

Dilation

Function Rule	Transformation of the Graph	Change to Coordinate Points
$f(x) + k$ Ex: $y = \sqrt{x} + k$	Vertical translation up k units	$(x, y) \rightarrow (x, y + k)$
$f(x) - k$ Ex: $y = x^2 - k$	Vertical translation down k units	$(x, y) \rightarrow (x, y - k)$
$f(x + h)$ Ex: $y = \sqrt{x + h}$	Horizontal Translation left h units	$(x, y) \rightarrow (x - h, y)$
$f(x - h)$ Ex: $y = (x - h)^3$	Horizontal translation right h units	$(x, y) \rightarrow (x + h, y)$
$-f(x)$ Ex: $y = -\sqrt{x}$	Reflection over x -axis	$(x, y) \rightarrow (x, -y)$
$f(-x)$ Ex: $y = \sqrt{-x}$	Reflection over the y -axis	$(x, y) \rightarrow (-x, y)$
$af(x)$ Ex: $y = 3\sqrt{x}$ (taller) intuitive	Vertical stretch for $ a > 1$	$(x, y) \rightarrow (x, ay)$
$af(x)$ Ex: $y = \frac{1}{2}\sqrt{x}$ (shorter) intuitive	Vertical compression for $0 < a < 1$	$(x, y) \rightarrow (x, ay)$
$f(bx)$ Ex: $y = \sqrt{4x}$ (narrower)	Horizontal compression for $ b > 1$	$(x, y) \rightarrow (\frac{x}{b}, y)$
$f(bx)$ Ex: $y = \sqrt{\frac{1}{4}x}$ (wider)	Horizontal stretch for $0 < b < 1$	$(x, y) \rightarrow (\frac{x}{b}, y)$