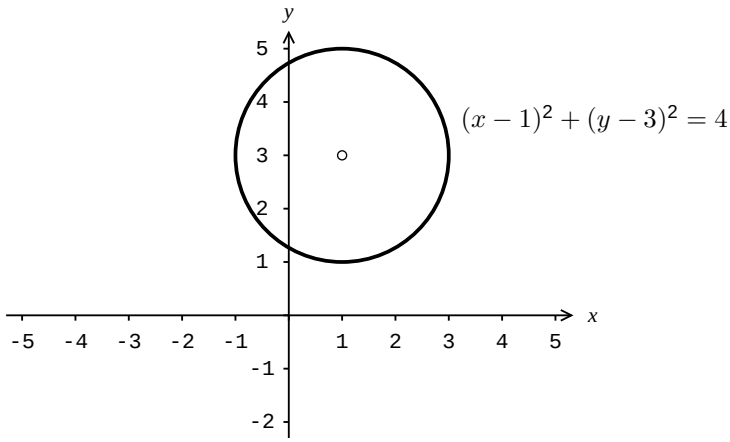
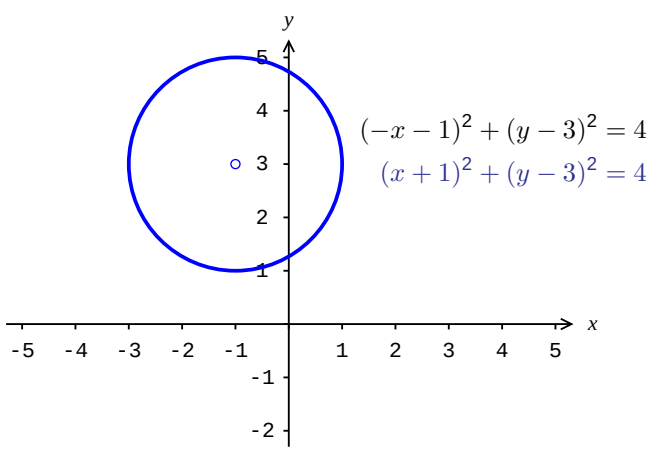
For this example, start with the equation of a circle:



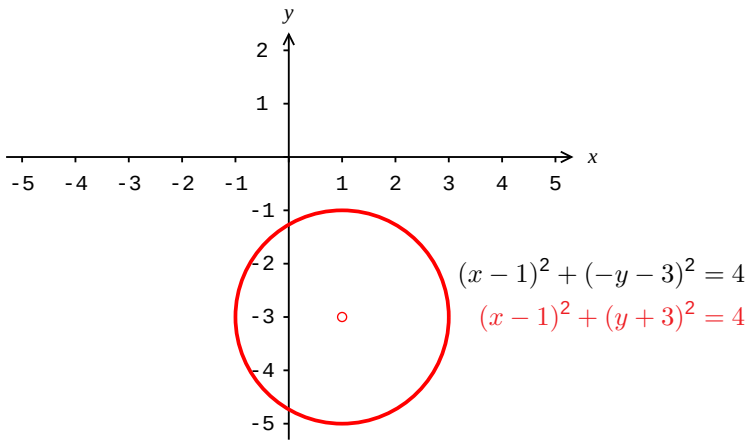
When we replace x with $-x$ in the original equation, we obtain the equation of a circle centered at $(-1, 3)$. This new circle is the **reflection** of the original across the y-axis.



In fact, whenever $E(x, y)$ is an equation in x and y:

- The graph of $E(-x, y)$ is obtained by reflecting the graph of $E(x, y)$ across the y-axis.

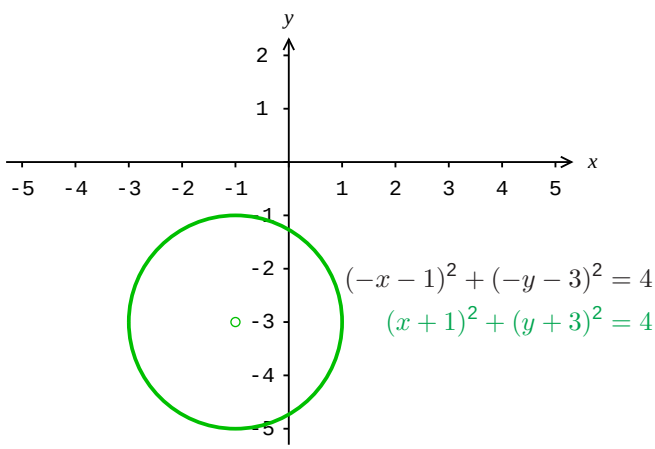
Next replace y with $-y$ in the original equation. The result is the equation of a circle centered at $(1, -3)$, i.e., the reflection of the original circle across the x-axis.



In fact, whenever $E(x, y)$ is an equation in x and y:

- The graph of $E(-x, y)$ is obtained by reflecting the graph of $E(x, y)$ across the y-axis.
- The graph of $E(x, -y)$ is obtained by reflecting the graph of $E(x, y)$ across the x-axis.

When we replace x with $-x$ and y with $-y$, the new circle is the reflection of the original through the origin:



In fact, whenever $E(x, y)$ is an equation in x and y:

- The graph of $E(-x, y)$ is obtained by reflecting the graph of $E(x, y)$ across the y-axis.
- The graph of $E(x, -y)$ is obtained by reflecting the graph of $E(x, y)$ across the x-axis.
- The graph of $E(-x, -y)$ is obtained by reflecting the graph of $E(x, y)$ through the origin.

Tests for symmetry. The graph of an equation is symmetric ...

... across the y-axis if replacing x by $-x$ results in an equivalent equation.
... across the x-axis if replacing x by $-y$ results in an equivalent equation.
... through the origin if replacing both x by $-x$ and y by $-y$ results in an equivalent equation.