

Function Transformations

if $f(x)$ is a function, let $g(x)$ be defined as a transformation of $f(x)$ by the following:

$$g(x) = a[f(b(x - c))] + d$$

a = vertical stretch/compression by a

if a is negative, indicates vertical reflection across the x-axis

b = horizontal stretch/compression by $\frac{1}{b}$

if b is negative, indicates horizontal reflection across the y-axis

c = horizontal shift of c

d = vertical shift of d

Examples:

$$g(x) = 4f(x)$$

vertical stretch by 4

$$g(x) = \frac{2}{5}f(x)$$

vertical compression by $\frac{2}{5}$

$$g(x) = -f(x)$$

vertical reflection across x-axis

$$g(x) = f(3x)$$

horizontal compression by $\frac{1}{3}$

$$g(x) = f\left(\frac{1}{6}x\right)$$

horizontal stretch by 6

$$g(x) = f(-x)$$

horizontal reflection across y-axis

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

horizontal shift right 2

$$g(x) = f(x + 1)$$

horizontal shift left 1

$$g(x) = f(x) + 7$$

vertical shift up 7

$$g(x) = f(x) - 9$$

vertical shift down 9

Order of Function Transformations

1. Vertical stretch/compression
2. Reflection across x-axis
3. Horizontal stretch/compression
4. Reflection across y-axis
5. Horizontal shift
6. Vertical shift