Instructional Focus: Compose and transform functions

	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Identify and Find Transformations (F.BF.3)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Identify the effect on a graph by replacing f(x) with <u>more than two</u> transformations: $f(x) + k$, $k\,f(x)$, $f(kx)$, $f(x + k)$ for specific positive and negative values of k Given the graph of a function and <u>more than two transformations</u>, find the values of the constants and coefficients <u>Given a partial graph</u>, complete the graph for both even and odd functions	Identify the effect on a graph by replacing f(x) with <u>two</u> transformations: $f(x) + k$, $k\,f(x)$, $f(kx)$, $f(x + k)$ for specific positive and negative values of k Given the graph of a function and <u>two transformations</u>, find the values of the constants and coefficients Recognize even and odd functions from graphs <u>and</u> <u>equations</u>	Identify the effect on a graph by replacing f(x) with a <u>single</u> transformation: $f(x) + k$, $k\,f(x)$, $f(kx)$, $f(x + k)$ for specific positive and negative values of k Given the graph of a function and a <u>single transformation</u>, find the value of the constant or coefficient Recognize even and odd functions <u>from graphs</u>	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1
Compose Functions (F.BF.1c)		Evaluate the composition of 2 functions <u>in context of a situation</u>	Evaluate the <u>composition of 2 functions</u>	Evaluate a function for a given value and use that result to <u>evaluate</u> a second function	

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.***

F.BF.1c Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*
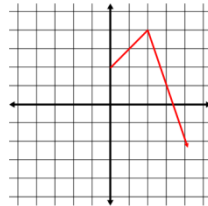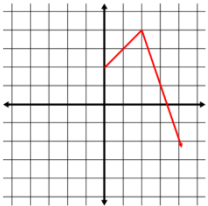
Sample Problems

Describe the changes to a function f(x) that would occur in the given function. g(x) =-2f(13x+4)-5
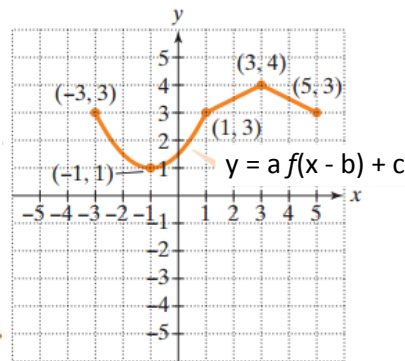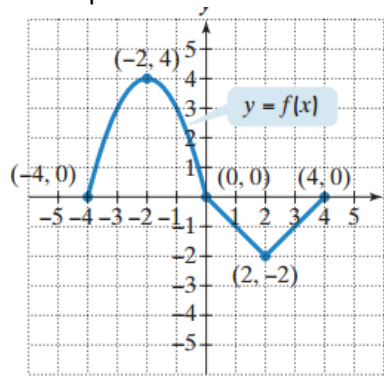
Complete the given graph so that the function would be
a) odd   b) even

Given a parent function and the transformed graph, find the values of a, b and c.

$(-2, 4)$
$y = f(x)$
$(-4, 0)$ $(0, 0)$ $(4, 0)$
$(2, -2)$

$(3, 4)$
$(-3, 3)$ $(5, 3)$
$(1, 3)$
$(-1, 1)$ y = a f(x - b) + c

2. A consumer advocacy company conducted a study to research the pricing of fruits and vegetables. They collected data on the size and price of produce items, including navel oranges. They found that, for a given chain of stores, the price of oranges was a function of the weight of the oranges, $p = f(w)$.

w weight in pounds	0.2	0.25	0.3	0.4	0.5	0.6	0.7
p price in dollars	0.26	0.32	0.39	0.52	0.65	0.78	0.91

The company also determined that the weight of the oranges measured was a function of the radius of the oranges, $w = g(r)$.

r radius in inches	1.5	1.65	1.7	1.9	2	2.1
w weight in pounds	0.38	0.42	0.43	0.48	0.5	0.53

Use the table to evaluate $f(g(2))$, and interpret this value in context.

Instructional Focus: Produce inverse functions

	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Produce inverse functions (F.BF.4)	Can extend thinking beyond the standard, including tasks that may involve one of the following: • Designing • Connecting • Synthesizing • Applying • Justifying • Critiquing • Analyzing • Creating • Proving	Compose functions to verify if one function is the inverse of another function Read values of an inverse function from a graph and table **Produce an invertible function** from a non-invertible function by restricting the domain so that the function is one-to-one	**Compose functions** to verify if one function is the inverse of another function Read values of an inverse function from a graph **and** table **Identify a domain** that that will produce an invertible function from a non-invertible function	Given a simple function**, find its inverse** Read values of an inverse function from a graph **or** table **Identify if a function is invertible** from a graph	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

F.BF.4 Find inverse functions.

b. (+) Verify by composition that one function is the inverse of another.

c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

Sample Problems

Given the table below, find $f^{-1}(4)$

x	f(x)
4	-1
5	4
9	3

Show that each function is the inverse of the other:

$$f(x) = 4x - 7 \quad \text{and} \quad g(x) = \frac{x + 7}{4}.$$

Given $f(x) = x^2 - 10x + 15$, restrict the domain so that the function is invertible and then find its inverse function.

Instructional Focus: Graph and interpret rational functions

	4 – Mastery	**3 – Proficient**	**2 - Basic**	**1 – Below Basic**	**0 – No Evidence**
Identify key features of graphs (F.IF.7) The concentration C (in mg/dl), of a certain prescription drug in a person's bloodstream is determined using the rational function: $C(t)=\dfrac{50t}{t^2+25}$ where t is the time (in hours) after taking the prescription drug What is the equation of the horizontal asymptote for the graph of the function? What does this value (and the fact that it is an asymptote) represent in the context of this problem?	Meets **all** of the criteria in a Level 3 **Justify solutions and critique the reasoning of others**	Graph rational functions, given the model, and interpret all related key features of a graph **in context of a real world situation**. • zeros • asymptotes • intercepts • end behavior	**Graph** rational functions, given the model, and identify all related key features of a graph. • zeros • asymptotes • intercepts • end behavior	**Given the graphs** of rational, exponential, logarithmic and trigonometric functions, and identify all related key features of a graph. • zeros • asymptotes • intercepts • end behavior	Little evidence of reasoning or application to solve the problem Does not meet the criteria in a level 1

F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★

d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.