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| MAFS.912.F-BF.2.3 | 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.* |
| Item Types | Equation Editor – May require creating a value or an expression.<br><br>GRID – May require plotting points or a transformed function.<br><br>Matching Item – May require matching an equation, a value of $k$, and an explanation of the effect on a graph.<br><br>Multiple Choice – May require selecting a graph or a table from a list.<br><br>Open Response – May require explaining the effects of a transformation.<br><br>Table Item – May require completing a table of values. |
| Clarifications | Students will determine the value of $k$ when given a graph of the function and its transformation.<br><br>Students will identify differences and similarities between a function and its transformation.<br><br>Students will identify a graph of a function given a graph or a table of a transformation and the type of transformation that is represented.<br><br>Students will graph by applying a given transformation to a function.<br><br>Students will identify ordered pairs of a transformed graph.<br><br>Students will complete a table for a transformed function. |
| Assessment Limits | Functions represented algebraically are limited to linear, quadratic, or exponential.<br><br>Functions represented using tables or graphs are not limited to linear, quadratic, or exponential.<br><br>Functions may be represented using tables or graphs.<br><br>Functions may have closed domains.<br><br>Functions may be discontinuous.<br><br>Items should have a single transformation. |
| Stimulus Attributes | Items should be given in a mathematical context.<br><br>Items may use function notation. |

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| | Items may present a function using an equation, a table of values, or a graph. |
| Response Attributes | Items may require the student to explain or justify a transformation that has been applied to a function.<br><br>Items may require the student to explain how a graph is affected by a value of *k*.<br><br>Items may require the student to find the value of *k*.<br><br>Items may require the student to complete a table of values. |
| Calculator | Neutral |

| Sample Item | Item Type |
|---|---|
| The table below shows the values for the function $y = f(x)$.<br><br>**x** \| **y**<br>−4 \| 7<br>−1 \| −2<br>0 \| 3<br>3 \| −4<br>6 \| 5<br><br>Complete the table for the function $y = f\left(\frac{1}{5}x\right)$.<br><br>**x** \| **y**<br>\| <br>\| <br>\| <br>\| <br>\| | Table Item |