

## Transformations

$f(x) + a$

$f(x) - a$

$f(x+a)$

$f(x-a)$

$-f(x)$

$f(-x)$

## Effect On Graph

Graph shifts 'a' boxes up  
(No effect on spread)

Graph shifts 'a' boxes down.  
(No effect on spread)

Graph shifts 'a' boxes to the left

Graph shifts 'a' boxes to the right

Reflection in  $x$ -axis

Reflection in  $y$ -axis

$a f(x)$

stretch parallel to y-axis  
with factor 'a'

- $a > 1$ , stretch vertically
- $a < 1$ , compress vertically

$f(ax)$

stretch parallel to x-axis  
with factor  $\left[\frac{1}{a}\right]$

- $a > 1$ , compress Horizontally
- $a < 1$ , stretch horizontally