

Transforming Functions

Transformation	Description	Example	Graph
$y = f(x) + a$	Translate $\begin{pmatrix} 0 \\ a \end{pmatrix}$	$y = x^2 - 3$ Translate $y = x^2$ 3 units down	
$y = f(x - a)$	Translate $\begin{pmatrix} a \\ 0 \end{pmatrix}$	$y = (x - 2)^2$ Translate $y = x^2$ 2 units to the right	
$y = a f(x)$	Vertical stretch factor a	$y = 2 \sin x$ Stretch $y = \sin x$ vertically by scale factor of 2	
$y = f(ax)$	Horizontal stretch factor $\frac{1}{a}$	$y = \sin\left(-\frac{x}{2}\right)$ Stretch $y = \sin x$ horizontally by a scale factor -2	