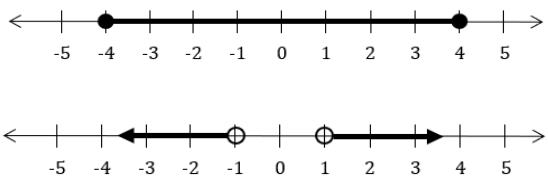
Learning Goal Check!

1. Consider each of the following. Graph the relation on a number line.

$|x| \geq 3$ $|x| < 4$

2. From the graph, state the relation.



3. Graph the following and state the domain and range.

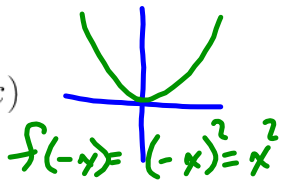
$f(x) = |x + 2| - 1$

1.03 - Properties of Graphs and Functions

Learning Goals:

- I can determine the important properties of functions from their equations.
- I can compare properties between parent functions, and within a parent function's family.
- I can prove algebraically and graphically that a function is even, odd or neither.

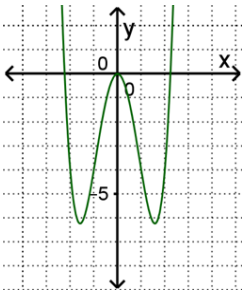
An **even** function is symmetrical on the *y*-axis.
Algebraically, all even functions have the property $f(-x) = f(x)$



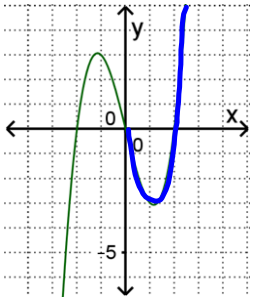
An **odd** function has rotational symmetry about the origin, or is symmetrical through the origin.
Algebraically, all odd functions have the property $f(-x) = -f(x)$

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

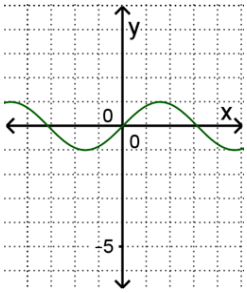
Ex. 1 Determine if each function is even, odd, or neither.



EVEN



ODD



ODD

$f(x) = x^3$

$f(-x) = (-x)^3$
$= -x^3$
$= -f(x)$
$\therefore$ ODD

$f(x) = x^2$

$f(-x) = (-x)^2$
$= x^2$
$= f(x)$
$\therefore$ EVEN

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

$f(-x) = (-x)^3 + (-x)^2$
$= -x^3 + x^2$
$= -(x^3 - x^2)$
NEITHER

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

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

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

$f(-x) = (-x)^4 + 2(-x)^3$
$= x^4 - 2x^3$
$= -(-x^4 + 2x^3)$
NEITHER

A **transformation** is a geometric operation, such as a translation, reflection and compression.

Each transformation is performed on a parent relation. There are many parent relations. A **parent function** belongs to the set of parent relations and is the simplest function in a family of functions. For example, the family of quadratic functions are all constructed from $y = x^2$.

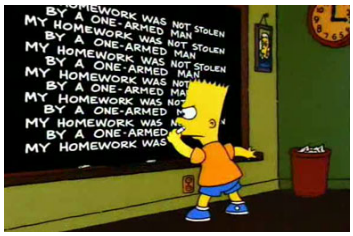
Ex. 2 Complete the table of properties for each of the following functions.

Function	$f(x) = x$	$f(x) = \|x\|$	$f(x) = x^2$	$f(x) = \frac{1}{x}$	$f(x) = \sqrt{x}$	$f(x) = 2^x$	$f(x) = sin(x)$
Domain	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$ $x \neq 0$	$x \geq 0$	$x \in \mathbb{R}$	$x \in \mathbb{R}$
Range	$y \in \mathbb{R}$	$y \geq 0$	$y \geq 0$	$y \in \mathbb{R}$ $y \neq 0$	$y \geq 0$	$y > 0$	$-1 \leq y \leq 1$
Zeroes	$x = 0$	$x = 0$	$x = 0$	NONE	$x = 0$	NONE	90° n
y-int	y-int $= 0$	y-int $= 0$	y-int $= 0$	NONE	$y = 0$	$y = 1$	0
Interval of increase	$x \in \mathbb{R}$	$x > 0$	$x > 0$	NONE	$x > 0$	$x \in \mathbb{R}$	
Interval of decrease	N/A	$x < 0$	$x < 0$	$x \in \mathbb{R}$ $x \neq 0$	N/A	N/A	
Even or Odd	ODD	EVEN	EVEN	ODD	NEITHER	NEITHER	ODD
VA	N/A	N/A	N/A	$x = 0$	N/A	N/A	N/A
HA	N/A	N/A	N/A	$y = 0$	N/A	$y = 0$	N/A
As $x \to \infty$	$y \to \infty$	$y \to \infty$	$y \to \infty$	$y \to 0$	$y \to \infty$	$y \to \infty$	
As $x \to -\infty$	$y \to -\infty$	$y \to \infty$	$y \to \infty$	$y \to 0$	N/A	$y \to 0$	

Practice:

Do: pg. 23 #3*, 4ad, 5**, 6, 7, 8, 10***, 15

* Error in answer: the function can be derived from <u>any</u> $y=b^x$, for any valid "b"),
** The instructions are poor. Simply apply what was learned today in the lesson.
*** In #10a, in the <u>instructions</u> for the question change $(-\infty,-2)$ to $(-\infty,2]$



positive 2

square bracket