

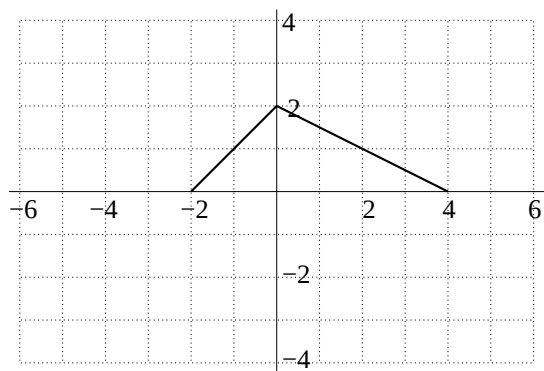
Sections 6.1-6.5 – Function Transformations

Example 1. Consider the function $f(x) = x^2 - 4x + 4$.

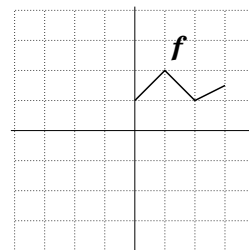
Transformation	Formula	Graph	Description
$y = f(x) + 2$			
$y = f(x) - 2$			
$y = f(x + 2)$			
$y = f(x - 2)$			
$y = f(-x)$			
$y = -f(x)$			

Example 2. Let $y = f(x)$ be the function whose graph is given to the right. Sketch the graphs of the transformations $y = f(x - 2)$, $y = -2f(x)$, and $y = f(-x)$. Then, fill in the entries in the table below.

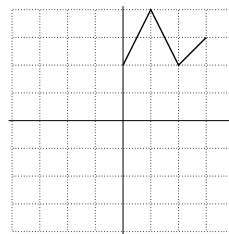
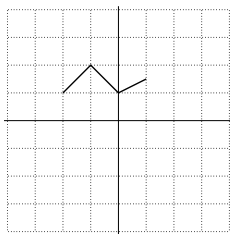
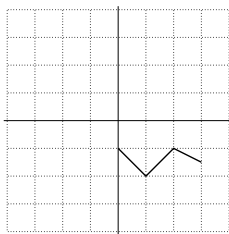
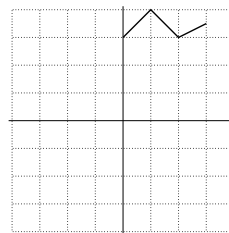
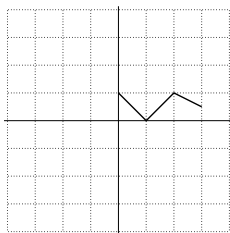
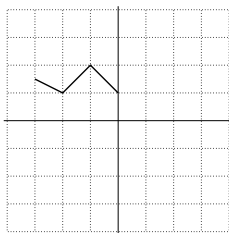
x	-4	-2	0	2	4	6
$f(x)$						
$f(x - 2)$						
$-2f(x)$						
$f(-x)$						



Example 3. To the right, you are given the graph of a function f . Match each graph below to the appropriate transformation formula. Note that some transformation formulas will not match any of the graphs.

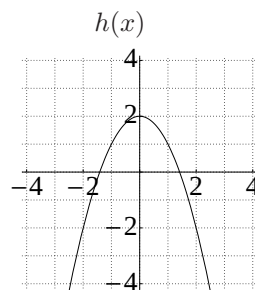
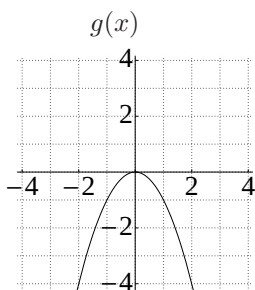
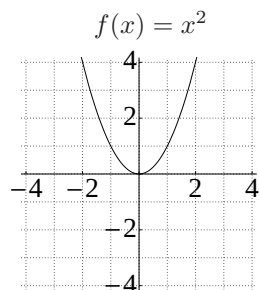


- | | | |
|--------------------|---------------------|-----------------|
| (a) $y = 2f(x)$ | (d) $y = 2f(x) + 2$ | (g) $y = -f(x)$ |
| (b) $y = f(x) + 2$ | (e) $y = f(x + 2)$ | (h) $y = 4f(x)$ |
| (c) $y = 2 - f(x)$ | (f) $y = f(-x)$ | |

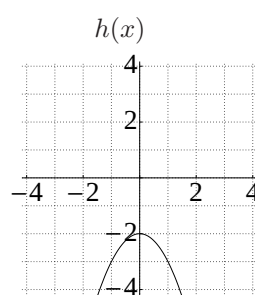
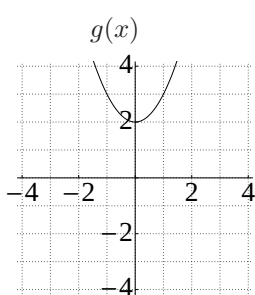
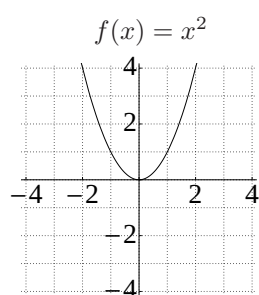


Example 4. In each of the two parts below, you are given a function f and are shown two transformations, g and h , of f . Describe in words how g is obtained from f , and how h is obtained from g , and then find formulas for g and h . Check your answers either using a graphing calculator or by plotting test points.

(a)



(b)



Examples and Exercises

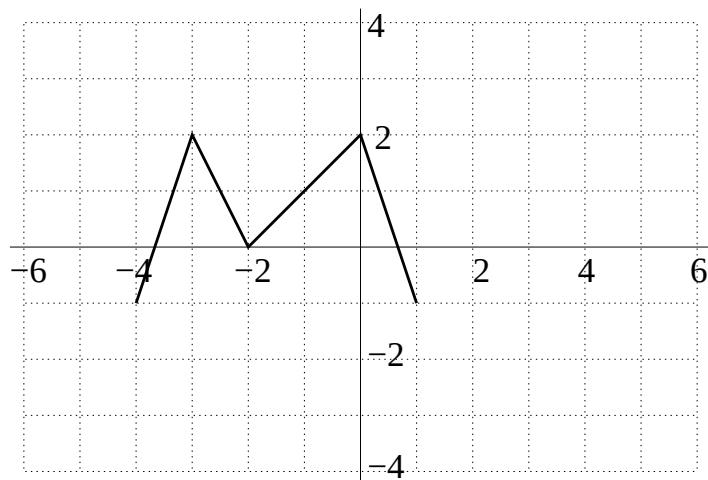
1. Write formulas for each of the following transformations of the function $q(p) = p^2 - p + 1$.

(a) $q(p - 1)$

(b) $q(p) - 1$

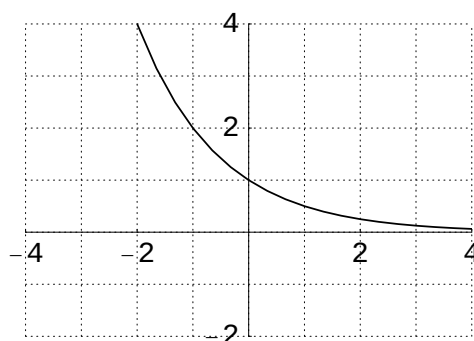
(c) $-2q(-p)$

2. Let $y = f(x)$ be the function whose graph is given below. Fill in the entries in the table below, and then sketch a graph of the transformations $y = f(-x)$ and $y = 1 - 2f(x)$.



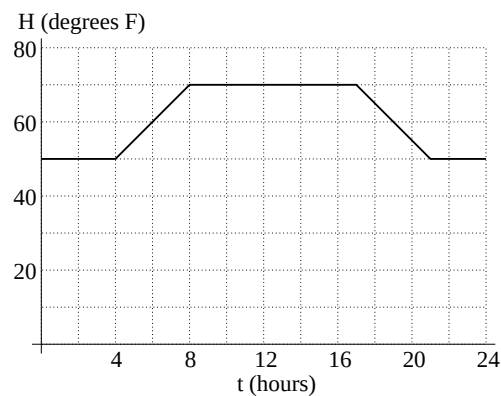
x	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
$f(x)$													
$f(-x)$													
$1 - 2f(x)$													

3. Given to the right is the graph of the function $y = \left(\frac{1}{2}\right)^x$. On the same set of axes, sketch the graph of $y = \left(\frac{1}{2}\right)^{x-2}$ and $y = \left(\frac{1}{2}\right)^x - 2$.



4. Let $H = f(t)$ be the temperature of a heated office building t hours after midnight. (See diagram to the right for a graph of f .) Write down a formula for a new function that matches each story below.

- (a) The manager decides that the temperature should be lowered by 5 degrees throughout the day.



- (b) The manager decides that employees should come to work 2 hours later and leave 2 hours later.

Definition

We say that a function is *even* if $f(-x) = f(x)$ for all x in the domain of the function. In other words, an even function is symmetric about the

_____.

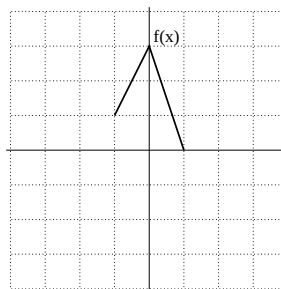
Sketch

We say that a function is *odd* if $f(-x) = -f(x)$ for all x in the domain of the function. In other words, an odd function is symmetric about the

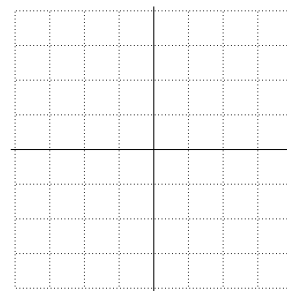
_____.

5. Use algebra to show that $f(x) = x^4 - 2x^2 + 1$ is an even function and that $g(x) = x^3 - 5x$ is an odd function.

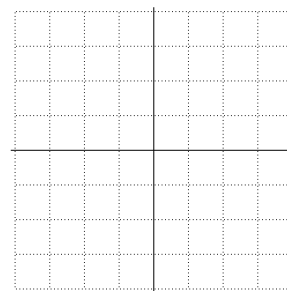
6. Given the graph of $y = f(x)$ to the right, sketch the graph of the following related functions:



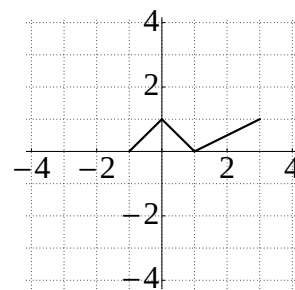
(a) $y = -f(x + 3) + 1$



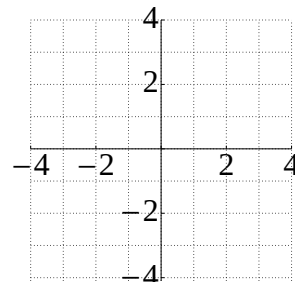
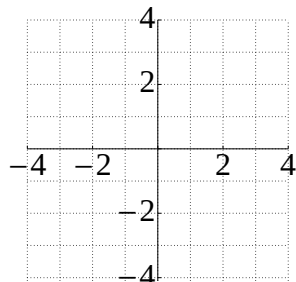
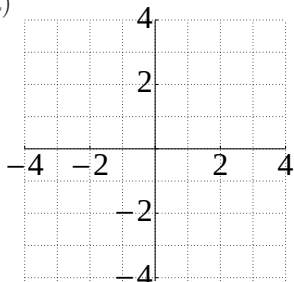
(b) $y = 2 - f(1 - x)$



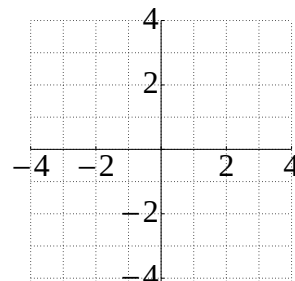
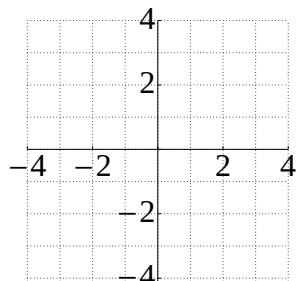
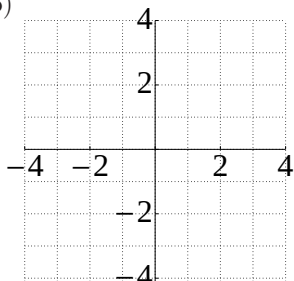
7. To the right, you are given the graph of a function f . Find formulas for the following transformations of f , and also sketch the intermediate transformations.



(a)



(b)



(c)

