

### Topic 3: Transformations with scale changes (F.BF.3)

**Purpose:** Now that students have been introduced to transforming graphs in the four cardinal directions we will turn our attention to scaling the graphs. The purpose of the first 3 examples is to get students to communicate, orally and in writing, the interpretation of a given transformation on an equation and a description of how that transformation will move the graph. Note that the interpretation is a literal way of determining the change in input and/or output. The description is the effect that the transformation will have on the graph. The purpose of the last three examples is for students to match the graphical transformation to an equation. This type of reasoning forces students to process information differently and therefore raises the rigor of the task. 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 write their interpretations/descriptions of the first four functions. Examples are provided that may help students understand what is being asked for. 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. If most of the class is unable to start on the task then facilitate the first example as a whole class think-aloud. When students have finished with their writing have them share their responses with a partner and then drag the equations to the graph to check the predictions. Take time to clarify misconceptions and mistakes at this point. Choose a student to share your favorite mistake.

**Explore (pairs):** Using example 2, give students a few minutes to work together to write their interpretations and descriptions. If students are stuck, consider suggesting that students send a representative to another pair to get some advice. If many students are stuck consider having another pair of students explain to the whole class how they wrote their interpretations and descriptions. Repeat in pairs or groups of 4 with example 3.

**Discuss (Whole Class):** Call on some students to share their writing 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. The second and third examples for this topic can be completed in an accelerated manner as long as the first example was completed thoroughly. After the first three examples have been completed, return to the launch, explore, and discuss cycle with examples 4 through 6. Remember that in examples 4 through 6 students need to match the graph of a transformed function with the appropriate equation. This process may need to be modeled by a student or teacher before some students can get started.