

Transformations of functions.

Some of the common functions and the respective domain, range and if the function is even, odd or neither .

$$\begin{array}{ccccccc}
 f(x) = 1.5 & f(x) = x & f(x) = |x| & f(x) = x^2 & f(x) = \sqrt{x} & f(x) = x^3 & f(x) = \sqrt[3]{x} \\
 y = 1.5 & y = x & y = |x| & y = x^2 & y = \sqrt{x} & y = x^3 & y = \sqrt[3]{x}
 \end{array}$$

D:

R:

S:

$$y = A f(Bx + C) + D$$

Apply effects of C before B and A before D.

Effects the Domain (Inversely) "x" variable position - 〈 Horizontal Change 〉

if $C < 1$ the function is "Translated Horizontally (shift or slide) C units to the right "

C:

if $C > 1$ the function is "Translated Horizontally (shift or slide) C units to the left "

if B is negative the function is "Reflected Horizontally (flipped) over the y -axis"

B: if $|B| > 1$ the function is "Compressed Horizontally (squeezed) toward the y -axis by a factor of $\frac{1}{|B|}$ "

if $0 < |B| < 1$ the function is "Expanded Horizontally (stretched) from the y -axis by a factor of $\frac{1}{|B|}$ "

Apply effects A before D.

Effects the Range (Directly) "y" variable position - 〈 Vertical Change 〉

if A is negative the function is "Reflected Vertically (flipped) over the x -axis"

A: if $|A| > 1$ the function is "Expanded Vertically (stretched) from the x -axis by a factor of $|A|$ "

if $0 < |A| < 1$ the function is "Compressed Vertically (stretched) toward the y -axis by a factor of $|A|$ "

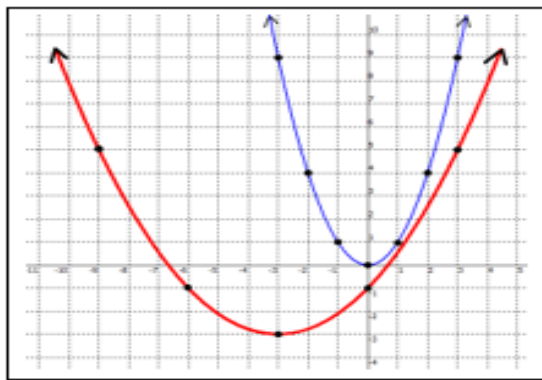
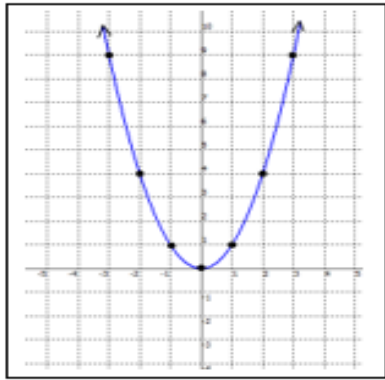
if $D < 1$ the function is "Translated Vertically (shift or slide) D units down "

D:

if $D > 1$ the function is "Translated Vertically (shift or slide) D units up "

The graph of $y = 2 \left(\frac{1}{3}x + 1 \right)^2 - 3$ as a transformation from the parent function $R(x) = x^2$.

- 1st Translate (Shift or Slide) the points of the parent function _____ units to the _____.
- 2nd Expand (Stretch) the points of the graph _____ to positions ___ times as far from the ___-axis.
- 3rd Expand (Stretch) the points of the graph _____ from the _____-axis to positions _____ times as far from the _____-axis.
- 4th Translate (Shift or Slide) the points of the graph _____ units _____.



$$y = 2 \left(\frac{1}{3}x + 1 \right)^2 - 3$$

$$y = (x)^2$$

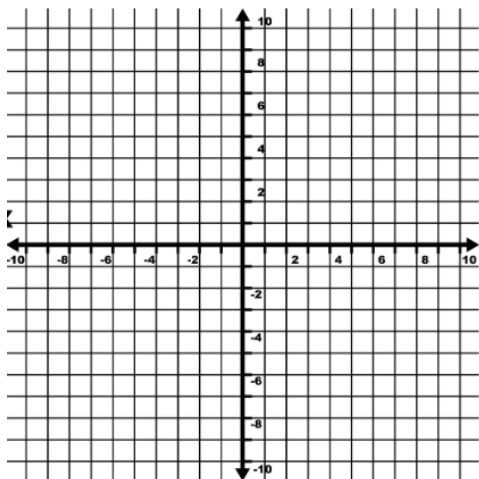
$\cdot 3$	$[-1$	x	y	$\cdot 2$	$]-3$
-3	-1	0	0	0	-3
-6	-2	-1	1	2	-1
0	0	1	1	2	-1
-9	-3	-2	4	8	5
3	1	2	4	8	5
-12	-4	-3	9	18	15
-6	2	3	9	18	15

Different form changes the order that things are done so now apply effects of C before B and A before D.

$$y = A f \left(B [x + C] \right) + D$$

The graph of $g(x) = -3 \left| \frac{1}{2}(x+4) \right| - 2$ as a transformation from the parent function $A(x) = |x|$

- 1st Expand (Stretch) the points of the graph horizontally to positions _____ times as far from the ___-axis.
- 2nd Translate (Slide) the points of the parent function _____ units to the _____.
- 3rd _____ the points of the graph over the _____-axis, then Expand (Stretch) them _____ to positions _____ times as far from the _____-axis.
- 4th Translate (Slide) the points of the graph _____ units _____.



$$y = -3 \left| \frac{1}{2}(x+4) \right| - 2$$

$-4 \swarrow$	$\cdot 2 \swarrow$	x	y	$\searrow \cdot -3$	$\searrow -2$
-4	0	0	0	0	-2
-6	-2	-1	1	-3	-5
-2	2	1	1	-3	-5
-8	-4	-2	2	-6	-8
0	4	2	2	-6	-8
-10	-6	-3	3	-9	-11
2	6	3	3	-9	-11