

## Transformation Rules

Function Notation	Type of Transformation	Change to Coordinate Point
$f(x) + d$	Vertical translation up $d$ units	$(x, y) \rightarrow (x, y + d)$
$f(x) - d$	Vertical translation down $d$ units	$(x, y) \rightarrow (x, y - d)$
$f(x + c)$	Horizontal translation left $c$ units	$(x, y) \rightarrow (x - c, y)$
$f(x - c)$	Horizontal translation right $c$ units	$(x, y) \rightarrow (x + c, y)$
$-f(x)$	Reflection over $x$ -axis	$(x, y) \rightarrow (x, -y)$
$f(-x)$	Reflection over $y$ -axis	$(x, y) \rightarrow (-x, y)$
$af(x)$	Vertical stretch for $ a  > 1$	$(x, y) \rightarrow (x, ay)$
$af(x)$	Vertical compression for $0 <  a  < 1$	$(x, y) \rightarrow (x, ay)$
$f(bx)$	Horizontal compression for $ b  > 1$	$(x, y) \rightarrow \left(\frac{x}{b}, y\right)$
$f(bx)$	Horizontal stretch for $0 <  b  < 1$	$(x, y) \rightarrow \left(\frac{x}{b}, y\right)$