NOTES-- Transformations

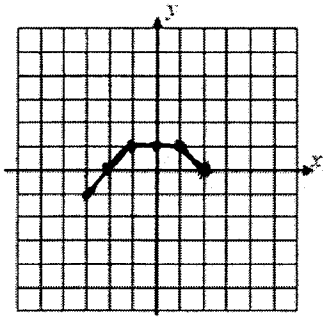
Transformations of the graphs of functions	
$f(x)+c$	shift $f(x)$ up c units
$f(x)-c$	shift $f(x)$ down c units
$f(x+c)$	shift $f(x)$ left c units
$f(x-c)$	shift $f(x)$ right c units
$f(-x)$	reflect $f(x)$ about the y-axis
$-f(x)$	reflect $f(x)$ about the x-axis
$cf(x)$	When $0 < c < 1$ – vertical shrinking of $f(x)$ When $c > 1$ – vertical stretching of $f(x)$ **Multiply the y values by c**
$f(cx)$	When $0 < c < 1$ – horizontal stretching of $f(x)$ When $c > 1$ – horizontal shrinking of $f(x)$ **Divide the x values by c**

Order of function transformati

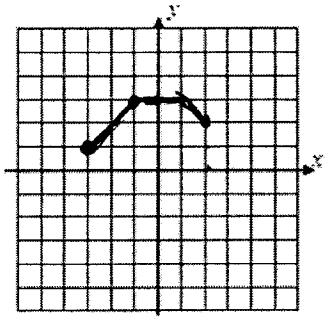
- Horizontal shifts
- Horizontal stretch/compression
- Reflection over y-axis
- Vertical stretch/compression
- Reflection over x-axis
- Vertical shifts

Example 1 Graph each transformation.

y = f(x)

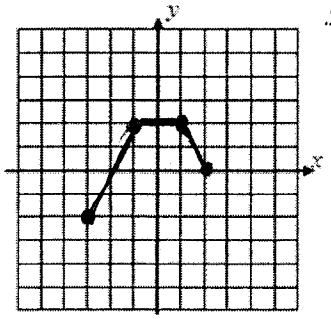


y = f(x) + 2 shift up 2

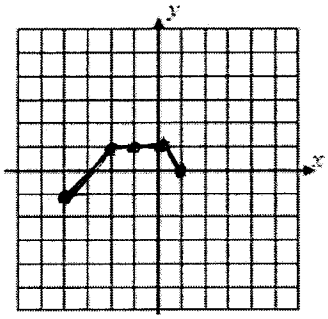


y = 2f(x) vertical stretch by a factor of 2

* y's by 2

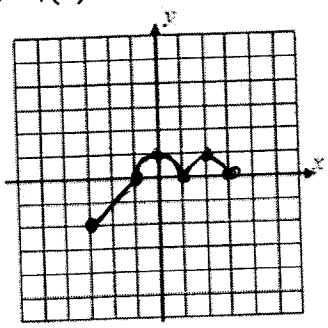


y = f(x + 1) shift left 1

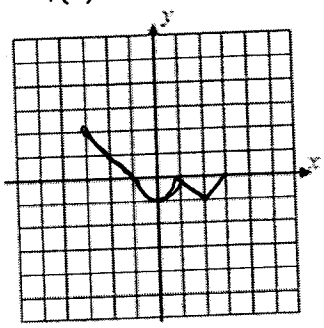


Example 2 Graph each transformation.

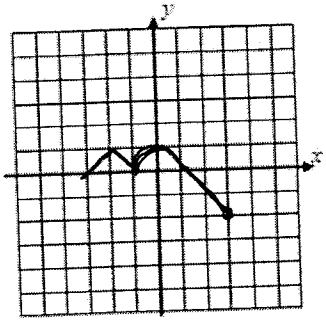
y = f(x)



y = -f(x) reflect over x-axis

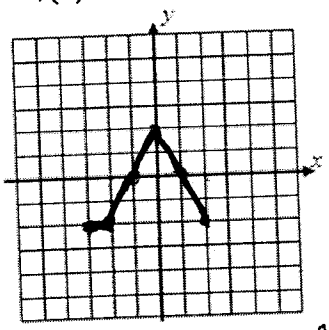


y = f(-x) reflect over y-axis



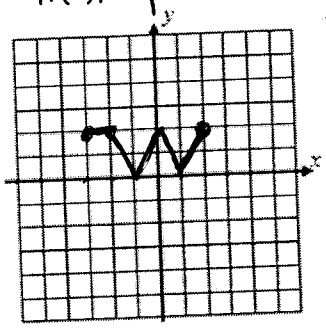
Example 3 Graph each transformation.

y = f(x)

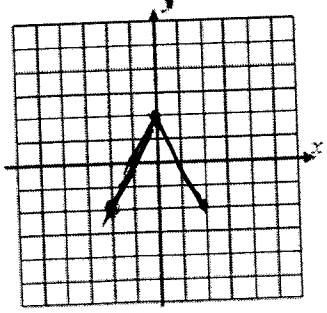


y = |f(x)| partial reflection over the x-axis

y-coordinates become 0 or pos.



y = f(|x|) partial reflection over the y-axis



Example 4 Given $f(x) = |x|$, write an equation reflecting the described transformations.

A. reflect over the x-axis, shift down 5

$y = -|x| - 5$

B. reflect over the y-axis, stretch vertically by a factor of 8, shift up 3 units

$y = 8|-x| + 3$

C. horizontally compress by a factor of $\frac{1}{2}$, reflect over the x-axis, shift down 10

$y = -|2x| - 10$

Example 5 Describe the transformations on the parent function.

A. $y = -2(x-5)^3 + 1$

parent $y = x^3$
shift right 5
vertical stretch by a factor of 2
reflect about x-axis
shift up 1

B. $y = 2^{-x} - 4$

parent $y = 2^x$
reflect over y-axis
shift down 4

C. $y = -\frac{3}{x} + 8$

parent $y = \frac{1}{x}$
vertical stretch by a factor of 3
reflect over x-axis
shift up 8

D. $y = -\frac{1}{2}\sqrt{x-7}$

parent $y = \sqrt{x}$
shift right 7
vertical shrink by a factor of $\frac{1}{2}$
reflect over x-axis