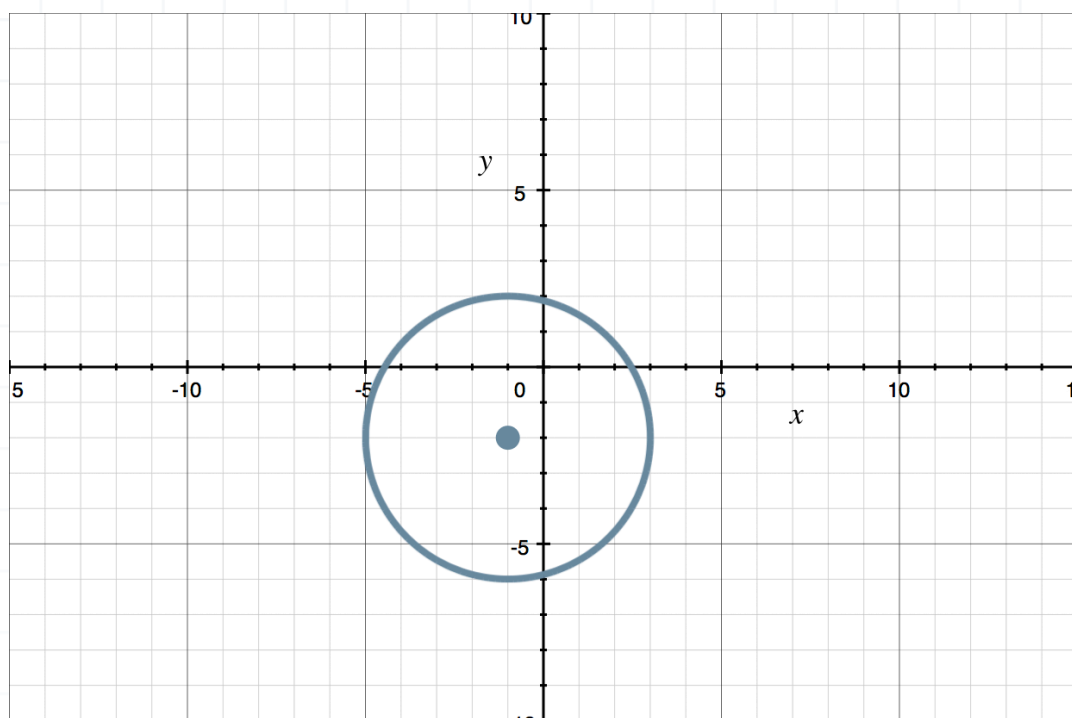
Let's do a few examples.

Example

What is the equation of the circle shown in the graph?

We need to find the equation of this circle in the form $(x - h)^2 + (y - k)^2 = r^2$, which means we need to find the coordinates of the center of the circle and its radius.

Let's find the coordinates of the center first.

The center is at the point $(-1, -2)$, so $h = -1$ and $k = -2$. Now let's find the radius, by determining the distance from the center of the circle to some point on the circumference. One point on the circumference of this circle is $(3, -2)$. The y-coordinate of this point is equal to the y-coordinate of the center of the circle. Therefore, the distance of the point $(3, -2)$ from the center is the difference in their x-coordinates, which is $3 - (-1) = 4$, so $r = 4$.

Now let's plug everything into the standard form of the equation of a circle.

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

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

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

Let's try another example.

Example

Graph the circle.

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

In order to graph a circle, we need to know the coordinates of its center and its radius. In standard form, the equation of a circle is
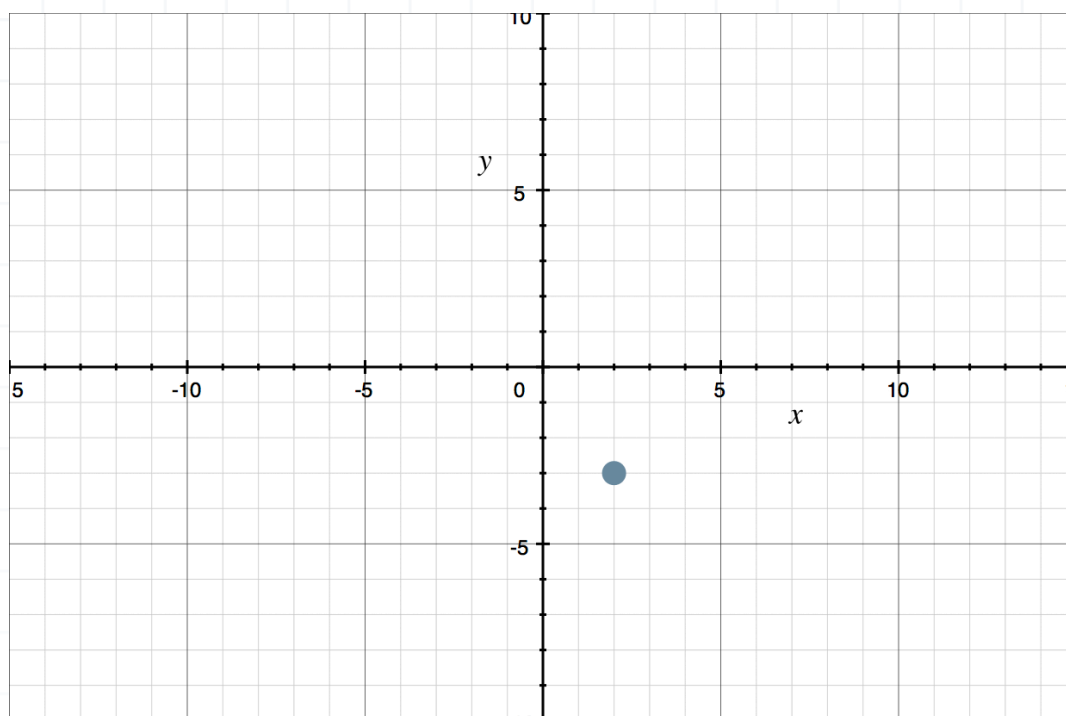
$$(x-h)^2 + (y-k)^2 = r^2$$

where (h, k) are the coordinates of the center and r is the radius. Let's write the equation of the circle in this form, by writing the constant term on the right-hand side, which is 9, as 3^2.

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

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

Now we can see that the coordinates of the center are $(h, k) = (2, -3)$ and the radius is $r = 3$. Let's graph the circle, starting with the center.

Since the radius is $r = 3$, we can plot several points that are 3 units from the center and use them to construct a rough sketch of the circle, or we can use a compass to draw a more perfect circle.