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

$$(x - 1)^2 + (y - 3)^2 = 4$$

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.

$$(x + 1)^2 + (y - 3)^2 = 4$$

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.

$$\begin{align*}
(x - 1)^2 + (-y - 3)^2 &= 4 \\
(x - 1)^2 + (y + 3)^2 &= 4
\end{align*}$$

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:

$$\begin{align*}
(-x - 1)^2 + (-y - 3)^2 &= 4 \\
(x + 1)^2 + (y + 3)^2 &= 4
\end{align*}$$

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.