Assume the original function is ***f(x)***.

Vertical Transformations (y-values)

How is the original function changing? (What is the new function?)	How are the points of f(x) affected?	What does this look like on the graph?
$f(x) + d$	(x, y) → (x, y + d)	Vertical shift UP by d
$f(x) - d$	(x, y) → (x, y - d)	Vertical shift DOWN by d
$c \cdot f(x)$	(x, y) → (x, cy)	Stretch vertically by c
$\frac{1}{c} \cdot f(x)$	(x, y) → (x, (1/c)y)	Shrink vertically by 1/c
$-f(x)$	(x, y) → (x, -y)	Flip over the x-axis

fxn

|c|>1

0<|c|<1 decimal

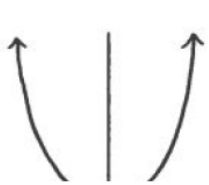
compression

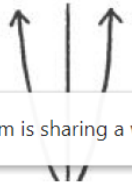
switch sign

reflection

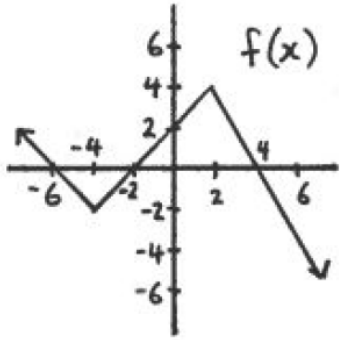
Horizontal Transformations (x-values)

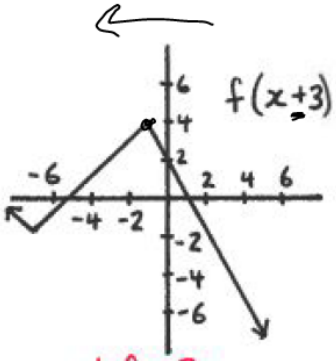
How is the original function changing? (What is the new function?)	How are the points of f(x) affected?	What does this look like on the graph?
$f(x + d)$	(x, y) → (x - d, y)	Horizontal shift LEFT by d
$f(x - d)$	(x, y) → (x + d, y)	Horizontal shift RIGHT by d
$f(c \cdot x)$ ex) $f(2x)$	(x, y) → (1/c x, y) $(\frac{1}{2}x, y)$	Shrink horizontally by c (compression)
$f(\frac{1}{c} \cdot x)$ ex) $f(\frac{1}{3}x)$	(x, y) → (cx, y) $(3x, y)$	Stretch horizontally by c
$f(-x)$	(x, y) → (x, y)	Flip over the y-axis (reflection)



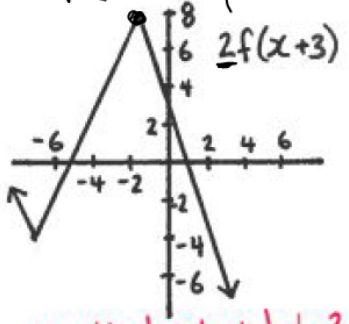


$f(x+2)$
$=$
$(x+2)^2$

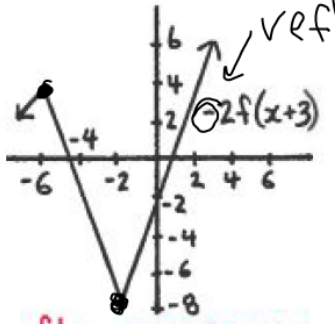


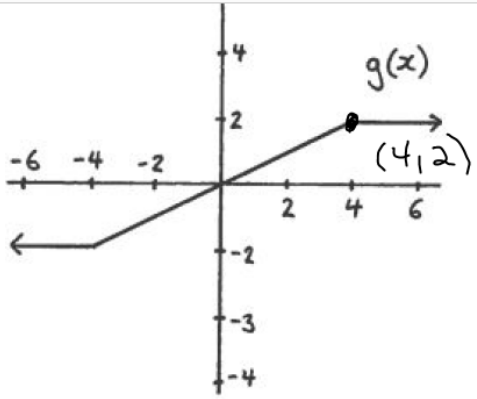


mult. y-values by 2



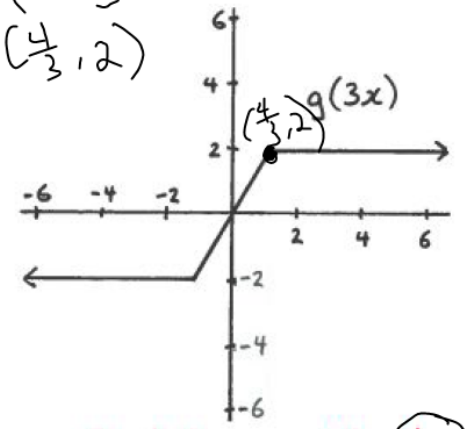
reflect



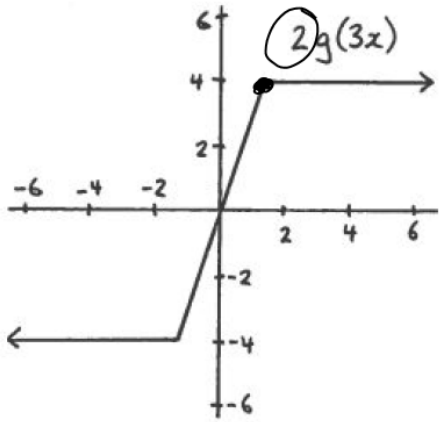


$(4,2) \to \left(4 \cdot \frac{1}{3}, 2\right)$

$\left(\frac{4}{3}, 2\right)$



shrink horizontal by $\frac{1}{3}$



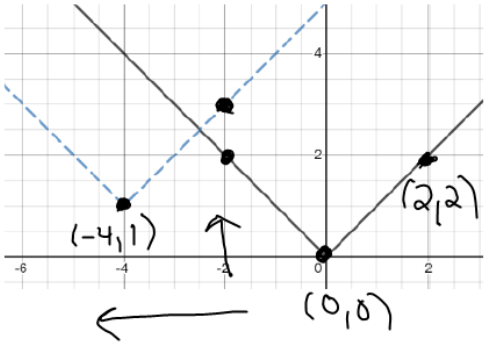
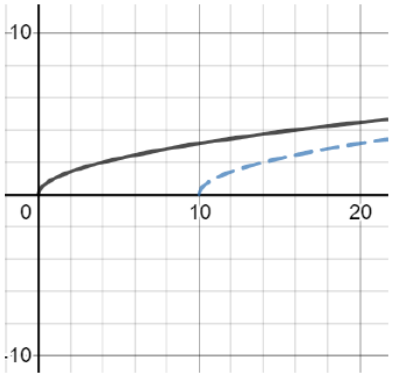
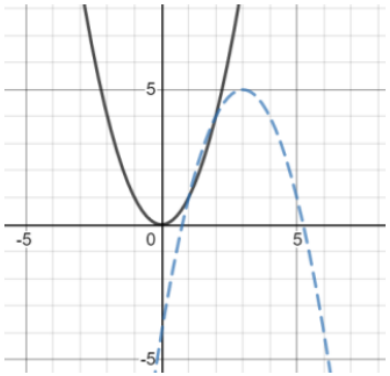
stretch vertical by 2

$\left(\frac{4}{3}, 2\right) \to \left(\frac{4}{3}, 2 \cdot 2\right)$

$\to \left(\frac{4}{3}, 4\right)$

$\sqrt{x}, f(x) = |x|$

- Describe using words, the transformation that occurred from the parent function.
- Write the transformation function represented by the given dotted graph.

1. 	2. 	3. 
f(x)=|x| Shifted left 4 up 1 $f(x) = \|x+4\| + 1$		
4.	5.	6.