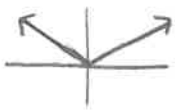
A function is an **Even Function** if $f(-x) = f(x)$

- when x is replaced w/ $-x$, function stays the same

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

- symmetric w/ respect to the y-axis

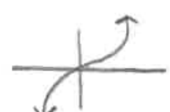
ex) 

A function is an **Odd Function** if $f(-x) = -f(x)$

- when x is replaced w/ $-x$, every term of the function changes sign
  * a neg. can be factored out & it is neg (original function)

ex) $f(x) = x^3 + x$ $\quad f(-x) = (-x)^3 + (-x) = -x^3 - x$
$= -(x^3 + x)$

- symmetric w/ respect to the origin

ex) 

1. Determine (algebraically) whether the function is **even**, **odd**, or **neither**.

a. $f(x) = x^3 + x$ $\boxed{\text{odd}}$

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

b. $f(x) = x^2 + 2x$ $\boxed{\text{neither}}$

$f(-x) = (-x)^2 + 2(-x)$
$= x^2 - 2x$

c. $f(x) = 2x^2 + 3x^4 + 1$ $\boxed{\text{even}}$

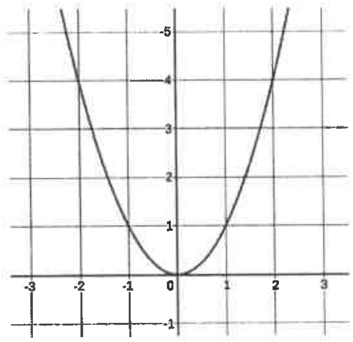
$f(-x) = 2(-x)^2 + 3(-x)^4 + 1$
$= 2x^2 + 3x^4 + 1$

d. $f(x) = 2x^3 - 6x^5$ $\boxed{\text{odd}}$

$f(-x) = 2(-x)^3 - 6(-x)^5$
$= -2x^3 + 6x^5$
$= -(2x^3 - 6x^5)$

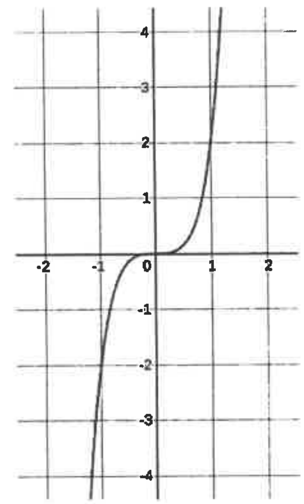
2. Use the graphs below to determine whether the relations are **even, odd,** or **neither**.

a.



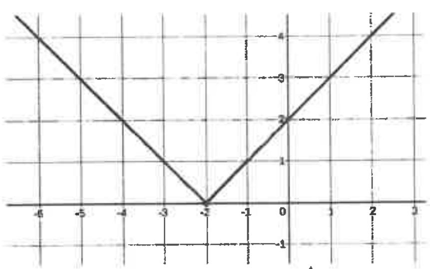
even

c.



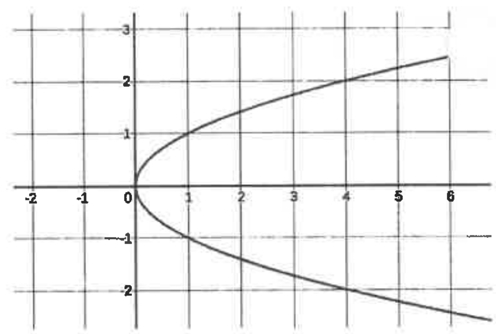
odd

b.



neither

d.



neither

Observations that can be made about even/odd functions

- even → all exponents even
  can include a vertical shift

- odd → all exponents odd
  cannot include vertical or horizontal shifts