# MAT123

Symmetry

# Even/Odd Functions

A function is <u>even</u> if $f(-x) = f(x)$ for all $x$-values in the domain

$$ex: \; g(x) = x^4 - 3x^2$$

$$g(-x) = (-x)^4 - 3(-x)^2$$

$$= x^4 \quad - 3x^2 \; = g(x)$$

since $g(-x) = g(x)$
$g(x)$ is an <u>even</u> function

A function is <u>odd</u> if $f(-x) = -f(x)$ for all $x$-values in the domain

$$ex: \; h(x) = x^3 - 6x$$

$$h(-x) = (-x)^3 - 6(-x)$$

$$(-x)^3 = (-x)(-x)(-x)$$

$$= -x^3$$

$$= -x^3 + 6x \quad \text{factor out negative}$$

$$= -(x^3 - 6x)$$

$$= -h(x)$$

since $h(-x) = -h(x)$
$h(x)$ is an <u>odd</u> function

Example of neither:
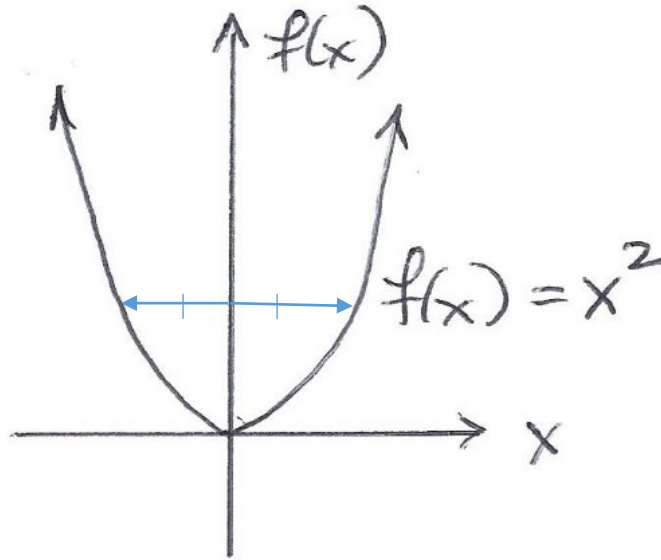
$$f(x) = x^2 + 2x + 1$$

$$f(-x) = x^2 - 2x + 1 \quad \neq f(x) \quad \neq -f(x)$$

$f(x)$ is <u>neither</u> even nor odd

# Even/Odd - Symmetry on a Graph

Even functions have <u>y-axis</u> symmetry:

ex. $f(x) = x^2$



Odd functions have <u>origin</u> symmetry:

ex. $f(x) = x^3$