

Combinations of Transformations**Stretched vertically by a factor of a**

- If $a > 1$, the graph is expanded
- If $0 < a < 1$ the graph is compressed
- If $a < 0$, the graph is reflected in the x -axis

Translated vertically c units

- If $c > 0$, the graph shifts up
- If $c < 0$, the graph shifts down

$$y = af(k(x-d)) + c$$

Stretched horizontally by a factor of $1/k$

- If $k > 1$, the graph is compressed
- If $0 < k < 1$ the graph is expanded
- If $k < 0$, the graph is reflected in the y -axis

Translated horizontally d units

- If the sign is negative, the graph shifts to the right
- If the sign is positive, the graph shifts to the left

The a affects the graph $y = f(x)$ by stretching or compressing the graph by a factor of a .

If the a is negative, there is a reflection about the x -axis.

The d affects the graph $y = f(x)$ by translating left or right d units.

The c affects the graph $y = f(x)$ by translating up or down c units.

The k affects the graph $y = f(x)$ by stretching or compressing the graph by a factor of $\frac{1}{k}$.

If the k is negative, there is a reflection about the y -axis.

Does the order of transformations matter?