FUNCTION TRANSFORMATIONS: ORDER OF OPERATIONS

$$y = a(bx - h) + k$$

Last Updated: 11/10/19

Order	Component	Transformation	Description
1	$-b$ (Refers to the "$-$" in front of b)	Reflect About the *y*-Axis	The "$-$" in front of b reflects graph about the *y*-axis.
2	b	Horizontal Stretch or Horizontal Compression	Each *x*-coordinate is multiplied by $\frac{1}{b}$. $b > 1$ *compresses* graph horizontally by factor of $\frac{1}{b}$. $0 < b < 1$ *stretches* graph horizontally by factor of $\frac{1}{b}$.
3	h	Horizontal Shift (Translation)	$+h$ shifts graph left h units. $-h$ shifts graph right h units.
4	$-a$ (Refers to the "$-$" in front of a)	Reflect About the *x*-Axis	The "$-$" in front of a reflects graph about the *x*-axis.
5	a	Vertical Stretch or Vertical Compression	Each *y*-coordinate is multiplied by a. $a > 1$ *stretches* graph vertically by factor of a. $0 < a < 1$ *compresses* graph vertically by factor of a.
6	k	Vertical Shift (Translation)	$+k$ shifts graph up k units. $-k$ shifts graph down k units.

Notes:

- Components a, b, h, k are positive constants.
- *Order of Operations* for function transformations are analogous to those in algebra. Begin inside the parentheses then follow this order:
  - **1.** Reflections **2.** Compressions and Stretches **3.** Shifts.