

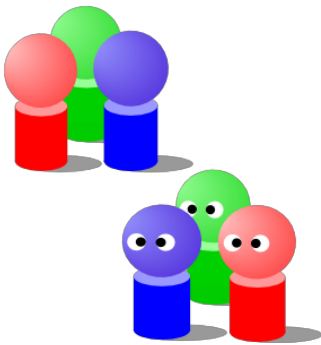
Warm Up: If $f(x) = x^3 + 4$:

inverse

WARM UP!

(a) find $f^{-1}(x)$

(b) Prove this is the inverse



(a) $x = y^3 + 4$

$$\sqrt[3]{x-4} = \sqrt[3]{y^3}$$

$$\sqrt[3]{x-4} = f^{-1}(x)$$

(b) $(\sqrt[3]{x-4})^3 + 4$

$$x - 4 + 4$$

x

OR

$$\sqrt[3]{x^3 + 4 - 4}$$

$$\sqrt[3]{x^3}$$

x

Today I can identify even & odd functions.

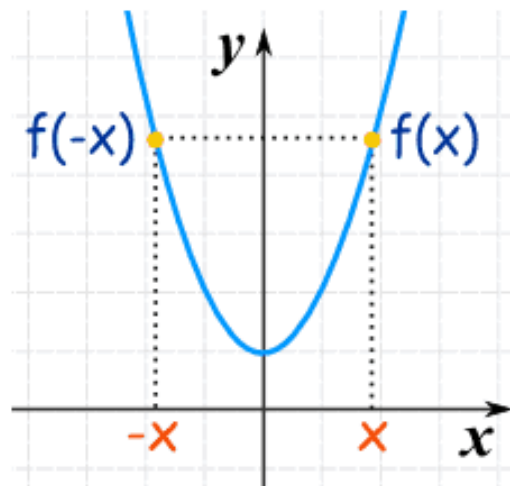
Even Functions

A function is "even" when:

$$f(x) = f(-x) \text{ for all } x$$

In other words there is symmetry about the y-axis (like a reflection):

If you substituted $(-x)$ for all x -values, you get back the original function



look at the table in the calculator:

X	Y1
-3	10
3	10

X = -3

This is the curve $f(x) = x^2 + 1$

$$f(x) = f(-x)$$

$$f(2) = f(-2)$$

*Symmetric over y-axis

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

$$= x^2 + 1$$

get back original

How to determine even, odd, or neither algebraically???? *if and only if*

A function f is **even** iff each x in the domain of f $f(-x) = f(x)$.

-Plug in $-x$ for each x & get original back!!!

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

$$= x^2 - 1$$

$f(x)$ is even b/c $f(-x)$ gives back the original $f(x) = f(-x)$

Odd Functions

A function is "odd" when:

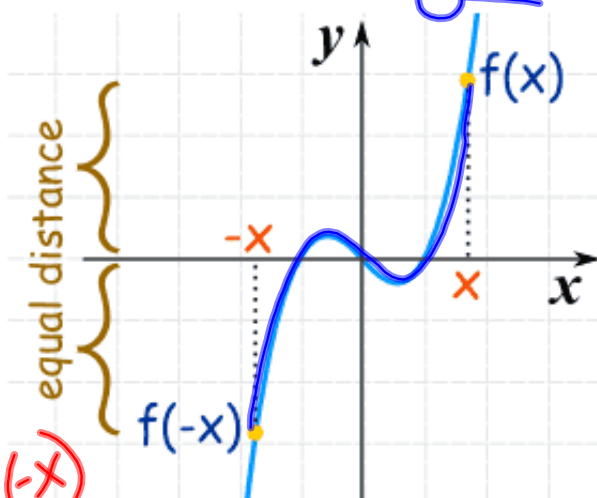
$$-f(x) = f(-x) \text{ for all } x$$

Note the minus in front of f: $-f(x)$.

180° Rotation thru
Origin

And we get origin symmetry:

If you substituted $(-x)$ for all x -values, you get back the negation of the function



look at the table in the calculator:

X	Y1
-3	-24
-2	-6
0	0
2	6
3	24

Press + for Δ Tbl

$$-f(x) = f(-x)$$

This is the curve $f(x) = x^3 - x$

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

$$-x \cdot x \cdot x$$

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

negation of original

$$(-3, -24) \quad (3, 24)$$

How to determine even, odd, or neither algebraically????

A function f is **odd** iff each x in the domain of f $f(-x) = -f(x)$.

-Plug in $-x$ for each x & factor out a -1!!!

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

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

$f(-x) = -f(x)$

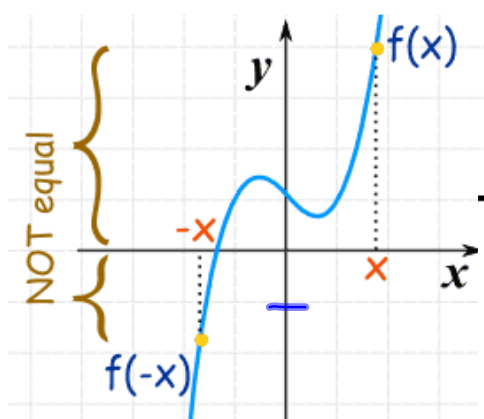
$f(x)$ is odd
 b/c $f(-x)$ gives
 back the negation

Neither Odd nor Even

Don't be misled by the names "odd" and "even" ... they are just **names** ... and a function does **not have to be** even or odd.

In fact most functions are neither odd nor even. For example, just adding 1 to the curve above gets this:

If you substituted $(-x)$ for all x -values, you neither get back the original nor negation of the function



look at the table in

X	Y1
-3	-23
-2	-5
-1	1
0	1
1	7
2	25

Press + for Δ

This is the curve $f(x) = x^3 - x + 1$

It is **not an odd function**, and it is **not an even function** either.

It is neither odd nor even!

$$\begin{aligned}
 f(-x) &= (-x)^3 - (-x) + 1 \\
 &= \underbrace{-x^3 + x}_{\text{neg.}} + \underbrace{1}_{\text{same}}
 \end{aligned}$$

Neither

How to determine even, odd, or neither algebraically????

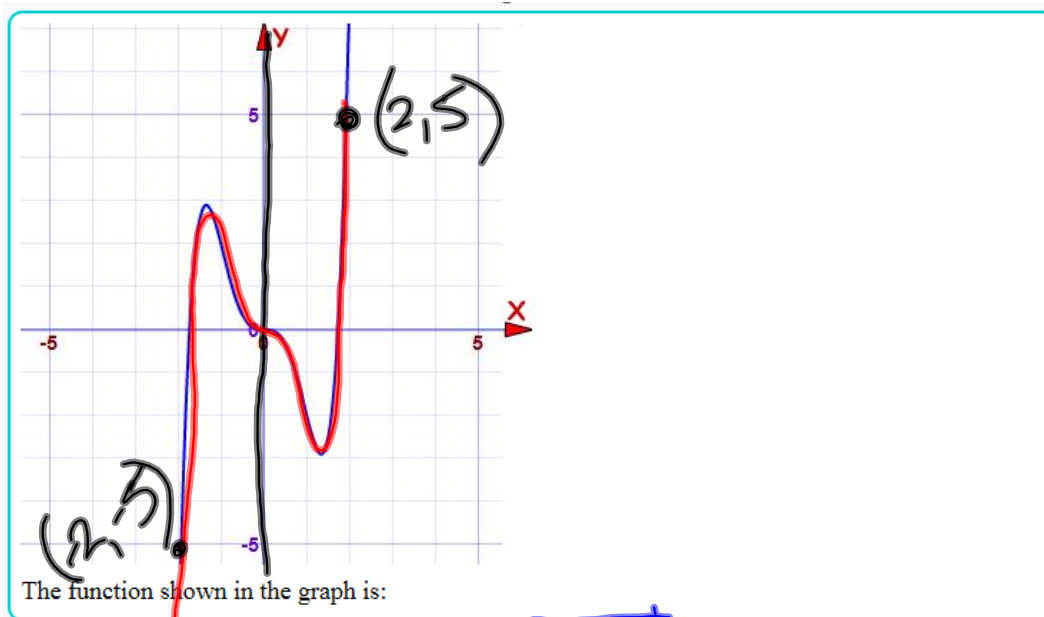
If neither rule works, then it is neither even nor odd!!!

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

$$\begin{aligned} f(-x) &= (-x)^2 + (-x) - 1 \\ &= x^2 - x - 1 \end{aligned}$$

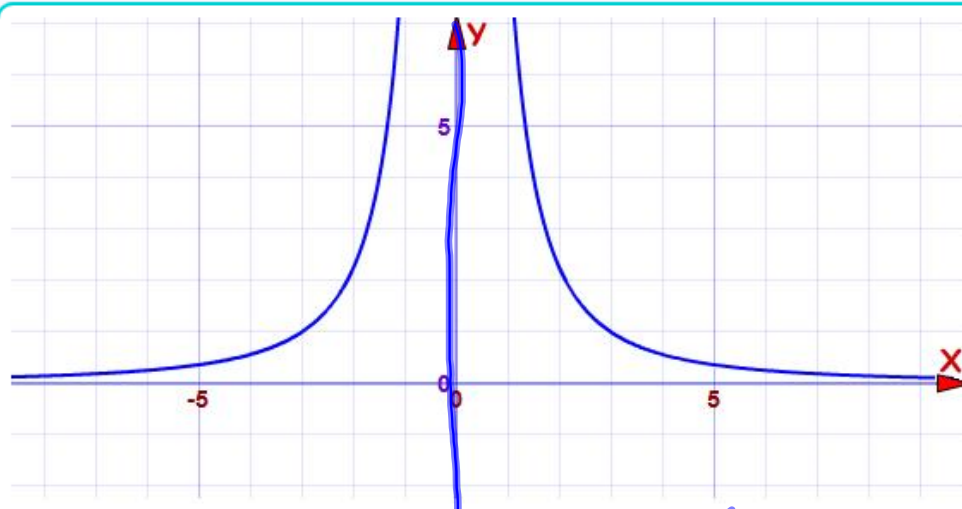
Neither b/c
 $f(-x)$ doesn't
give back the
original or negation

$$\begin{aligned} f(-x) &\neq f(x) \\ &\text{and} \\ f(-x) &\neq -f(x) \end{aligned}$$



- A Even y-axis sym.
- B Odd 180° Rot. thru (0,0)
- C Neither even nor odd
- D Both even and odd





The function shown in the graph is:

A Even

B Odd

C Neither even nor odd

D Both even and odd

reflection over y-axis





1) $f(x) = |x|$

X	Y1
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3

Even

2) $g(x) = x^3 - x^1$ ← every exp. is odd

3) $f(x) = 2x^3 - 3x^2 - 4x^1 + 4x^0$
Neither

4) $f(x) = 10x^1 + 5x^0$
Neither



5) $f(x) = x\sqrt{x+5}$

X	Y1
-3	-4.243
-2	-3.464
-1	-2
0	0
1	2.4495
2	5.2915
3	8.4853

Neither

Determine whether each f(x) is even, odd, neither.

- 1) even
- 2) odd
- 3) neither
- 4) neither
- 5) neither

a) $f(x) = x^2 - 5$

Determine whether each $f(x)$ is even, odd, neither.

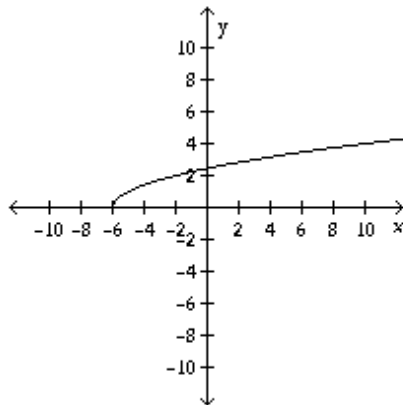
b) $g(x) = x^3 - 1$



c) $h(x) = 5x^3 - x$

The graph of a function is given. Decide whether it is even, odd, or neither.

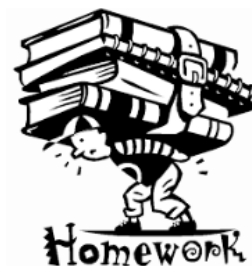
• 5)



- A) Neither
- B) Even
- C) Odd



Homework: Finish anything from the previous pages in the packet that we didn't get to in class.



Attachments

Mental Math Multiplication.ppt

Simplifying Rational Exponents.pdf