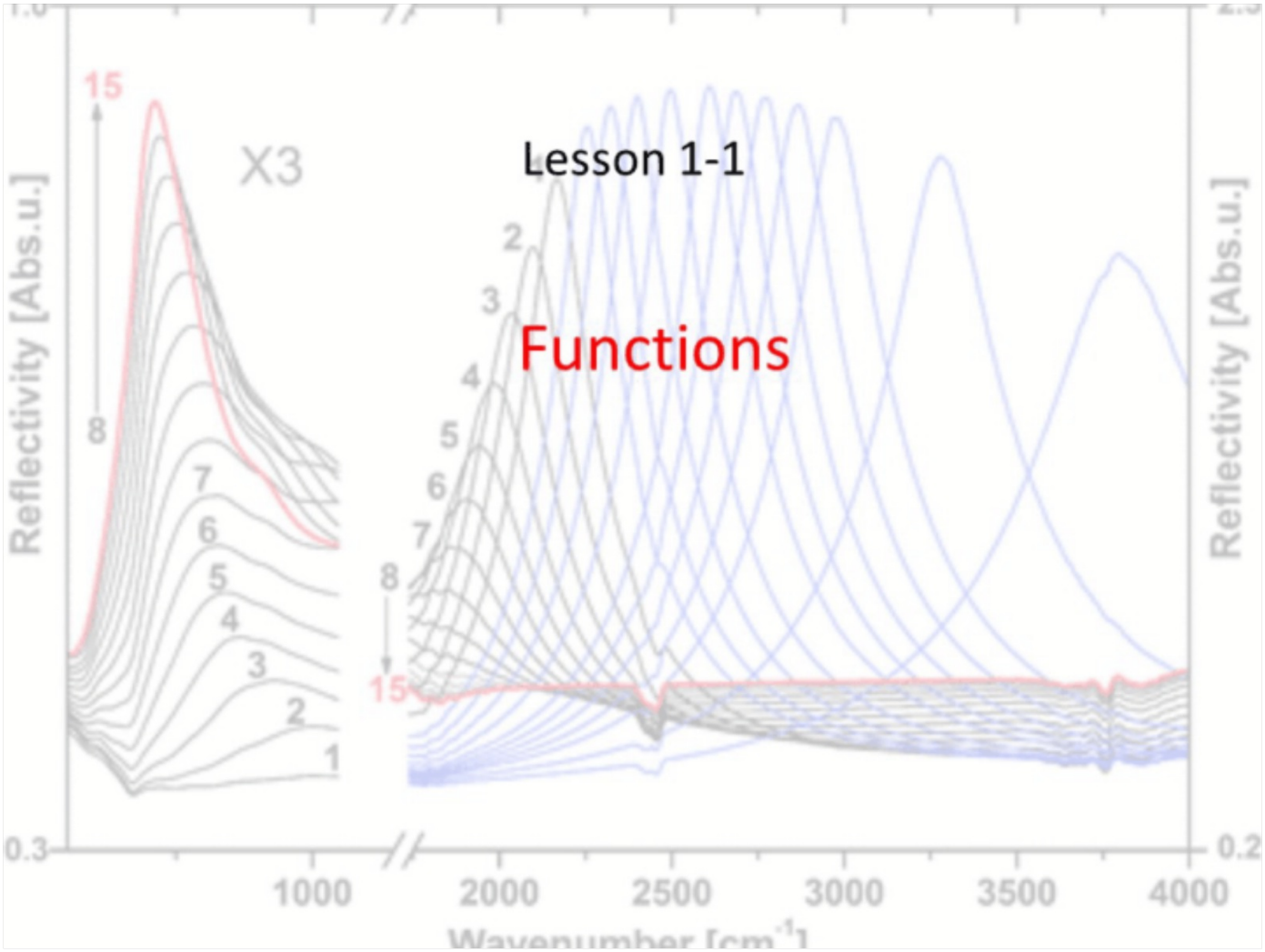

Lesson 1-1
Functions
X3
15
8
7
6
5
4
3
2
1
Reflectivity [Abs.u.]
Reflectivity [Abs.u.]
0.3
0.2
1000
2000
2500
3000
3500
4000
Wavenumber [cm-1]

Objective

Students will...

- Be able to define what an input and an output is.
- Be able to define what a function is.

Functional Relationship

A **functional relationship** is a relationship in which one quantity **depends** on another. In other words, given two variables, one is always **dependent** on the other.

ex. Height is a function of age

Temperature is a function of date

Cost of mail is a function of weight.

Independent vs Dependent Variables

That being said, we must always be able to define both the independent and dependent variables.

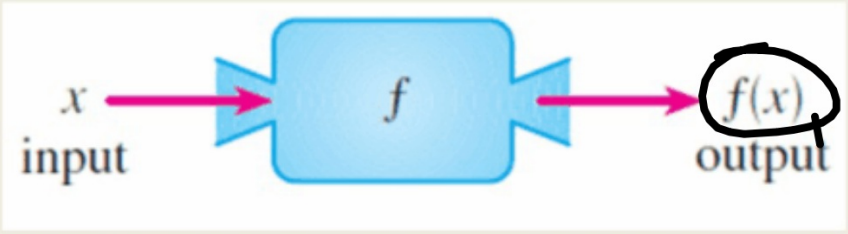
ex. Height is a function of age.

Temperature is a function of date.

Cost of mail is a function of weight.

Input vs Output

Mathematically speaking, we can also differentiate the independent and the dependent variables as inputs and outputs. Consider the following picture:



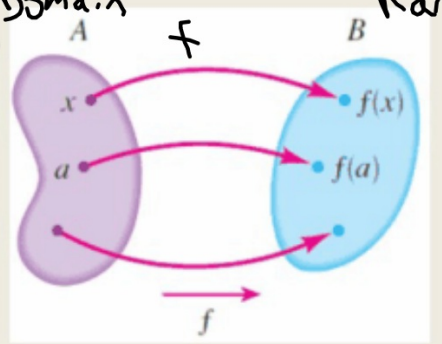
Here the function "f" is the rule that the machine operates in, and what comes out depends on what goes in.

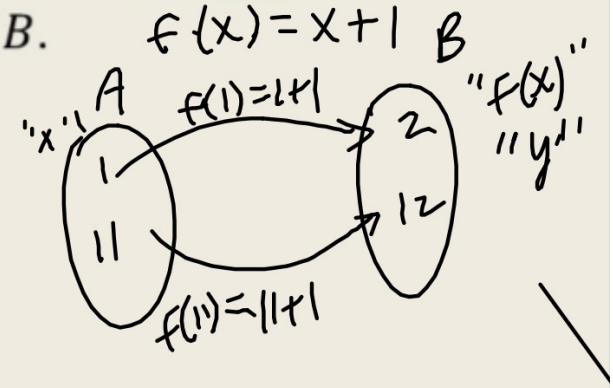
Definition of a Function

So now we are ready to define what a function is.

A **function**, say f, is a rule that assigns to each element (item) x in a certain set A **exactly one** element, called $f(x)$, in a set B.

Ex. Domain Range.





The set A is also known as the **domain**, and set B is known as the **range**.

Examples of Functions

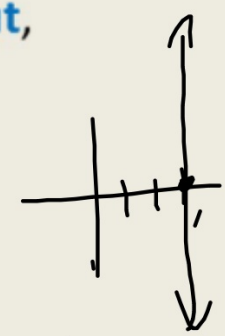
Another way to define function is for every **input**, there is exactly **one** **output**.

Ex.

$f(x) = x - 3$

Ex:

$x = 3$



Not a function.

$f(x) = x^2$

$f(2) = 2^2 = 4$

$f(-2) = (-2)^2 = 4$

Evaluating Functions

Consider the function $f(x) = x - 3$

Here, x is the input, while $f(x)$ is the output. That being said, $f(x)$ would change as x changes. We can evaluate functions by placing different inputs. For the above function,

$$f(1) = (1) - 3 = -2$$
$$f(2) = (2) - 3 = -1$$
$$f(0) = (0) - 3 = -3$$
$$f(-3) = (-3) - 3 = -6$$

PEMDAS

Examples

Let $f(x) = 3x^2 + x - 5$. Evaluate each function value.

1. $f(-2) = 3(-2)^2 + (-2) - 5$

$= 3(4) - 2 - 5$

$= 12 - 2 - 5$

$= \boxed{5}$

2. $f(0)$

3. $f(4)$

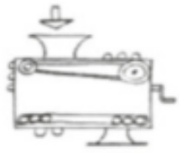
4. $f(\frac{1}{2})$

FUNCTION MACHINES

Obtain a set of four function machines (Lesson 1.1.1C Resource Pages). Your team's job is to stack the machines in a particular order so that one machine's output becomes the next machine's input. As you work, discuss what you know about the kind of output each function produces to help you arrange the machines in the order that produces each result described below. The four functions are reprinted below.

$f(x) = \sqrt{x}$ $g(x) = -(x-2)^2$

$h(x) = 2^x - 7$ $k(x) = -\frac{x}{2} - 1$



In what order should you stack the machines so that when 6 is dropped into the first machine, the last machine output is 1?

Examples

Use the function to evaluate the indicated expression.

2 times f(x)

$f(x) = 3x - 1; f(2x), 2f(x)$

$F(2x) = 3(2x) - 1$

$= 6x - 1$

$2f(x) = 2(3x - 1)$

$= 6x - 2$

Homework Due 8/14

Review and Preview WKSHT