

$$\begin{array}{r} x^2 \quad 1 \quad 1 \\ 3 \quad 1 \quad 3 \quad 3 \quad 1 \end{array}$$

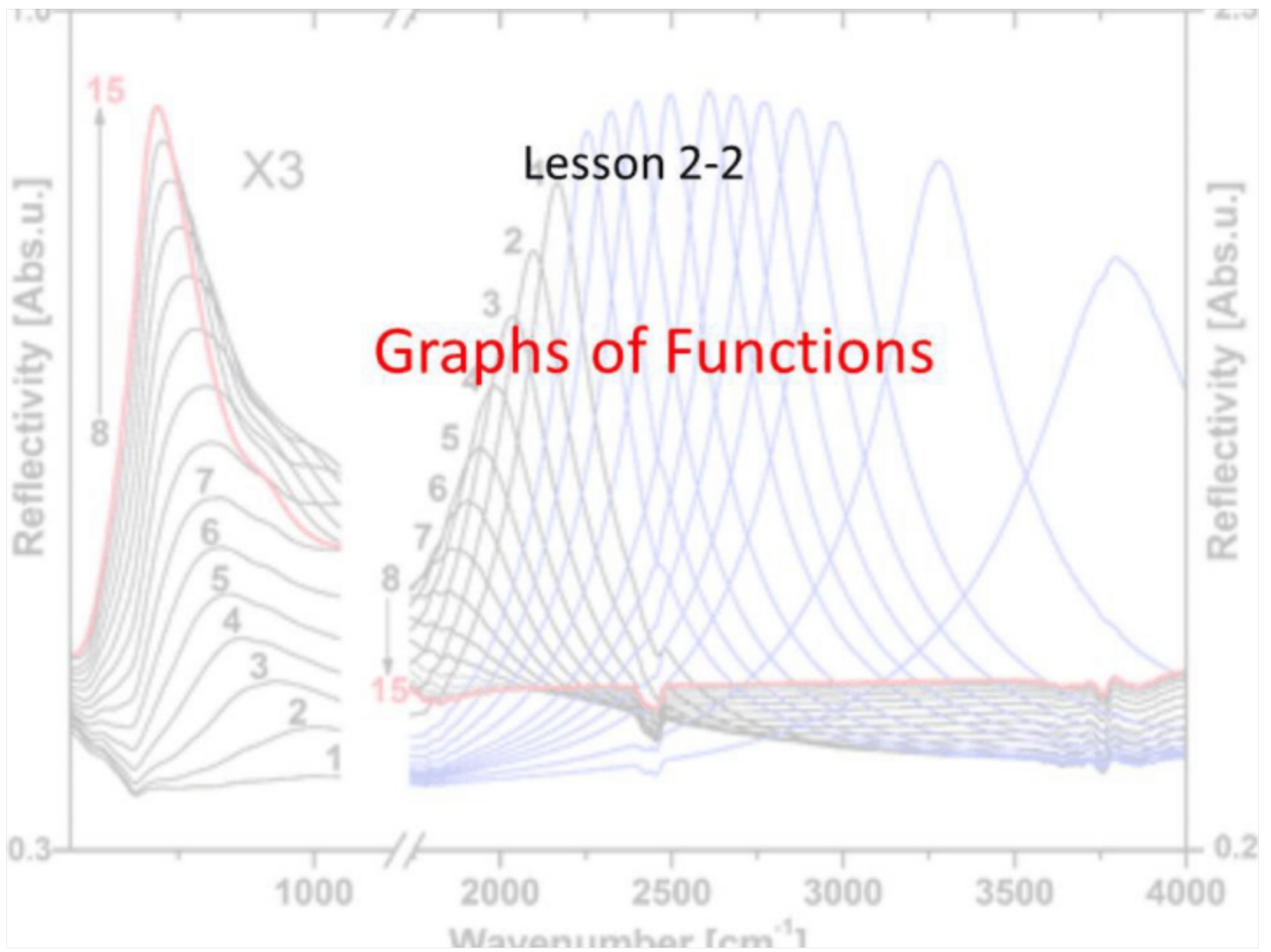
Warm Up 9/5

Let $f(x) = x^3$. Evaluate $f(a)$, $f(a+h)$, $f = \frac{f(a+h)-f(a)}{h}$

$$f(a) = a^3$$

$$f(a+h) = (a+h)^3 = a^3 + 3a^2h + 3ah^2 + h^3$$

$$\frac{\cancel{a^3} + 3a^2h + 3ah^2 + h^3 - \cancel{a^3}}{h} = \frac{h(3a^2 + 3ah + h^2)}{h}$$



Objective

Students will...

- Be able to make a table of values for a given function.
- Be able to graph each function using its table of values.
- Be able to determine the domain and the range of each function from its graph.

Four Ways of Representing a Function

To help us understand what a function is, we have used machine and arrow diagrams. We can represent a functional relationship in following ways:

1. Verbally (by a description in words)
2. Algebraically (by an explicit formula)
3. Visually (by a graph)
4. Numerically (by a table of values)

Four Ways to Represent a Function

Four Ways to Represent a Function

Verbal

Using words:

$P(t)$ is "the population of the world at time t "

Relation of population P and time t

Algebraic

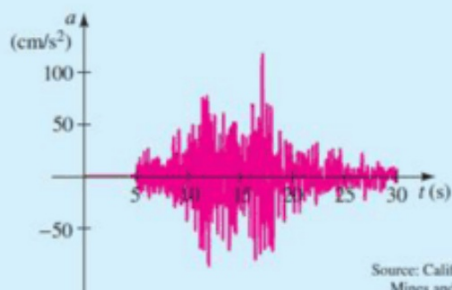
Using a formula:

$$A(r) = \pi r^2$$

Area of a circle

Visual

Using a graph:



Vertical acceleration during an earthquake

Numerical

Using a table of values:

w (ounces)	$C(w)$ (dollars)
$0 < w \leq 1$	0.37
$1 < w \leq 2$	0.60
$2 < w \leq 3$	0.83
$3 < w \leq 4$	1.06
$4 < w \leq 5$	1.29
\vdots	\vdots

Cost of mailing a first-class letter

Functions and their Graphs

If f is a function with domain A , then the graph of f is the set of ordered pairs: $\{(x, f(x)) \mid x \in A\}$

(x, y)

such that

"contained" in

In other words, the graph of f is the set of all points (x, y) such that $y = f(x)$; that is, the graph of f is the graph of the equation $y = f(x)$.

$(1, 2)$

Hence, we can place each **input** and **output** as an ordered pair, namely, $(input, output)$.

x y
 x $f(x)$

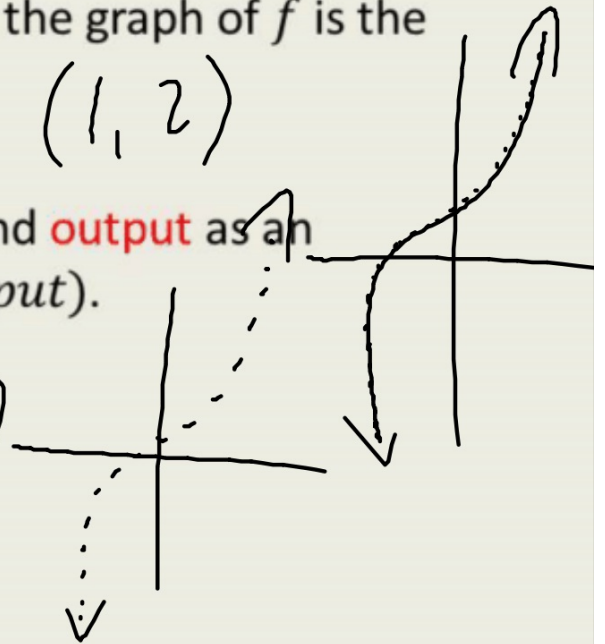


Table of Values

Thus, we can graph every function the way we first learned how to graph- by making a table of values. Consider the following functions:

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

$$g(x) = x^3$$

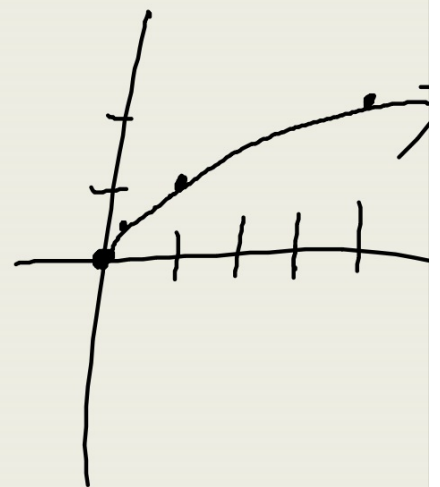
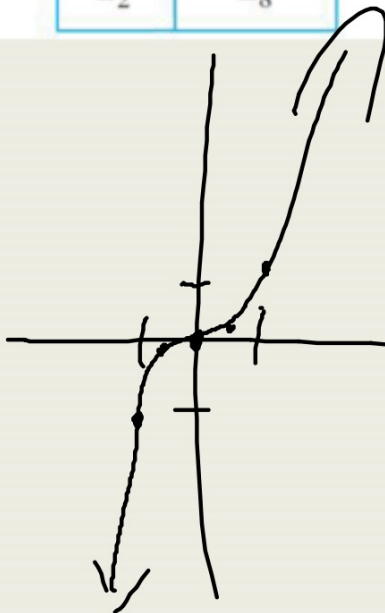
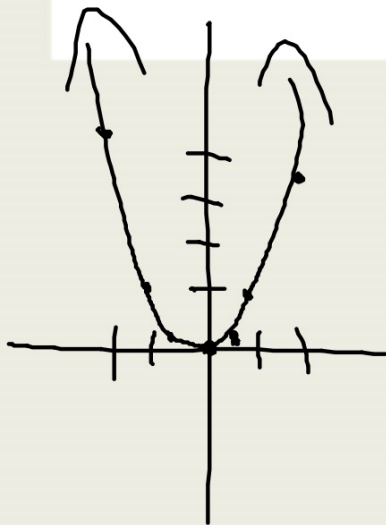
$$h(x) = \sqrt{x}$$

Graphing Functions (Mother functions)

x	$f(x) = x^2$
0	0
$\pm\frac{1}{2}$	$\frac{1}{4}$
± 1	1
± 2	4
± 3	9

x	$g(x) = x^3$
0	0
$\frac{1}{2}$	$\frac{1}{8}$
1	1
2	8
$-\frac{1}{2}$	$-\frac{1}{8}$
-1	-1
-2	-8

x	$h(x) = \sqrt{x}$
0	0
1	1
2	$\sqrt{2}$
3	$\sqrt{3}$
4	2
5	$\sqrt{5}$



Getting Information from the Graph

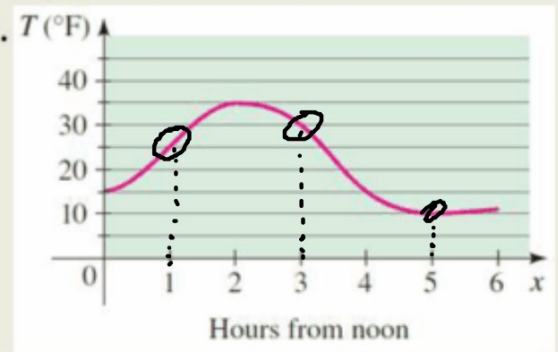
The values of a function are represented by the y-coordinates of its graph. So, we can read off the values of a function from its graph.

Ex. The function T graphed gives the temperature between noon and 6 P.M. at a certain weather station.

a. Find $T(1)$, $T(3)$, $T(5)$.

25 30 10

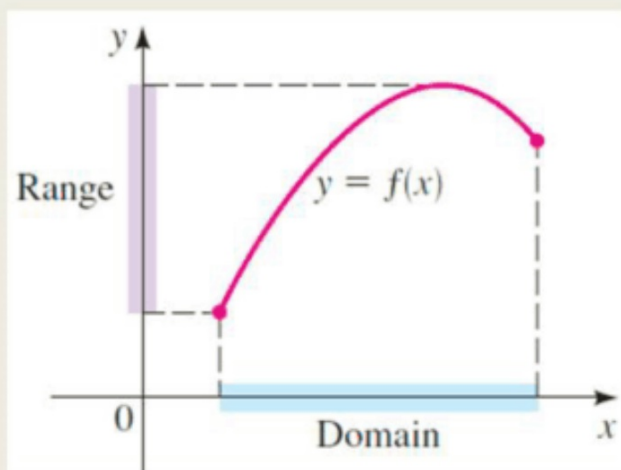
b. Which is larger, $T(2)$ or $T(4)$?



Domain and Range from Graphs

You can also determine the **domain** and the **range** of functions from their graphs. Remember that domain is all possible **x -values**, while the range is the all possible **y -values**. So, from the graph the domain is always from the lowest **x -coordinates** to the highest **x -coordinates**. Likewise, the range is from the **lowest y -coordinates** to the highest **y -coordinates**.

Ex.

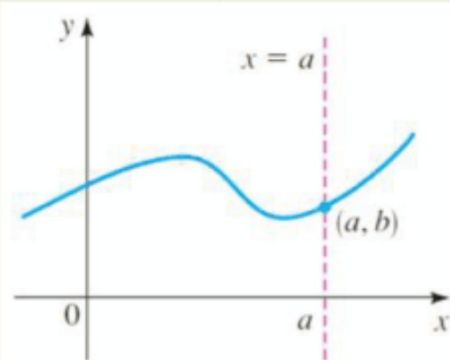


Vertical Line Test

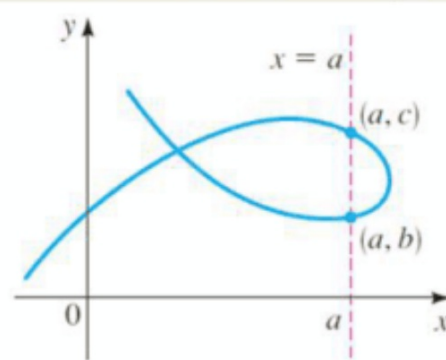
Remember that in a function, for every input there is exactly one output. Graphically this means that for every x -value there must be only one y -value. Thus, a **vertical line test** can be used on a graph of any given expression to determine whether it is a function.

Vertical Line Test- A curve in the coordinate plane is the graph of a function if and only if no vertical line intersects the curve **more than once**.

Ex.



Graph of a function



Not a graph of a function

Homework 9/5

TB pg. 167-169 #1, 4, 6, 11, 23, 24, 57-60