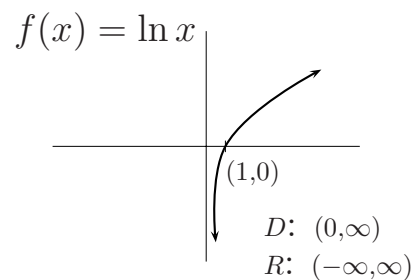
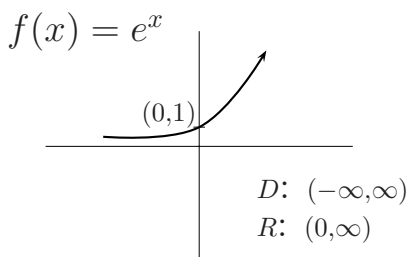
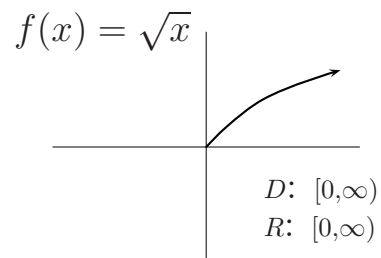
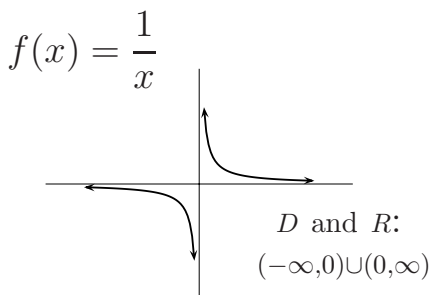
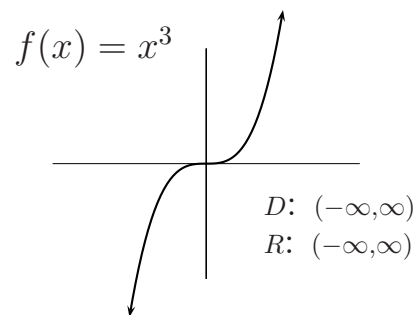
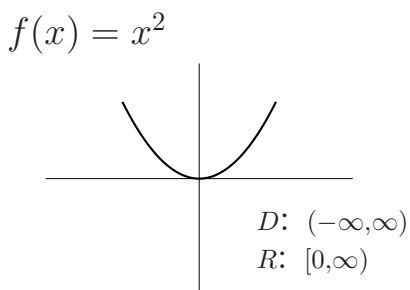
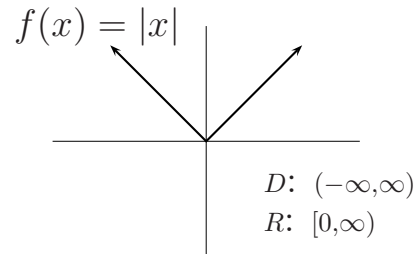
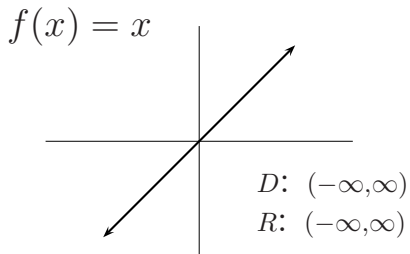

MATH 150 – TOPIC 1
FUNCTIONS

This section covers functions and their basic characteristics including domain and range, symmetry, graphs and transformations.

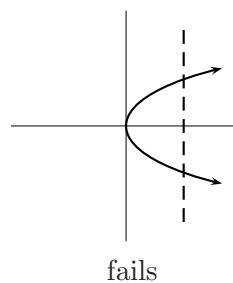
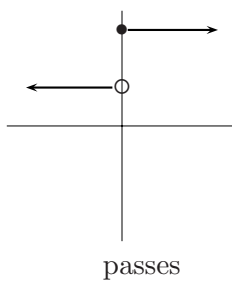
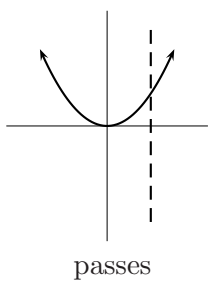
- I. Graphs of Commonly Used Functions
- II. Vertical Line Test
- III. Even and Odd Functions
- IV. Transformations

Practice Problems

- I. Here are the graphs of some commonly used functions. The domain and range are included. Remember, the domain of a function consists of all x such that $f(x)$ is defined and real.



- II. All functions must pass the Vertical Line Test. That means, any vertical line will intersect the graph at a single point.

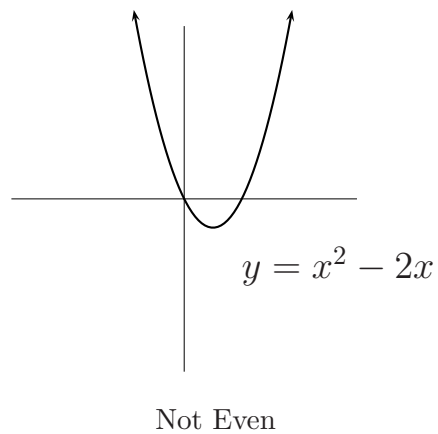
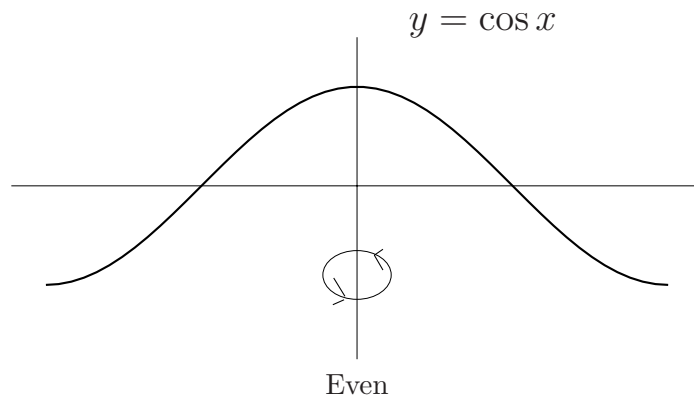
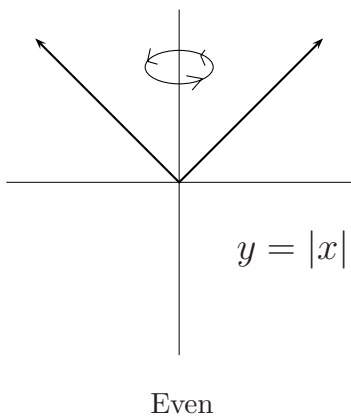


This graph does not represent a function.

III. Some functions may be referred to as EVEN or ODD.

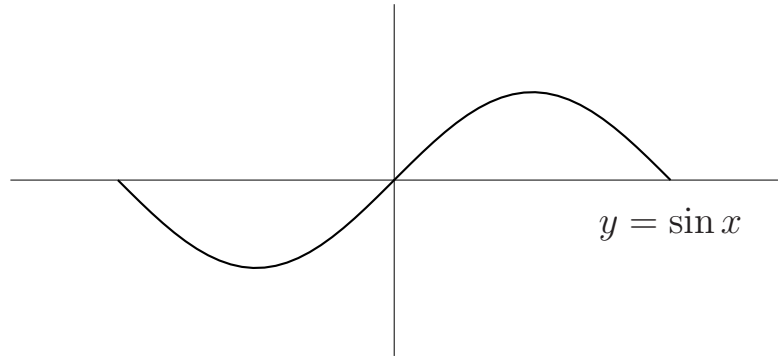
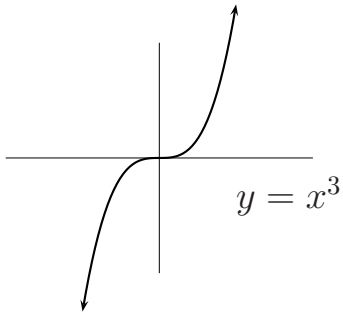
1. Def. of EVEN:
- $f(-x) = f(x)$

Even functions are symmetric about the y axis. Imagine this as a rotation around the y axis. Such a function guarantees that if (a, b) is a point on f , so is $(-a, b)$. Here are two examples of an even function, and one that is not.



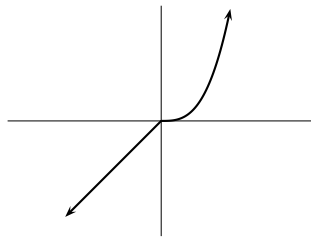
III. 2. Def. of ODD: $f(-x) = -f(x)$

Odd functions are symmetric with respect to the origin. Picture this as a rotation about the y axis and also about the x axis. An Odd function guarantees that if (a, b) is a point on f , so is $(-a, -b)$. Here are 2 examples:

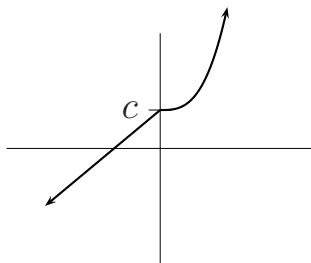


IV. Transformations: SHIFTS and REFLECTIONS

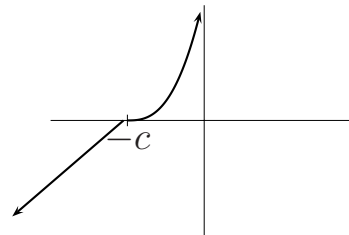
Suppose $f(x)$ has the following graph and c is some positive number



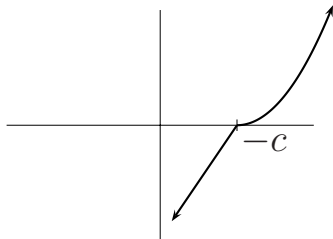
a) $f(x) + c$ is a vertical shift of \underline{c} units



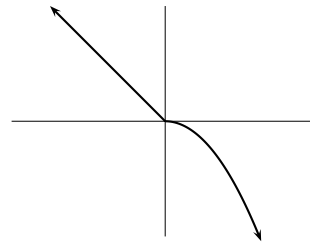
b) $f(x + c)$ is a horizontal shift of $\underline{-c}$ units



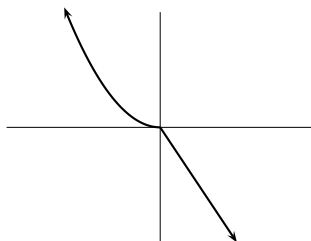
c) $f(x - c)$ is a horizontal shift of \underline{c} units



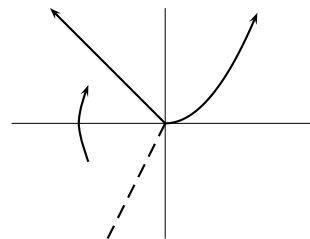
d) $-f(x)$ is a reflection about the x axis



e) $f(-x)$ is a reflection about the y axis



f) $|f(x)|$ is like a partial reflection. Negative values of $f(x)$ are rotated "up"



PRACTICE PROBLEMS for Topic 1 – Functions

1.1. State the domain of each.

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

Ex. $f(x) = \frac{\sqrt{x - 2}}{x - 3}$

b) $g(x) = \frac{x - 1}{(x + 2)^2}$

Solution: $\sqrt{x - 2}$ is real for $x \geq 2$. Since $f(3)$ is undefined, 3 must be excluded.

c) $h(x) = \sqrt{x - 1}$

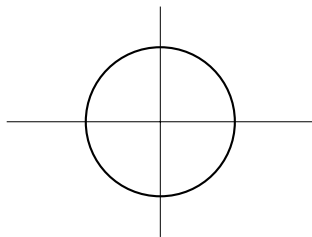
d) $t(x) = \sqrt[3]{x - 1}$

D: $[2, 3) \cup (3, \infty)$

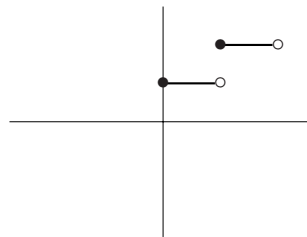
e) $s(t) = \ln(2 - t)$

1.2. Indicate whether the graph represents a function. Recall that all functions must pass the VLT.

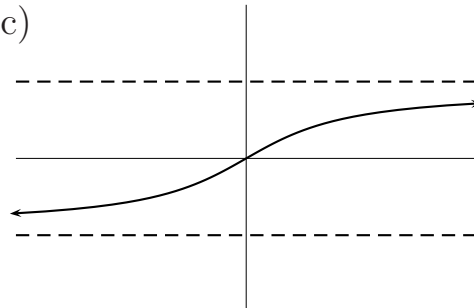
a)



b)



c)

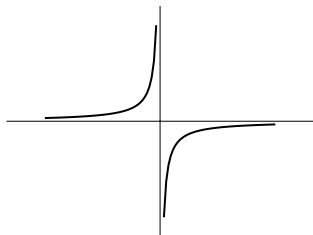


1.3. Indicate whether each function is even, odd, or neither.

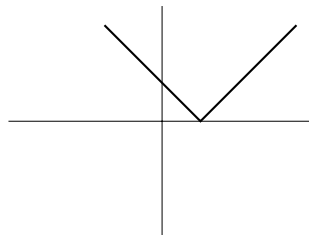
a) $f(x) = x + 2$

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

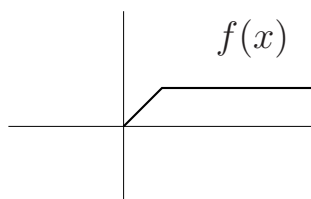
c)



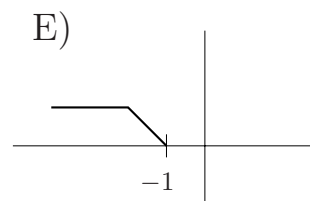
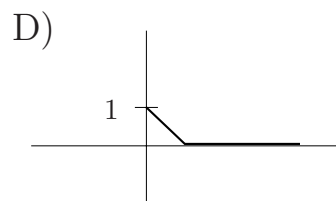
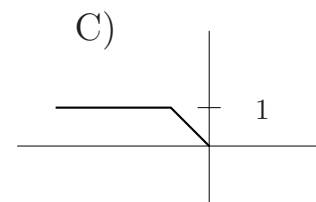
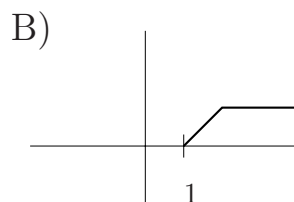
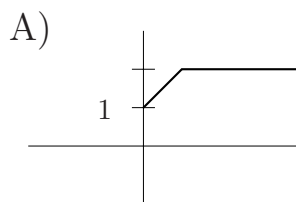
d)



1.4. Suppose $f(x)$ has the following graph.



Using transformations, match each graph with one of the functions listed below.



Match to:

$f(x + 1)$

$f(x - 1)$

$-f(x) + 1$

$f(x) + 1$

$f(-x)$

$f(1 - x)$

$-f(x + 1)$

$-f(x)$

ANSWERS to PRACTICE PROBLEMS (Topic 1 – Functions)

- 1.1 a) all reals b) all reals, $x \neq -2$
c) $x \geq 1$ d) all reals e) $t < 2$

Here are the same answers in interval form:

- a) $(-\infty, \infty)$ b) $(-\infty, -2) \cup (-2, \infty)$
c) $[1, \infty)$ d) $(-\infty, \infty)$ e) $(-\infty, 2)$
- 1.2 a) is not a function, b) and c) are functions.
- 1.3 a) neither b) even
c) odd d) neither
- 1.4 A) $f(x) + 1$ B) $f(x - 1)$
C) $f(-x)$ D) $-f(x) + 1$
E) $f(1-x)$ “Reflection” of the function in B

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[150 Review Topics](#)

[Skills Assessment](#)