

Core Content

Cluster Title: Build new functions from existing functions.
Standard F.BF.3: Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, 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.)
Concepts and Skills to Master
<ul style="list-style-type: none"> • Perform transformations on quadratic and absolute value functions with and without technology. • Describe the effect of each transformation on functions (e.g., If $f(x)$ is replaced with $f(x+k)$). • Given the graph of a function, describe all transformations using specific values of k. • Recognize which transformations take away the even nature of a quadratic or absolute value function.

Supports for Teachers

Critical Background Knowledge	
<ul style="list-style-type: none"> • Identify the effect of vertical translations of graphs of linear and exponential functions on their equations (I.2.F.BF.3). • Graph parent functions for quadratic and absolute value functions (II.2.F.IF.7). 	
Academic Vocabulary	
even function, odd function, rigid transformation, dilation, symmetry	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> • Use graphing technology to explore transformations of functions. • Explore transformations that preserve characteristics of graphs of functions and which do not. 	<ul style="list-style-type: none"> • Geogebra sliders • TI Transform App
Sample Formative Assessment Tasks	
<p>Skill-Based Task: Graph the following on the same set of axes. Describe the effect of the number 3 in each case.</p> $f(x) = x^2 \qquad f(x) = (x+3)^2$ $f(x) = -x^2 \qquad f(x) = x^2 - 3$ $f(x) = 3x^2$	<p>Problem Task: Sort the functions into the following categories: even, odd, and neither. Justify your work. For any function in the “neither” category, describe how you could transform it into an even or odd function.</p> $f(x) = x + 3 \qquad j(x) = 5x \qquad h(x) = (x - 4)^2$ $g(x) = 2 x + 1 \qquad m(x) = -7x^2 \qquad p(x) = 2^x$

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Standard F.BF.4: Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. <i>For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.</i>
Concepts and Skills to Master
<ul style="list-style-type: none"> Determine whether or not a function has an inverse, and find the inverse if it exists. Understand that creating an inverse of a quadratic function requires a restricted domain.

Supports for Teachers

Critical Background Knowledge	
<ul style="list-style-type: none"> Definition of a function. Domain and range. 	
Academic Vocabulary	
$f^{-1}(x)$, inverse, restricted domain	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> Use technology to explore inverse functions graphically. Compare the domains and ranges of a function and its inverse 	Geogebra Illustrative Mathematics, Temperature Conversions
Sample Formative Assessment Tasks	
Skill-Based Task: Find the inverse of each function, if it exists. $f(x) = \frac{2x-3}{5}$ $g(x) = 3x^2$ Give an example of a function that does not have an inverse function and explain how you know it does not.	Problem Task: Prove that the inverse of a non-horizontal linear function is also linear and that the slopes are reciprocals.