

Transformation Summary

Function with $k > 0$	Transformation
$f(x) + k$	Shifts vertically up k units
$f(x) - k$	Shifts vertically down k units
$f(x + k)$	Shifts horizontally left k units
$f(x - k)$	Shifts horizontally right k units
$-f(x)$	Reflects vertically about the x -axis
$f(-x)$	Reflects horizontally about the y -axis
$kf(x)$	Stretch/Shrink vertically by a factor of k
$f(kx)$	Stretch/Shrink horizontally by a factor of $1/k$

Even and Odd Functions

Even Function	Odd Function
For all values of x in the domain of $f(x)$: $f(-x) = f(x)$	For all values of x in the domain of $f(x)$: $f(-x) = -f(x)$
Symmetric about the <u>y-axis</u> . This means the part of the graph to the left of the y -axis is the mirror image of the part to the right of the y -axis.	Symmetric about the <u>origin</u> . This means that if the graph is reflected across the x -axis and then reflected across the y -axis, the graph is unchanged.
If $f(x)$ is even and has the point $(2,-7)$, what other point must be on the graph?	If $f(x)$ is odd and has the point $(2,-7)$, what other point must be on the graph?
Example: Is $f(x) = x^4 + x^2 - 5$ even or odd? $f(-x) = (-x)^4 + (-x)^2 - 5$ $= x^4 + x^2 - 5$ $= f(x)$ This is an even function.	Example: Is $f(x) = x^3 + x$ even or odd? $f(-x) = (-x)^3 + (-x)$ $= -x^3 - x$ $= -f(x)$ This is an odd function.

Note: $f(x) = x^4 + x^3 - 5$ is neither even nor odd. Do you see why?