

Transformations

Shift right:
a units

$$y = f(x - a) \quad a > 0$$

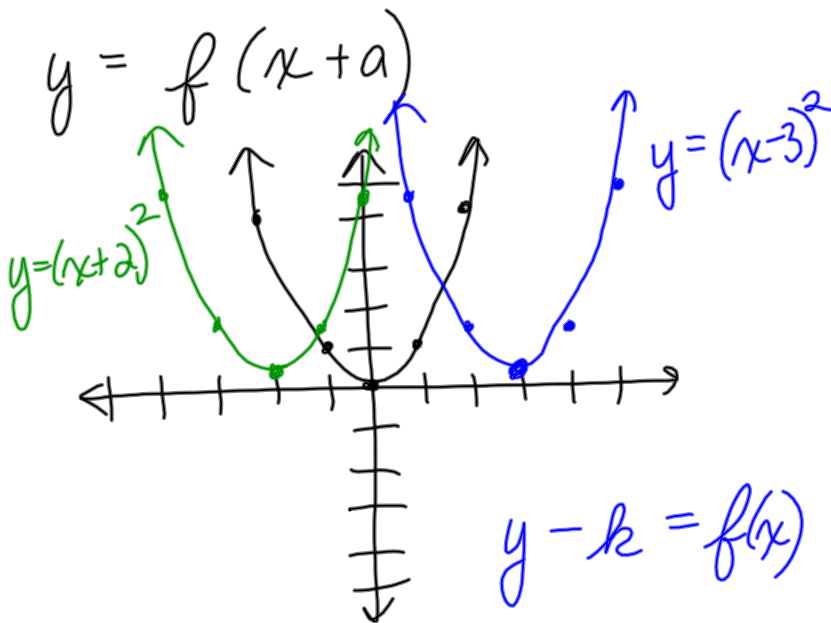
Shift left:
a units

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

Ex: $y = x^2$

$$y = (x - 3)^2$$

x	y
0	9
1	4
2	1
3	0
4	1
5	4

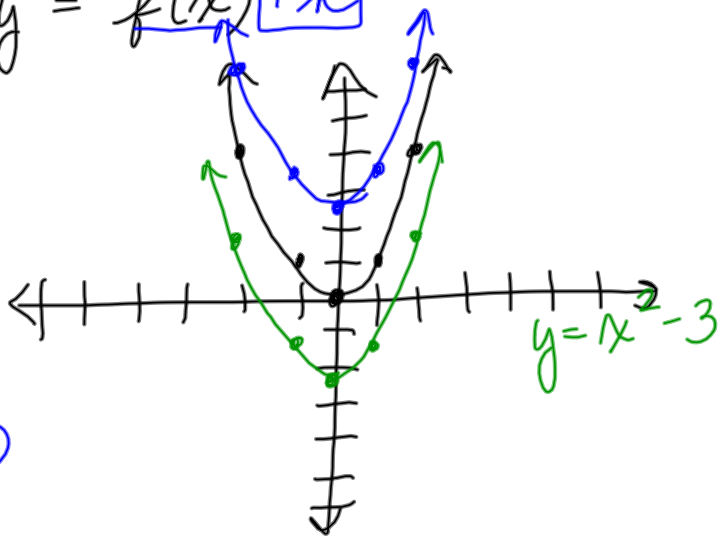


$$y - k = f(x)$$

Shift up: $k > 0$

x	y = x^2
0	0 + 2
1	1 + 2
2	4 + 2
-1	1 + 2
-2	4 + 2

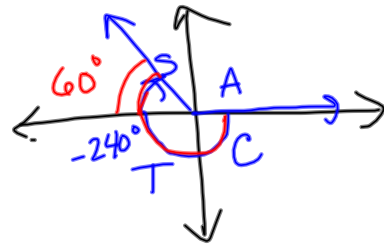
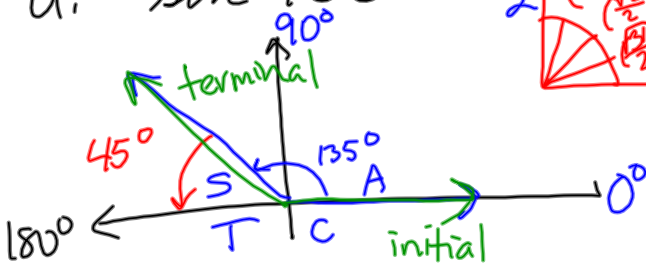
$$y = f(x) + k$$



Shift down: $k < 0$

Evaluate without using a calculator. $-\frac{1}{2}$

a. $\sin 135^\circ = \frac{\sqrt{2}}{2}$ b. $\cos(-240^\circ)$



Use the given point on the terminal side at angle θ in standard position to evaluate the six trigonometric functions of θ .

a. $(4, -3)$

$$a^2 + b^2 = c^2$$

$$(-3)^2 + 4^2 = c^2$$

$$9 + 16 = c^2$$

$$25 = c^2$$

$$5 = c$$

$$- \sin \theta = -\frac{3}{5}$$

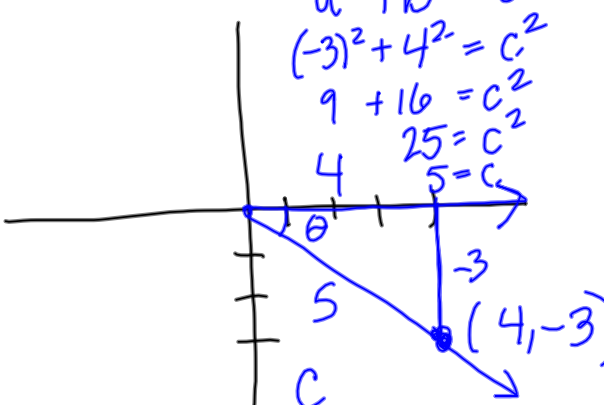
$$+ \cos \theta = \frac{4}{5}$$

$$- \tan \theta = -\frac{3}{4}$$

$$- \csc \theta = -\frac{5}{3}$$

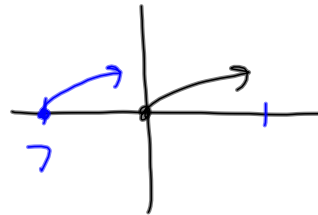
$$+ \sec \theta = \frac{5}{4}$$

$$- \cot \theta = -\frac{4}{3}$$

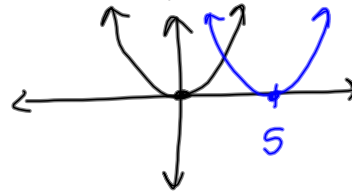


What shift occurs?

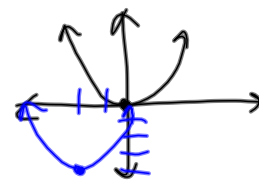
a. $y = \sqrt{x+7}$ left 7
 $y = \sqrt{x}$



b. $y = (x-5)^2$ right 5
 $y = x^2$

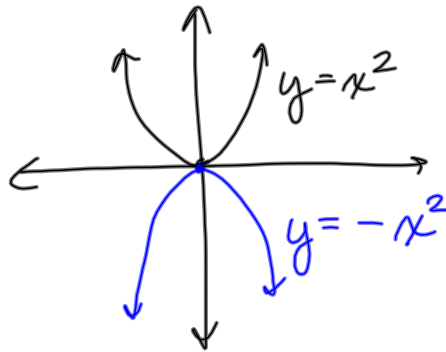


c. $y = (x+2)^2 - 4$ left 2 down 4
 $y = x^2$



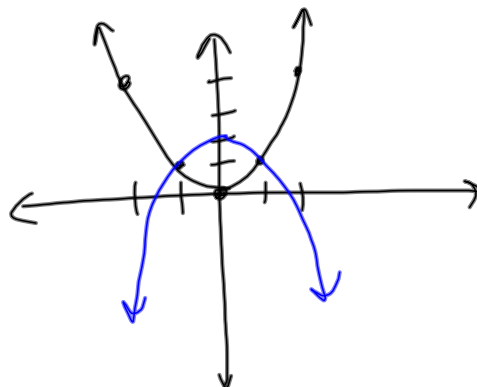
reflection over the x-axis (flip):

$y = -f(x)$



x	y
0	0
1	-1
2	-4
-1	-1
-2	-4

Ex: $y = -x^2 + 2$ reflect. $y = x^2$ $\frac{+2}{2}$

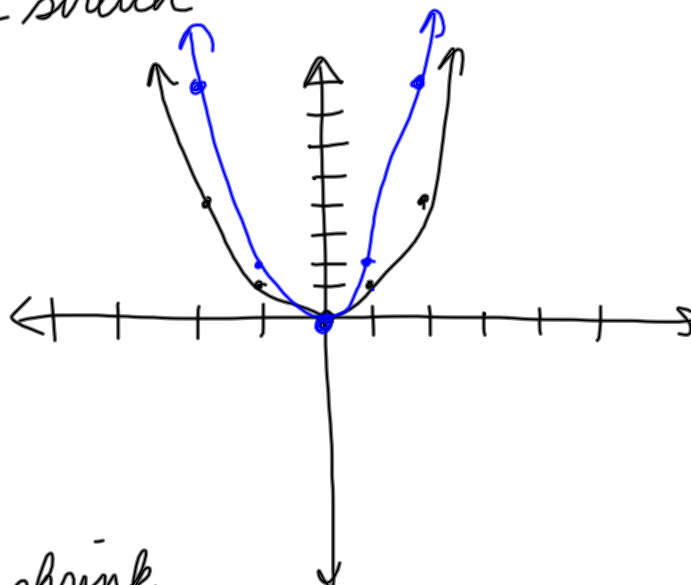


$$y = a f(x)$$

$a > 1$ vertical stretch

$$y = 2x^2$$

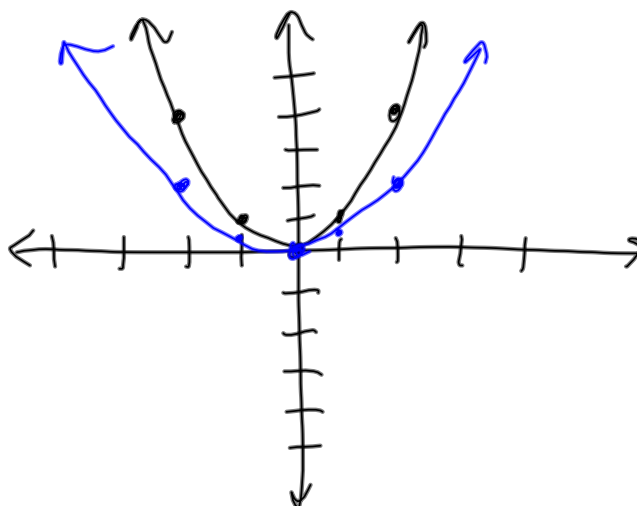
x	y
0	0×2
1	1×2
2	4×2
-1	1×2
-2	4×2



$0 < a < 1$ vertical shrink (compress)

$$y = \frac{1}{2}x^2$$

x	y	
0	$0 \times \frac{1}{2}$	0
1	$1 \times \frac{1}{2}$	$\frac{1}{2}$
2	$4 \times \frac{1}{2}$	2
-1	$1 \times \frac{1}{2}$	$\frac{1}{2}$
-2	$4 \times \frac{1}{2}$	2



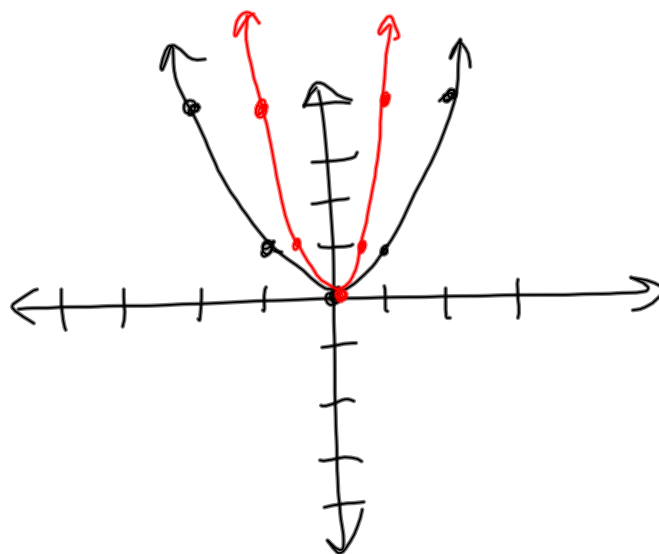
horizontal stretch/compress

$$y = f(ax)$$

$a > 1 \rightarrow$ horizontal compression of $\frac{1}{a}$ $\frac{1}{2}$

$$y = (2x)^2$$

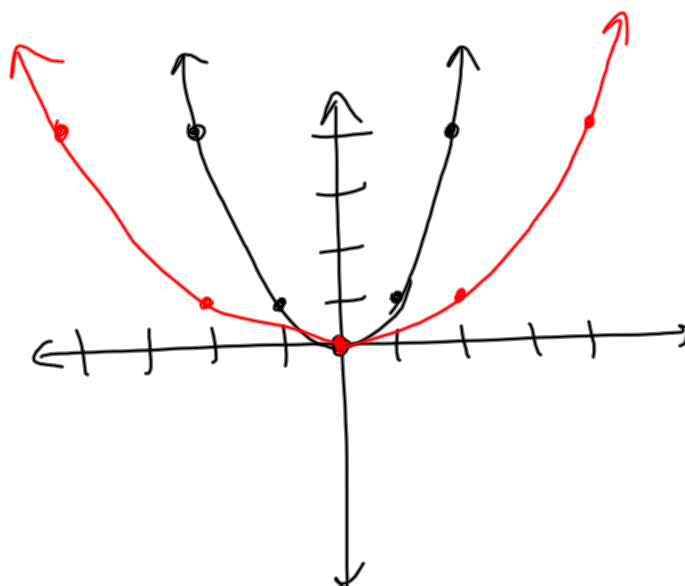
x	y
$\frac{1}{2} \times 0$	0
$\frac{1}{2} \times 1$	1
$\frac{1}{2} \times 2$	4
$\frac{1}{2} \times -1$	1
$\frac{1}{2} \times -2$	4



$0 < a < 1$ horizontal stretch $\rightarrow \frac{1}{a}$

$$y = \left(\frac{1}{2}x\right)^2$$

x	y
0×2	0
2×1	1
2×2	4
-2×1	1
-2×2	4



Odd / Even Functions

If a function is even, $f(-x) = f(x)$
* symmetric to the y-axis

If a function is odd, $f(-x) = -f(x)$
* reflected across x and y-axes.