Transformations of Graphs

Vertical Shifts

$y = f(x) + k$ Shifts graph k units up
(Add k to y-coordinate)

$y = f(x) - k$ Shifts graph k units down
(Subtract k from y-coordinate)

Horizontal Shifts

$y = f(x - h)$ Shifts graph h units to the right
(Add h to x-coordinate)

$y = f(x + h)$ Shifts graph h units to the left
(Subtract h from x-coordinate)

Stretching and Compressing

Vertical

$y = c \cdot f(x)$, where $c > 1$ Stretches graph vertically away from x-axis by a factor of c
(Multiply y-coordinate by c)

$y = c \cdot f(x)$, where $0 < c < 1$ Compresses graph vertically towards x-axis by a factor of c
(Multiply y-coordinate by c)

Horizontal

$y = f(c \cdot x)$, where $0 < c < 1$ Stretches graph horizontally away from y-axis by a factor of $\frac{1}{c}$
(Multiply x-coordinate by $\frac{1}{c}$; i.e. the reciprocal of c)

$y = f(c \cdot x)$, where $c > 1$ Compresses graph horizontally towards y-axis by a factor of $\frac{1}{c}$
(Multiply x-coordinate by $\frac{1}{c}$; i.e. the reciprocal of c)

Reflections

$y = -f(x)$ Reflects graph about the x-axis
(Multiply y-coordinate by -1)

$y = f(-x)$ Reflects graph about the y-axis
(Multiply x-coordinate by -1)