

Section 3.4 Notes

**Transformations of the graphs of functions:**

$f(x) + c$

$f(x) - c$

$f(x + c)$

$f(x - c)$

$f(-x)$

$-f(x)$

$cf(x)$

$f(cx)$

1-10 Suppose the graph of  $f$  is given. Describe how the graph of each function can be obtained from the graph of  $f$

2. (a)  $y = f(x + 4)$

(b)  $y = f(x) + 4$

4. (a)  $y = -f(x)$

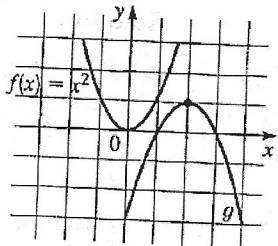
(b)  $y = f(-x)$

8. (a)  $y = 2f(x + 2) - 2$

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

11-16 The graphs of  $f$  and  $g$  are given. Find a formula for the function  $g$ .

16.

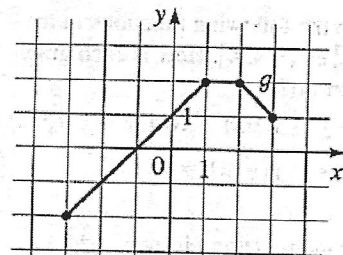
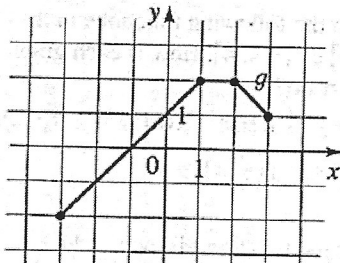
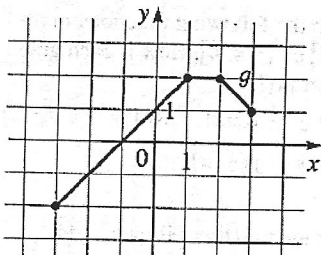


20. The graph of  $g$  is given. Sketch the graphs of the following functions.

a)  $y = g(x + 1)$

e)  $y = -g(x) + 2$

f)  $y = 2g(x)$

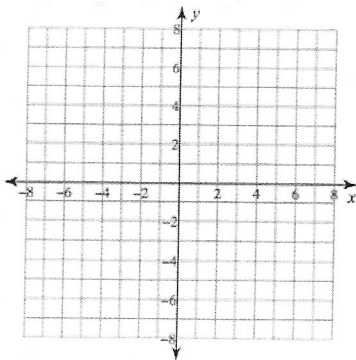


27-32 A function  $f$  is given, and the indicated transformations are applied to its graph (in the given order). Write the equation for the final transformed graph.

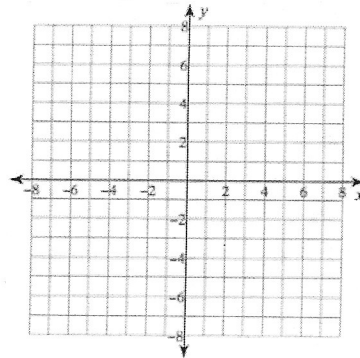
30.  $f(x) = \sqrt[3]{x}$ ; reflect in the  $y$ -axis, shrink vertically by a factor of  $\frac{1}{2}$ , and shift upward  $\frac{3}{5}$  unit.

33-48 Sketch the graph of the function, not by plotting points, but by starting with the graph of a standard function and applying transformations.

42.  $y = 3 - 2(x - 1)^2$

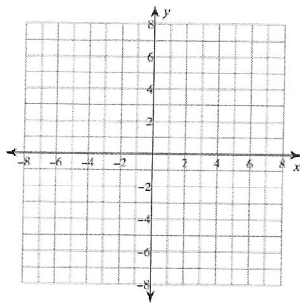


43.  $y = 5 + (x + 3)^2$

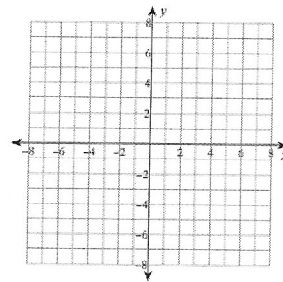


**Even & Odd Functions:**

Even Functions:

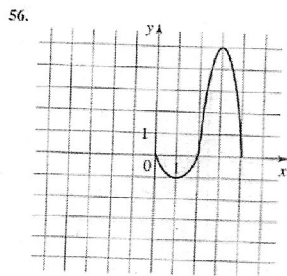


Odd Functions:

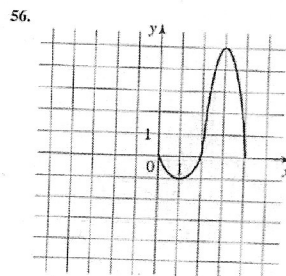


55-56 The graph of a function defined for  $x \geq 0$  is given. Complete the graph for  $x < 0$  to make

(a) an even function

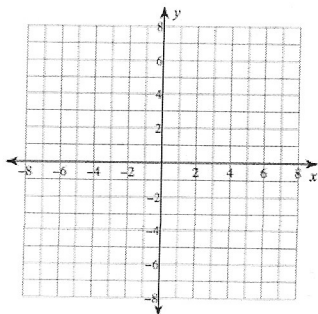


(b) an odd function.

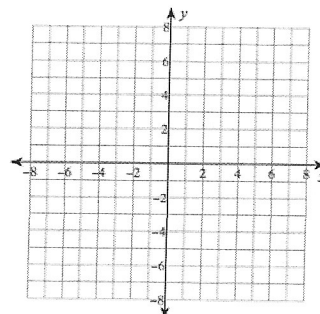


61-68 Determine whether the function  $f$  is even, odd, or neither. If  $f$  is even or odd, use symmetry to sketch its graph.

64.  $f(x) = x^4 - 4x^2$



66.  $f(x) = 3x^3 + 2x^2 + 1$



Section 3.4 Notes

**Transformations of the graphs of functions:**

$f(x) + c$  vertical  $\uparrow$  translation  $f(x) - c$  vertical  $\downarrow$  translation

$f(x + c)$  horizontal  $\leftarrow$   $f(x - c)$  horizontal  $\rightarrow$

$f(-x)$  reflection y-axis  $-f(x)$  reflection on x-axis

$cf(x)$  vertical stretching/shrinking  $f(cx)$  horizontal stretching and shrinking

1-10 Suppose the graph of  $f$  is given. Describe how the graph of each function can be obtained from the graph of  $f$

2. (a)  $y = f(x + 4)$  left 4 (b)  $y = f(x) + 4$  up 4

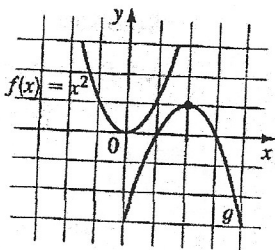
4. (a)  $y = -f(x)$  reflect x-axis (b)  $y = f(-x)$  reflect y-axis

8. (a)  $y = 2f(x + 2) - 2$  (b)  $y = 2f(x - 2) + 2$

stretch vert. by 2  $\leftarrow 2 \downarrow 2$  stretch vert. by 2  $\rightarrow 2 \uparrow 2$

11-16 The graphs of  $f$  and  $g$  are given. Find a formula for the function  $g$ .

16.



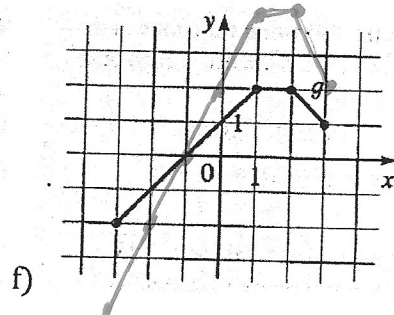
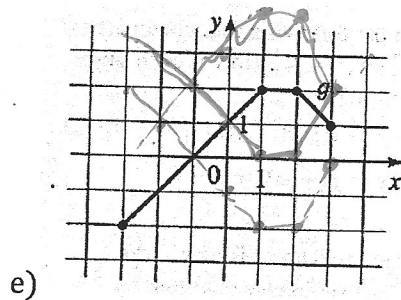
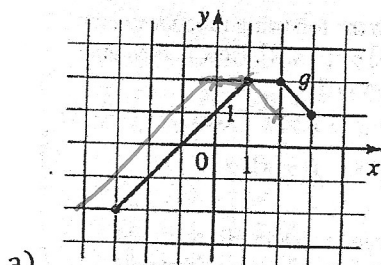
$\rightarrow 2 \uparrow 1$   $f(x) = -(x - 2)^2 + 1$   
reflected on x-axis

20. The graph of  $g$  is given. Sketch the graphs of the following functions.

a)  $y = g(x + 1)$

e)  $y = -g(x) + 2$

f)  $y = 2g(x)$



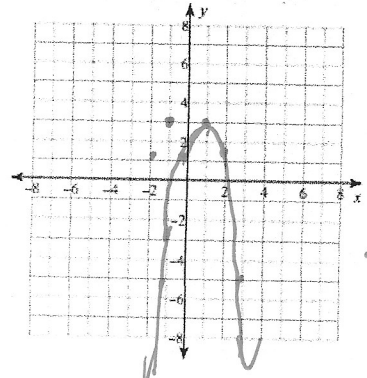
27-32 A function  $f$  is given, and the indicated transformations are applied to its graph (in the given order). Write the equation for the final transformed graph.

30.  $f(x) = \sqrt[3]{x}$ ; reflect in the y-axis, shrink vertically by a factor of  $\frac{1}{2}$ , and shift upward  $\frac{3}{5}$  unit.

$$\frac{1}{2} \sqrt[3]{-x} + \frac{3}{5}$$

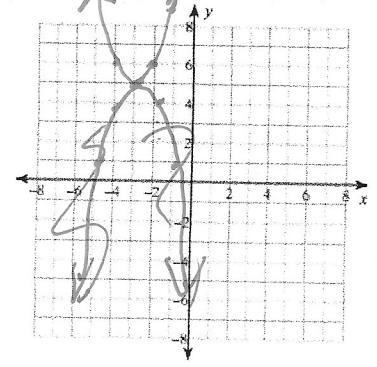
33-48 Sketch the graph of the function, not by plotting points, but by starting with the graph of a standard function and applying transformations.

42.  $y = 3 - 2(x - 1)^2 + 3$



→ 1  
 ↑ 3  
 st. vert by 2  
 flip a.  
 x-axis

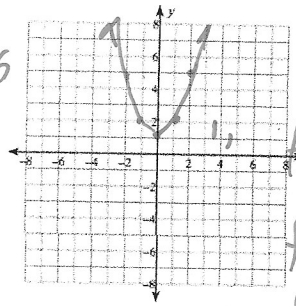
43.  $y = 5 + (x + 3)^2$



← 3  
 ↑ 5

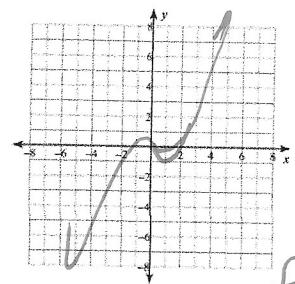
**Even & Odd Functions:**  
 Even Functions:

Sym.  
 on y-axis



$f(x) = f(-x)$   
 $f(x) = x^2 + 1$   
 $f(1) = 2$   
 $f(-1) = 2$   
 $f(-x) = x^2 + 1$

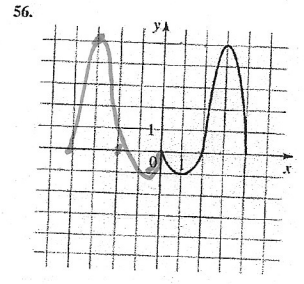
Odd Functions:



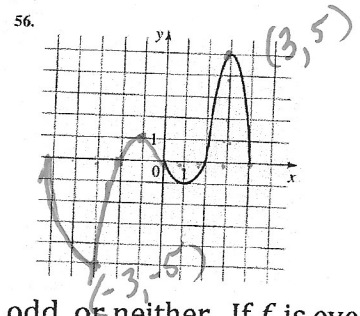
$-f(x) = f(-x)$   
 origin sym.  
 $f(x) = x^3 - x$   
 $f(-x) = -x^3 + x$   
 $-f(x) = -x^3 + x$

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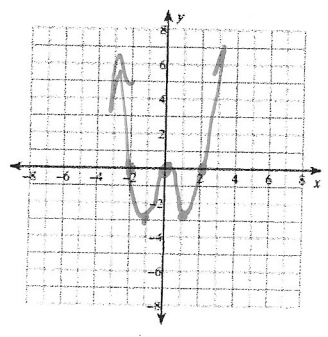
(b) an odd function.



61-68 Determine whether the function  $f$  is even, odd, or neither. If  $f$  is even or odd, use symmetry to sketch its graph.

64.  $f(x) = x^4 - 4x^2$

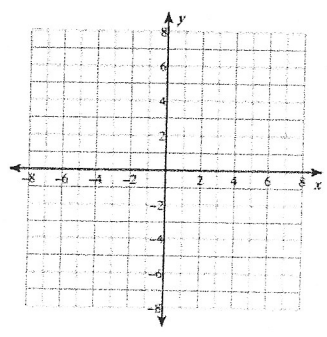
66.  $f(x) = 3x^3 + 2x^2 + 1$



even

0		0
1		-3
-1		-3
2		0
-2		0
+3		45

$81 - 36 = 45$



neither