Warm Up 9/5

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

$f(a) = a^3$

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

$$\frac{a^3+3a^2h+3ah^2+h^3-a^3}{h}$$

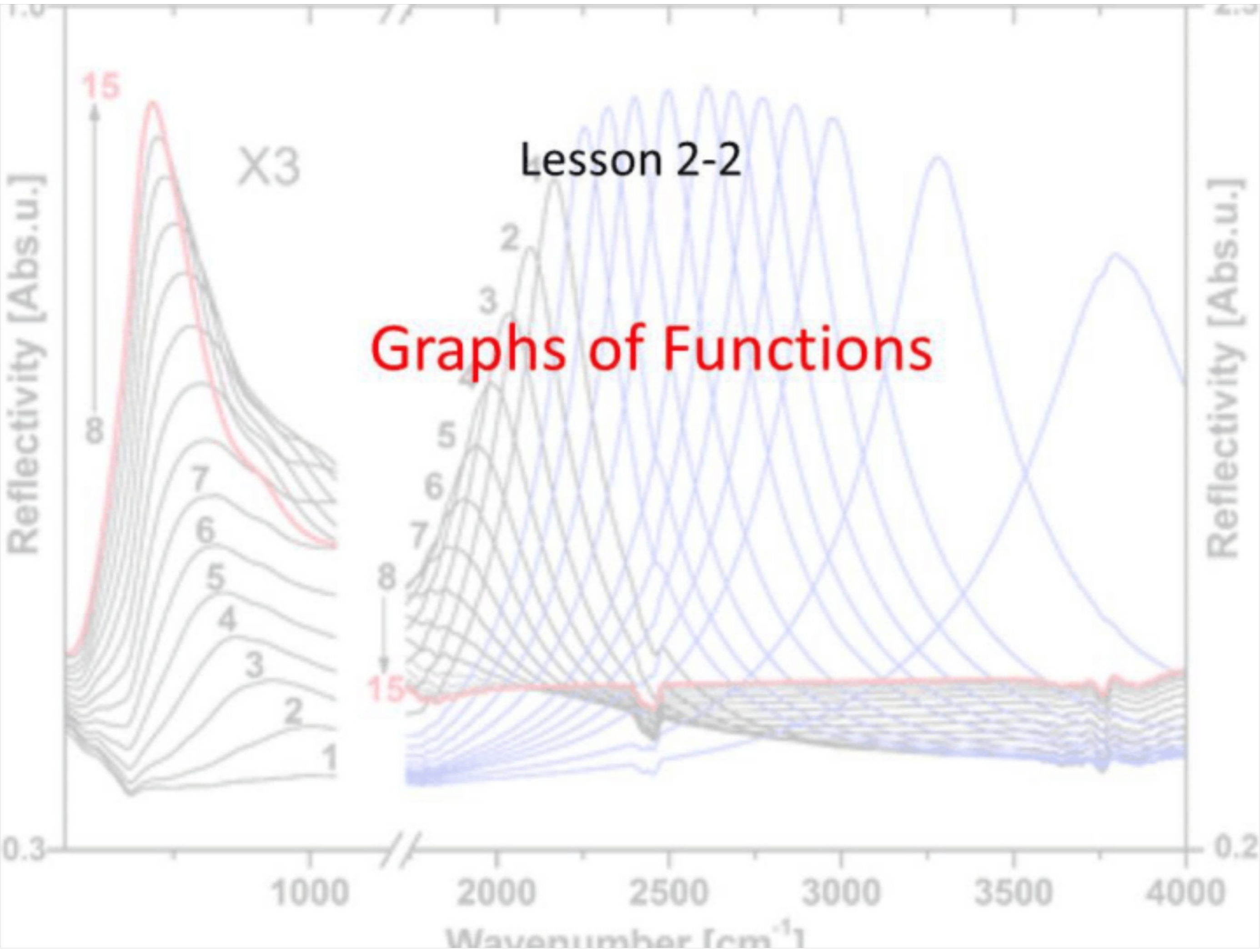
$$= \frac{3a^2h+3ah^2+h^3}{h}$$

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

$$= 3a^2+3ah+h^2$$

Lesson 2-2

Graphs of Functions



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

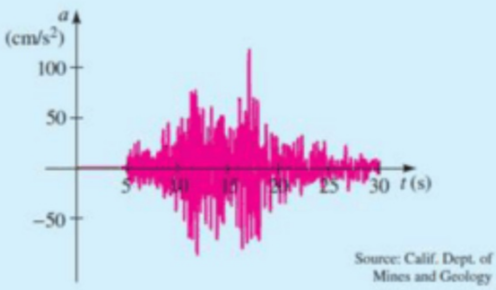
Using a formula:

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

Area of a circle

Visual

Using a graph:



Vertical acceleration during an earthquake

Numerical

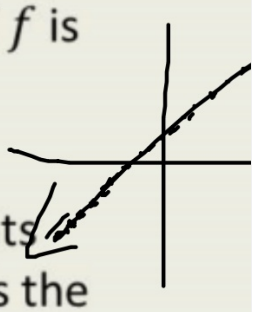
Using a table of values:

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
⋮	⋮

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: $\{(x, f(x)) \mid x \in A\}$



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 $y = f(x)$.

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

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:

$f(x) = x^2$ $\qquad$ $g(x) = x^3$ $\qquad$ $h(x) = \sqrt{x}$

x	f(x)
-1	1
0	0
1	1

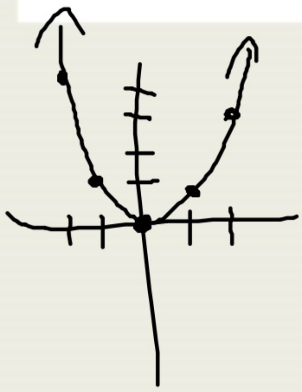
Graphing Functions

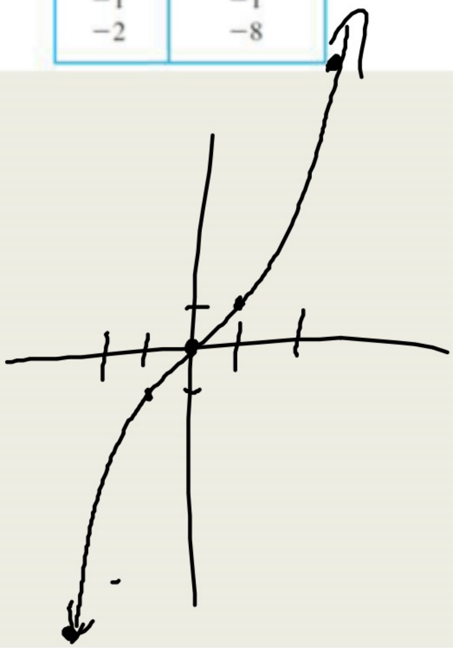
parent functions

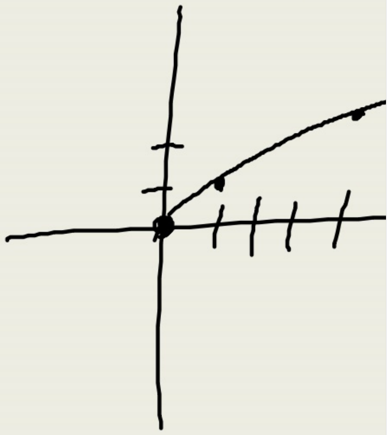
x	$f(x) = x^2$
0	0
$\pm\frac{1}{2}$	$\frac{1}{4}$
± 1	1
± 2	4
± 3	9

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	$\sqrt{5}$



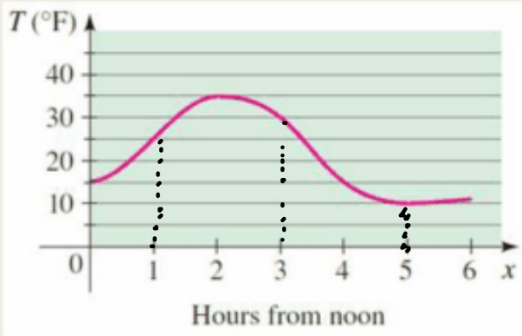




Getting Information from the Graph

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

$T(1) = 25°$ $T(5) = 10°$

$T(3) = 30°$

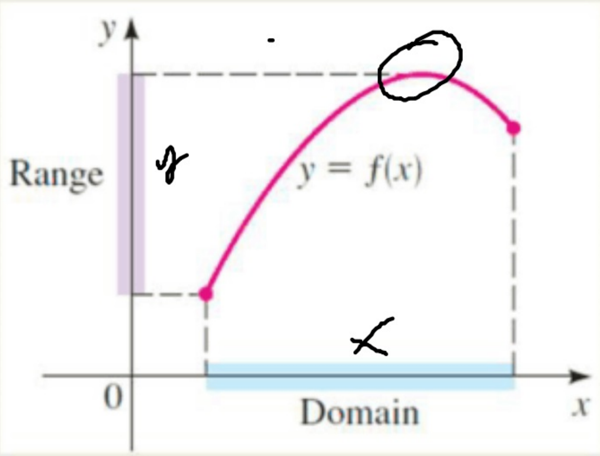
b. Which is ~~larger,~~ hotter $T(2)$ or $T(4)$?

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.

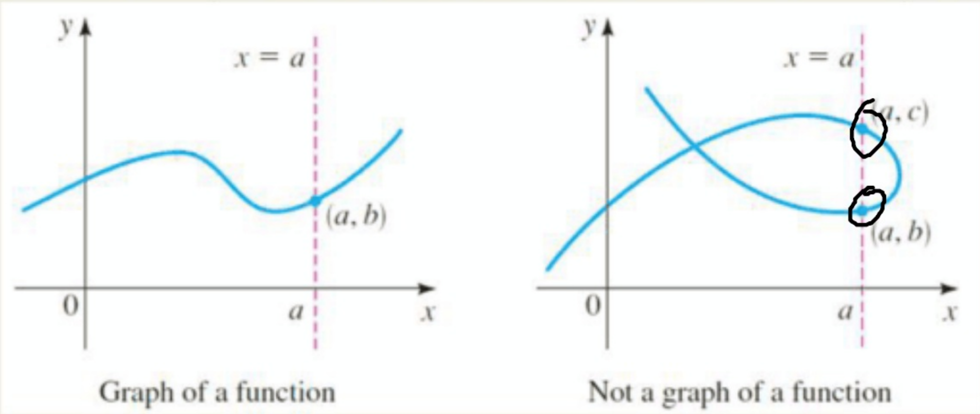


Vertical Line Test

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.



Homework 9/5

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