

### 3.2 Families of Graphs

1. Parent Graph Worksheet

2. Reflection

Flips a figure over a line called the axis of symmetry.

3. Linear Translation

Relocates a graph on the coordinate plane but does not change the shape or size.

4. Geometric Transformation

Occurs when a nonlinear graph is stretched or shrunk. Sometimes called dilations.

5. Summary of Translations and Transformations

If the equation of $y = f(x)$ is change to:	Then the graph of $y = f(x)$ is:
$y = -f(x)$	Reflected in the x-axis
$y = f(-x)$	Reflected in the y-axis
$y = cf(x),  c  > 1$	Stretched vertically by a factor of $c$
$y = cf(x), 0 <  c  < 1$	Shrunk vertically by a factor of $c$
$y = f(x - h)$	Translated $h$ units horizontally
$y = f(x) + k$	Translated $k$ units vertically
$y = f(cx),  c  > 1$	Shrunk horizontally by a factor of $\frac{1}{c}$
$y = f(cx), 0 <  c  < 1$	Stretch horizontally by a factor of $\frac{1}{c}$

Remember numbers w/ x  
do opposite of what  
you think!

6. When listing translations/transformation, **ORDER MATTERS!!!!**

- ① all horizontal movements first  
(reflect over y-axis always first)
- ② then all vertical movements

- ① reflect over y-axis
- ② horizontal stretch/comp
- ③ left/right
- ④ flip over x-axis
- ⑤ vert stretch/comp
- ⑥ up/down.

7. List the transformations, in order, that have occurred when compared to the parent graph.

a.  $g(x) = -x^2 - 2$

- ① reflect over x-axis
- ② down 2

b.  $f(x) = x^2 + 1$

up 1

c.  $h(x) = (x - 2)^2$

right 2

d.  $n(x) = (x + 3)^2$

left 3

e.  $m(x) = -(x - 3)^2$

- ① right 3
- ② reflected over x

f.  $s(x) = -(x + 5)^2$

- ① left 5
- ② reflected over x

g.  $t(x) = (x - 2)^2 + 3$

- ① right 2
- ② up 3

h.  $h(x) = (x + 8)^2 - 6$

- ① left 8
- ② down 6

i.  $a(x) = 3(x + 2)^2$

- ① left 2
- ② vert stretch by 3

j.  $g(x) = \frac{1}{3}(x + 6)^2$

- ① left 6
- ② vert comp by  $\frac{1}{3}$

k.  $f(x) = (-x)^3$

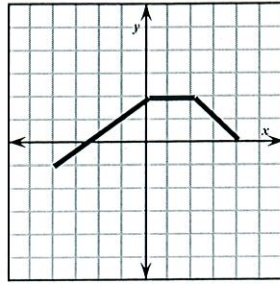
↑  
this is the reflection  
over y

l.  $h(x) = \left(\frac{1}{2}(x + 2)^2\right)$

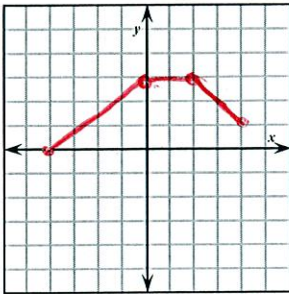
- ① left 2
- ② vert comp by  $\frac{1}{2}$

3. Use the graph of the function  $f$  to sketch the graph of the given function  $g$ . State the domain and range.

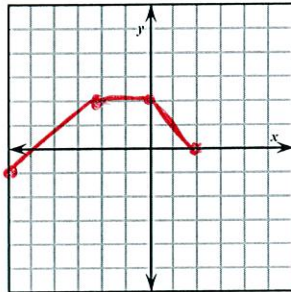
$f(x)$



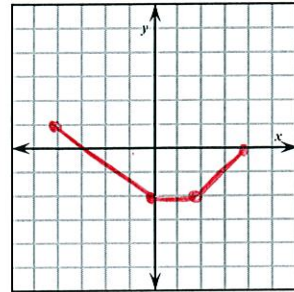
a.  $g(x) = f(x) + 1$



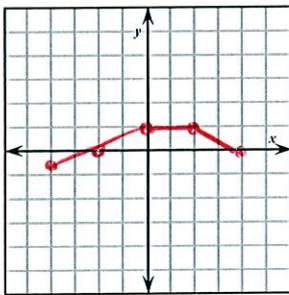
b.  $g(x) = f(x + 2)$



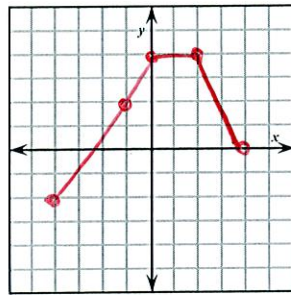
c.  $g(x) = -f(x)$



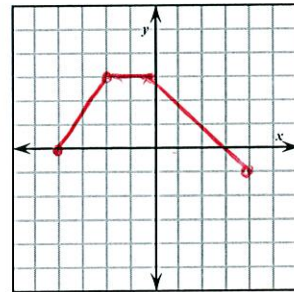
d.  $g(x) = \frac{1}{2}f(x)$



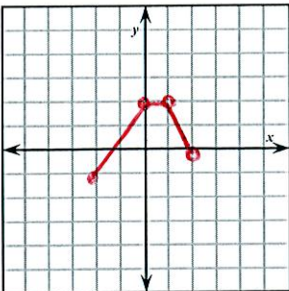
e.  $g(x) = 2f(x)$



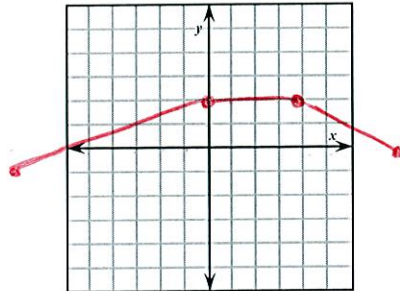
f.  $g(x) = f(-x)$



g.  $g(x) = f(2x)$



h.  $g(x) = f\left(\frac{1}{2}x\right)$



\* i.  $g(x) = |f(-x)| - 2$

