

Topic 2: Transformations: (F-BF.3)

Purpose: The purpose of the first four examples is to get students to predict the effect on the graph of a function when changing the input or output. The first two examples change x into a composition of x and a constant, the second two examples change y into y and a constant. The final two examples ask students to write an equation of two functions that are already graphed on the coordinate plane. These functions are related by a transformation. Note: Scale changes will be taught in the next topic, these examples only focus on moving left/right and up/down. Please use your professional judgment when following this guide, if students are struggling with the content and need more support then provide that additional support.

Core Standards Focus:

F-BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$ and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Launch (Individual time): Starting with example 1, ask students to take 1 minute individually to predict what they think will happen to the function when x is replaced. Some students may not be able to start on this task. Identify those students and consider pairing them with another student who may be able to provide additional support. You may also want to suggest that students start by creating an input/output table for the original function and the new function. If most of the class is unable to start on the task then facilitate the first example as a whole class think-aloud. Choose a student to share their response and justify their choice. Repeat this cycle for the second two examples. You may want to pick a student whose argument is based on the table that they created. Moving from the concrete to the abstract builds a solid conceptual framework to learn future transformations. Make sure all students understand the first example before moving on to the next example.

Explore (pairs): Using example e , give students a few minutes to work together to identify the equation of the line shown in the graph. If students are stuck, consider suggesting that students identify a few points on the graph or try to recall the parent function for the graph. They may be able to find the equation for this example since it is a linear function. After students have written their equations have them start on example f . Since this function is exponential you may need to support students more with this example.

Discuss (Whole Class): Call on some students to share their equations/descriptions and talk about their reasoning. Be selective with the student work you use and sequence the work in a way that will connect a variety of ideas. Use the FluidMath program to check their work. We encourage you to explore students' questions as they arise. When students are asking the questions it shows that they are engaged in learning mathematics and we want to nurture that in our students.