Warm Up

1. Describe the graph of the equation $y = x^n$, where n is an even integer.

2. Describe the graph of the equation $y = x^n$, where n is an odd integer.

Linear, quadratic, and cubic functions are all examples of *polynomial functions*. A **polynomial function** is a function that can be written in the form

$$\square x^n + \square x^{n-1} + \ldots \square x^2 + \square x + \square$$

In a polynomial function, the coefficients, represented by each $\square$, are complex numbers and the exponents of the variables are nonnegative integers.

You know that a polynomial function of degree 3 is a cubic function. A **quartic function** is a fourth degree polynomial function, while a **quintic function** is a fifth degree polynomial function.

Transformations performed on any polynomial function $f(x)$ to form a new function $g(x)$ can be described by the transformational function:

$$g(x) = Af(B(x - C)) + D$$

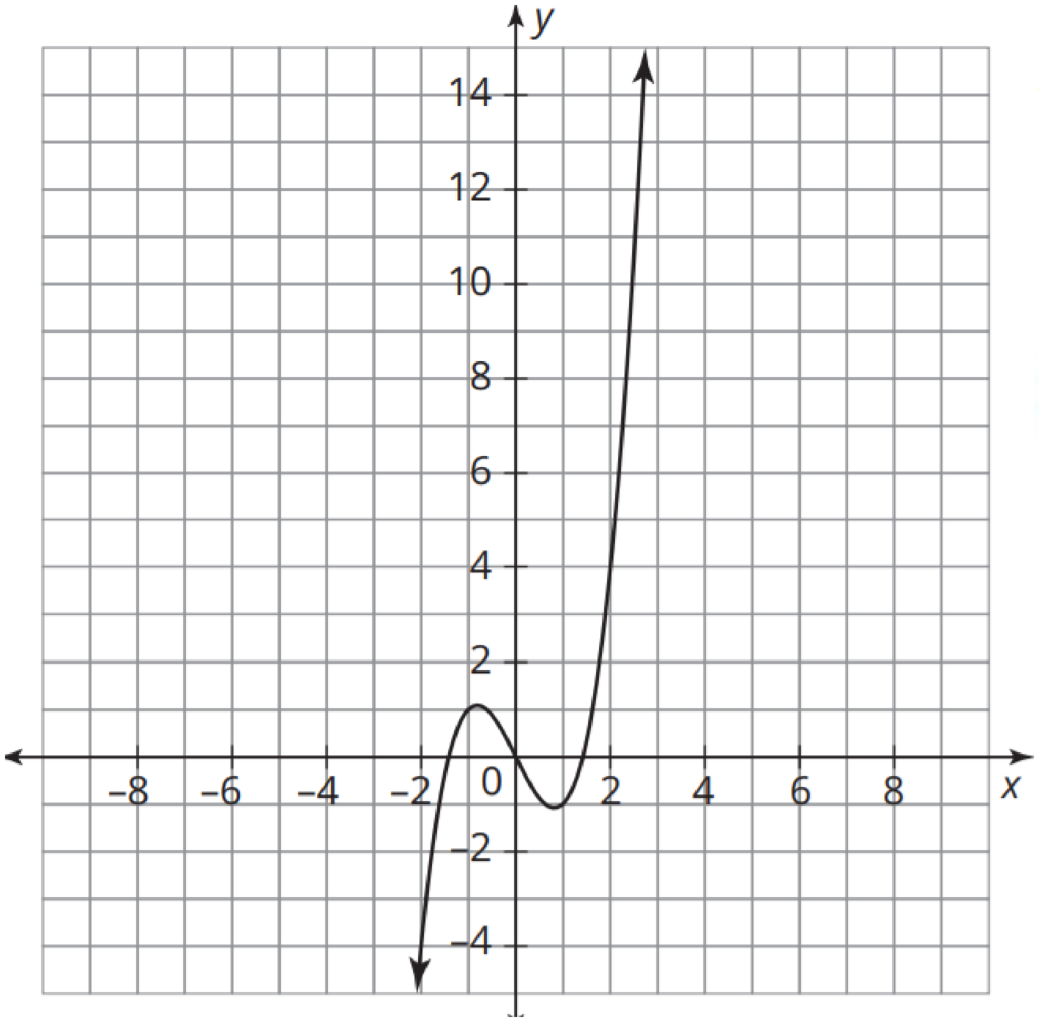
2. **Explain why Sanjay's reasoning is not correct. Rewrite the transformation to identify the correct *B*- and *C*-values.**

Sanjay

I can tell from the expression that the transformation given by $f(2x + 5)$ has a B-value of 2 and a C-value of 5.

Function Form	Equation Information	Description of Transformation of Graph
$y = Af(x)$	$\lvert A\rvert > 1$	vertical stretch of the graph by a factor of A units
	$0 < \lvert A\rvert < 1$	vertical compression of the graph by a factor of A units
	$A < 0$	reflection across the x-axis
$y = f(Bx)$	$\lvert B\rvert > 1$	compressed horizontally by a factor of $\frac{1}{\lvert B\rvert}$
	$0 < \lvert B\rvert < 1$	stretched horizontally by a factor of $\frac{1}{\lvert B\rvert}$
	$B < 0$	reflection across the y-axis
$y = f(x - C)$	$C > 0$	horizontal shift right C units
	$C < 0$	horizontal shift left C units
$y = f(x) + D$	$D > 0$	vertical shift up D units
	$D < 0$	vertical shift down D units

1. **The graph of the function $f(x) = x^3 - 2x$ is shown.**



a. **Determine whether $f(x)$ is an even function, an odd function, or neither. Show your work.**

b. **Suppose that $g(x) = 2f(x)$. Use the given reference points to complete the table of values for $g(x)$. Then, use properties of symmetry to graph and label $g(x)$ on the same coordinate plane as $f(x)$.**

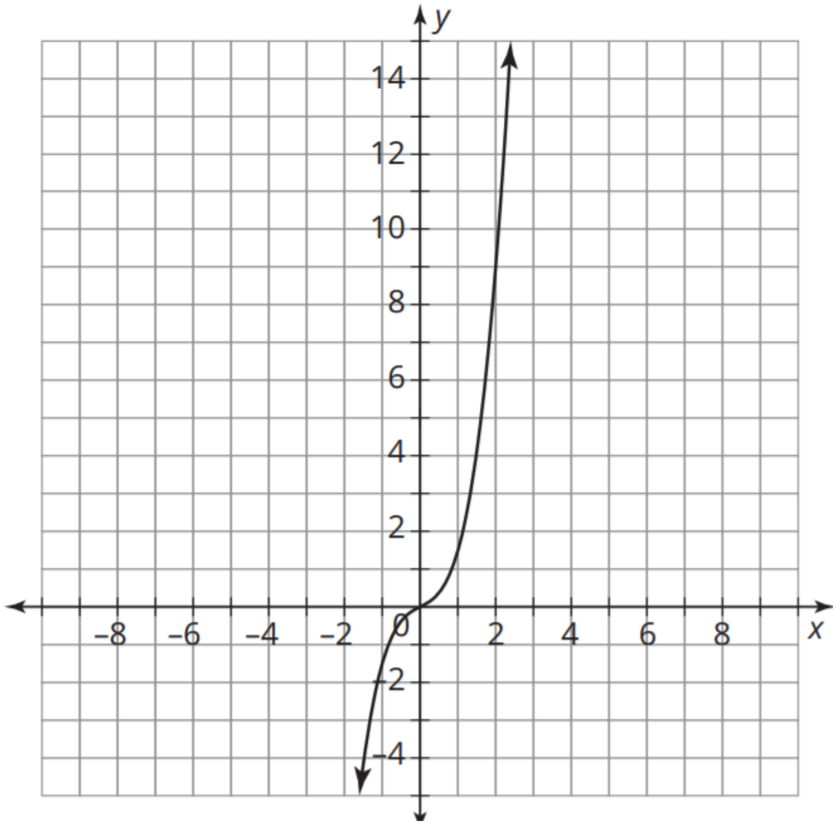
Reference Point on $f(x)$	Corresponding Point on $g(x)$
(0, 0)	
(1, −1)	
(2, 4)	

Reference Point on $f(x)$	Corresponding Point on $h(x)$
(0, 0)	
(1, −1)	
(2, 4)	

b. Suppose that $g(x) = 2f(x)$. Use the given reference points to complete the table of values for $g(x)$. Then, use properties of symmetry to graph and label $g(x)$ on the same coordinate plane as $f(x)$.

c. Suppose that $h(x) = \frac{1}{2}f(x)$. Use the given reference points to complete the table of values for $h(x)$. Then, use properties of symmetry to graph and label $h(x)$ on the same coordinate plane as $f(x)$.

2. The graph of the function $d(x) = x^3 + \frac{1}{2}x$ is shown.



a. Verify that $d(x)$ is an odd function. Show your work.

b. **Suppose that $j(x) = d(2x)$.**
Use the given reference points to complete the table of values for $j(x)$. Then, use properties of symmetry to graph and label $j(x)$ on the same coordinate plane as $d(x)$.

Reference Point on $d(x)$	Corresponding Point on $j(x)$
$(0, 0)$	
$\left(1, \frac{3}{2}\right)$	
$(2, 9)$	

c. **Suppose that $k(x) = d\left(\frac{1}{2}x\right)$.**
Use reference points to complete the table of values for $k(x)$. Then, use properties of symmetry to graph and label $k(x)$ on the same coordinate plane as $d(x)$.

Reference Point on $d(x)$	Corresponding Point on $k(x)$
$(0, 0)$	
$\left(1, \frac{3}{2}\right)$	
$(2, 9)$	