New Functions from Old Functions

Transformational graphing allows us to build new functions from old ones by translating (shifting), stretching/shrinking, and reflecting.

We also get new functions by combining two or more functions using addition, subtraction, multiplication, division and/or composition.

Assuming a, b, c, and d are constants, describe the effect on the graph of $y = f(x)$ in each case.

1. $y = f(x) + d$
vert. shift

2. $y = f(x-c)$ *
horiz. shift*

3. $y = af(x)$
vert. dilation

4. $y = f(bx)$
horiz. dilation*

5. $y = -f(x)$
Vert. reflection

6. $y = f(-x)$
horiz. reflection

7. $y = |f(x)|$
anything on or above x-axis stays the same
reflect anything below x-axis vertically

8. $y = f(|x|)$
discard portion of graph left of the y-axis
reflect a copy of the right side over the y-axis
keep the right side

*does the opposite of what you'd think

Given two functions, f and g, they can be combined in several ways. The domain of the combination is noted for each combination, given that the domain of f is written as D_f and the domain of g is written as D_g.

$$y = f(x) + g(x), \quad D_{f+g} = D_f \cap D_g$$

$$y = f(x) - g(x), \quad D_{f-g} = D_f \cap D_g$$

$$y = f(x) \cdot g(x), \quad D_{f \cdot g} = D_f \cap D_g$$

$$y = f(x) \,/\, g(x), \quad D_{f/g} = D_f \cap D_g, \;\; g(x) \neq 0$$

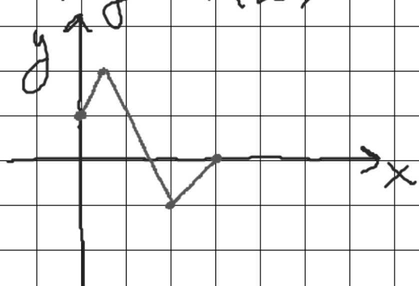
$y = (f \circ g)(x)$, $D_{f \circ g}$ = the set of all x in the domain of g such that $g(x)$ is in the domain of f.

As time permits, do examples from the text on pages 43-45.

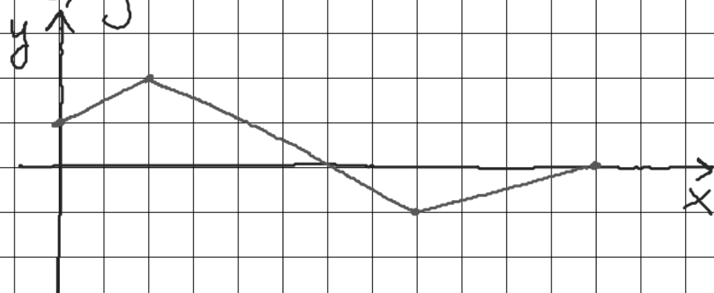
3,5,11,15,23,30,32,44,56

3. a) shift f right 4, #3
   b) shift f up 3, #1
   c) shrink vert. by a factor of $\frac{1}{3}$, #4
   d) reflect vert, shift left 4, #5
   e) stretch vert. by a factor of 2, Shift left 6, #2

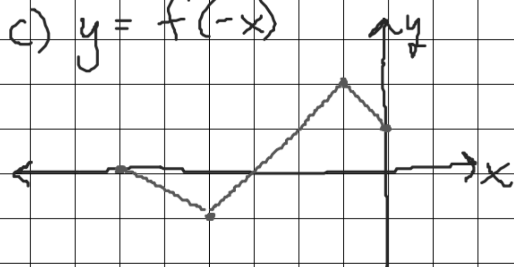
5. a) $y = f(2x)$



b) $y = f(\frac{1}{2}x)$



c) $y = f(-x)$



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