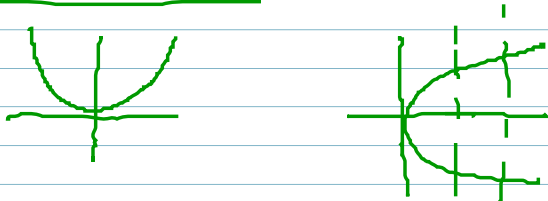


Transformation



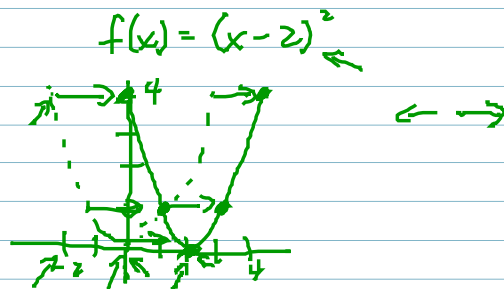
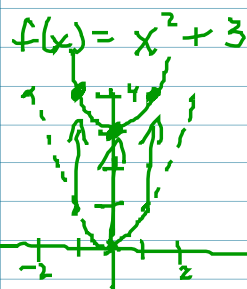
Shift

Vertical
 $y = f(x) + k$

Up - $k > 0$
 Down - $k < 0$

Horizontal

$y = f(x-h)$
 right - $h > 0$
 left - $h < 0$



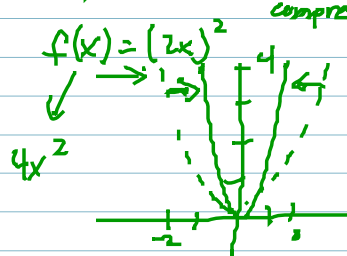
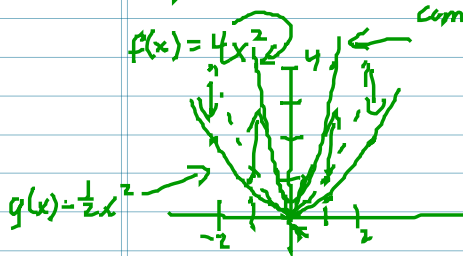
Stretch/compress

vertical
 $y = a f(x)$

stretch - $a > 1$
 compress - $0 < a < 1$

Horizontal

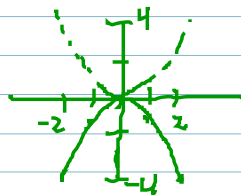
$y = f(bx)$
 stretch - $0 < b < 1$
 compress - $b > 1$



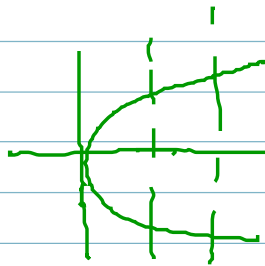
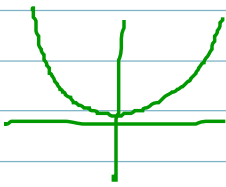
Reflection

Vertical
 $y = -f(x)$

$f(x) = -x^2$



Transformation



Shift

Vertical

$$y = f(x) + k$$

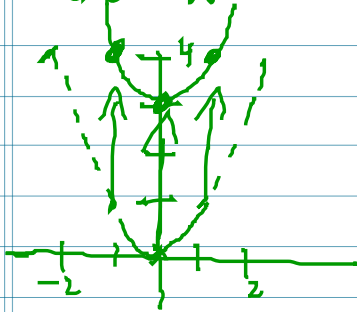
Up - $k > 0$
Down - $k < 0$

Horizontal

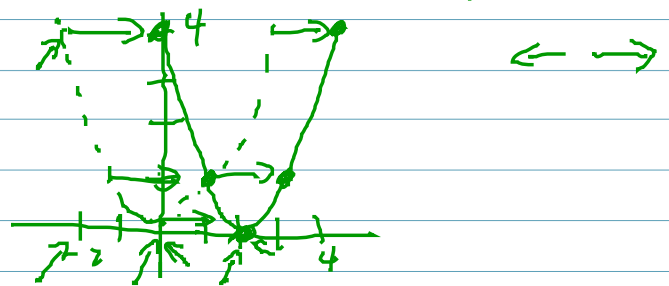
$$y = f(x - h)$$

right - $h > 0$
left - $h < 0$

$$f(x) = x^2 + 3$$



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



Stretch/Compress

Vertical

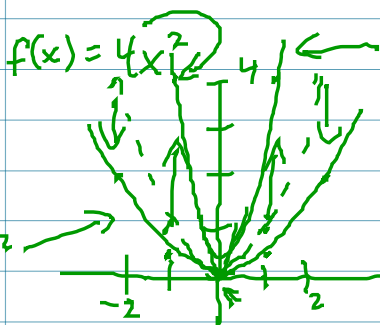
$$y = a f(x)$$

stretch - $a > 1$
compress - $0 < a < 1$

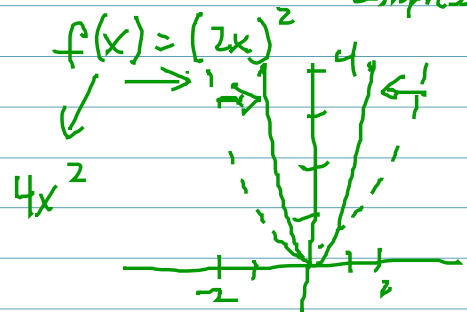
Horizontal

$$y = f(bx)$$

stretch - $0 < b < 1$
compress - $b > 1$



$$g(x) = \frac{1}{2}x^2$$

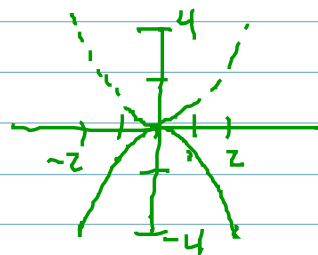


Reflection

Vertical

$$y = -f(x)$$

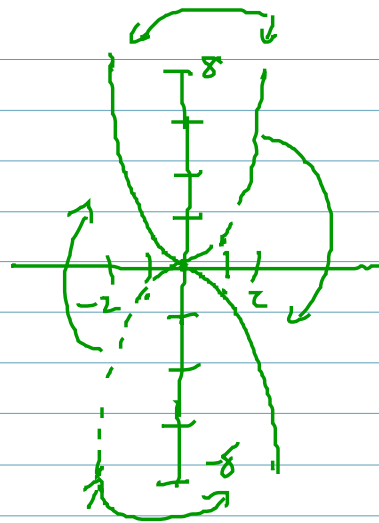
$$f(x) = -x^2$$



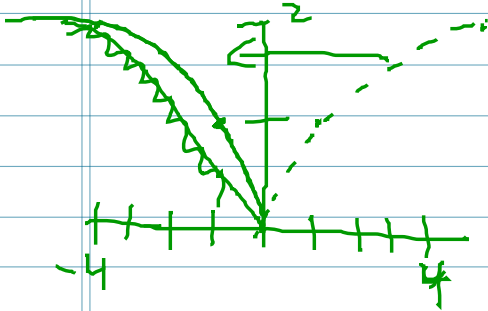
Horizontal
 $y = f(-x)$

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

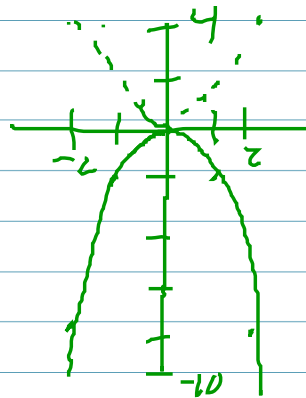
$$= -x^3$$



$$g(x) = \sqrt{-x}$$

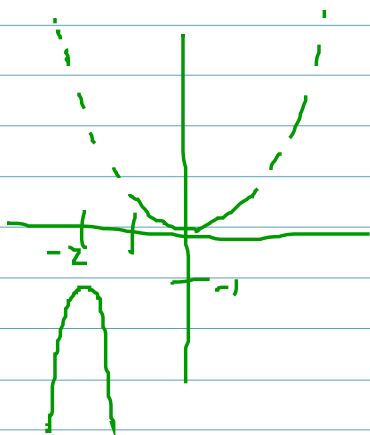


$$f(x) = -2x^2$$

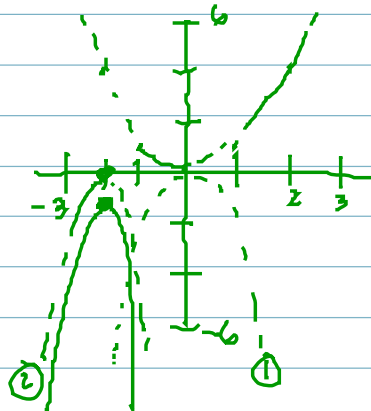


$$y = \frac{a}{b} f\left(\frac{b}{a}(x-h)\right) + k$$

\uparrow \uparrow \uparrow \uparrow
 V%L H%L HS VS
 VR HR



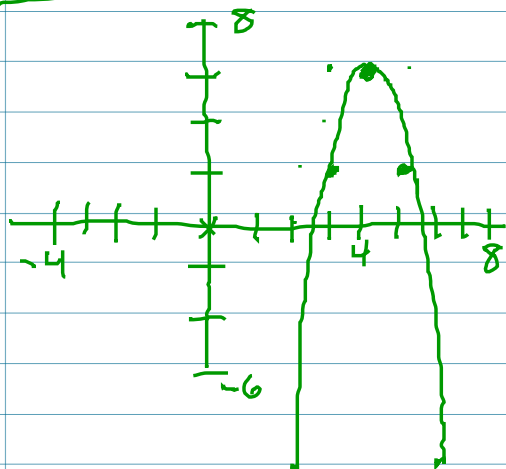
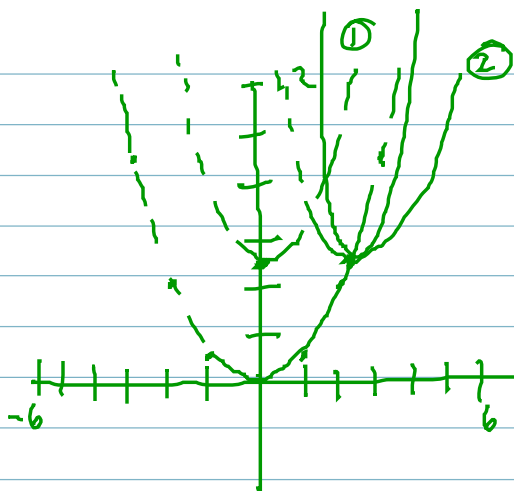
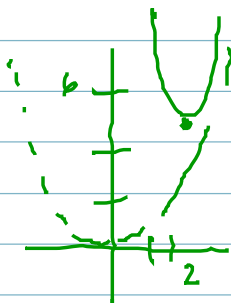
$$f(x) = -3(x+2)^2 - 1$$



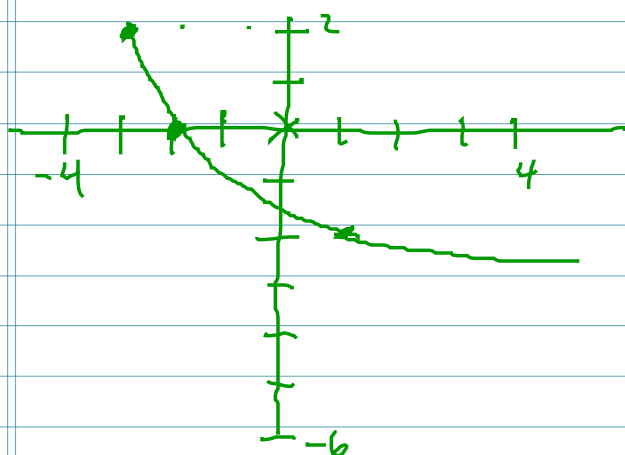
$$f(x) = (3x - 6)^2 + 5$$

\uparrow \uparrow \uparrow
 ③ ② ①

$$(3(x-2))^2 + 5$$



$$f(x) = -4(x-4)^2 + 6$$



$$f(x) = -2 \cdot \sqrt{x+3} + 2$$

$$f(x) = -2 \sqrt{x+3} + 2$$