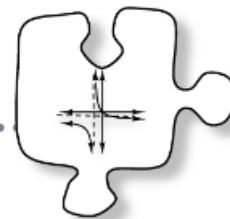# 2.2.4  How can I transform other graphs?

Transforming Non-Functions

In this lesson, you will consider two equations of parent graphs that are different from the ones you have seen in previous lessons because they are not functions. Despite this difference, you will be able to use your function skills to transform the graphs of these equations.

2-89. Begin by fully investigating $x = y^2$ and $x^2 + y^2 = 25$ as follows.

**2-89.** Begin by fully investigating $x = y^2$ and $x^2 + y^2 = 25$ as follows.

a. Without using your graphing calculator, make a table and a graph for each equation.

b. Marabel and Lissa are working on this problem. Marabel is making a table for $x = y^2$. For an $x$-value of 4, she finds a $y$-value of 2. Lissa is watching and says, *"Wait! When x is 4, there is also another possible value for y."* What does Lissa mean? Look back at your tables and decide if there are more points you could add.

c. Fully describe the graphs of $x = y^2$ and $x^2 + y^2 = 25$.

d. How are the relationships described by these equations and graphs different from other relationships you have investigated in this chapter?

e. The second equation may look familiar from your work with right triangles. Did you use any right triangles when you were making the graph? Explain any connections you noticed.

**2-90.** TRANSFORMATIONS OF A NON-FUNCTION

The non-function $x = y^2$ has a graph that can be described as a "sleeping parabola". Now apply your knowledge of transforming functions to transform a sleeping parabola, as follows.

**Your Task:** As a team, transform the graph of $x = y^2$ in as many ways as you can. Then write an equation in graphing form for this family of graphs. Be prepared to share your results and your strategies with the class. Explore using the *2-90 Student eTool* (Desmos). Click in the lower right corner of the graph to view it in full-screen mode. Desmos Accessibility
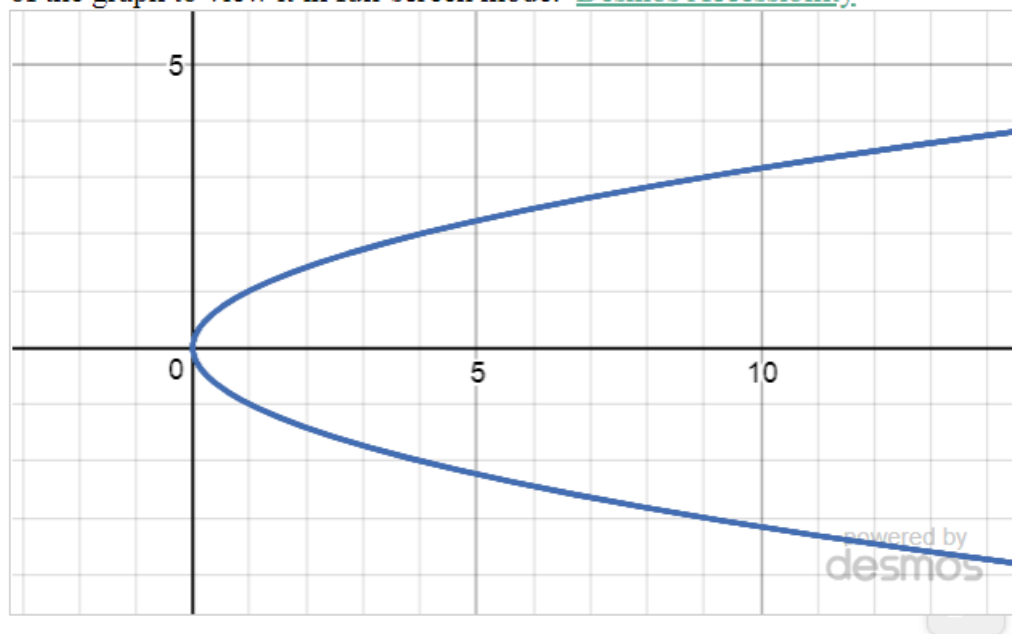


## Discussion Points

How can we change the equation so the graph is translated horizontally?

How can we change the equation so that the graph is stretched?

How can we change the equation so that the graph is reflected?

How can we use our graphing tools to help us determine the transformations?

**2-91.** TRANSFORMATIONS OF CIRCLES

a. As a team, translate the graph of $x^2 + y^2 = 25$ horizontally and vertically. Then write an equation in graphing form for this family of circles using $h$ and $k$. Be prepared to share your results and your strategies with the class. Explore using the *2-91 Student eTool* (Desmos). Click in the lower right corner of the graph to view it in full-screen mode. Desmos Accessibility
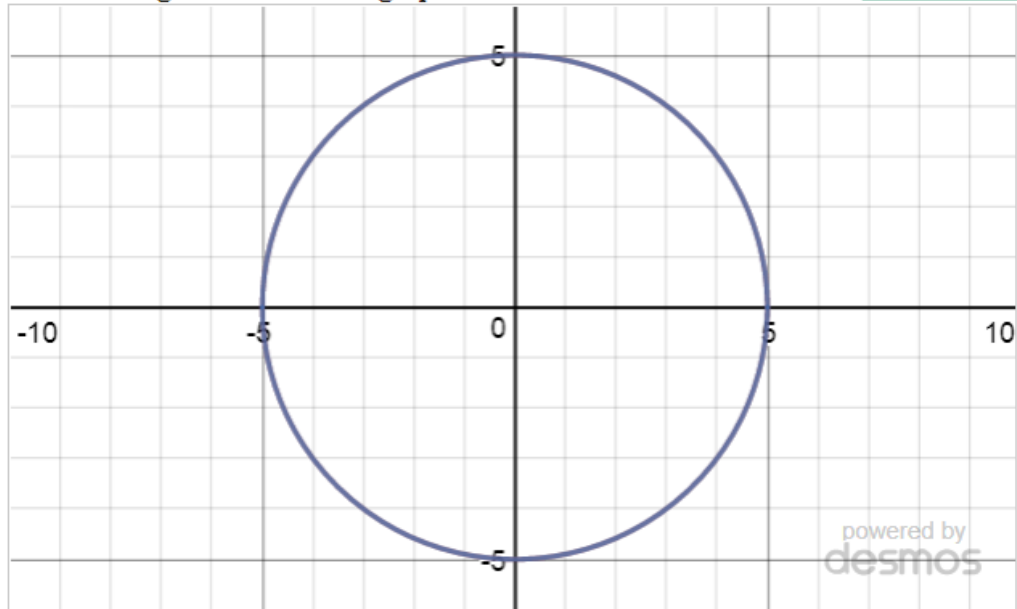


b. How can you make the circle larger or smaller? Refer to your graph of $x^2 + y^2 = 25$. What is the radius? How is the radius of the circle relate to the equation?

c. What is the equation of a circle that has its center at $(5, -7)$ with radius 10? With radius 12?

**2-92.** GRAPHING FORM OF A CIRCLE

    a. Now generalize the connection between the radius and the equation of a circle. Write the graphing form of the equation for a circle with any center $(h, k)$ and any radius $r$.

    b. Given the equation $(x - 3)^2 + (y + 7)^2 = 169$, what is the radius of the circle? How do you know?

**2-93.** Rewrite $x = y^2$ and $x^2 + y^2 = 25$ in $y =$ form. When you have rewritten both equations, try graphing them using your calculator. Do they look like the graphs you made in problem 2-89?

**2-94.** LEARNING LOG

In the last few lessons, you have developed the ability to create a family of functions by transforming *any* graph. Does the equation you start with affect how you will change the equation to transform it? If so, how? If not, why not? Are there any graphs that are hard for you to transform? Why or why not? Write a Learning Log entry answering these questions. Title it "Transforming Any Graph" and include today's date.