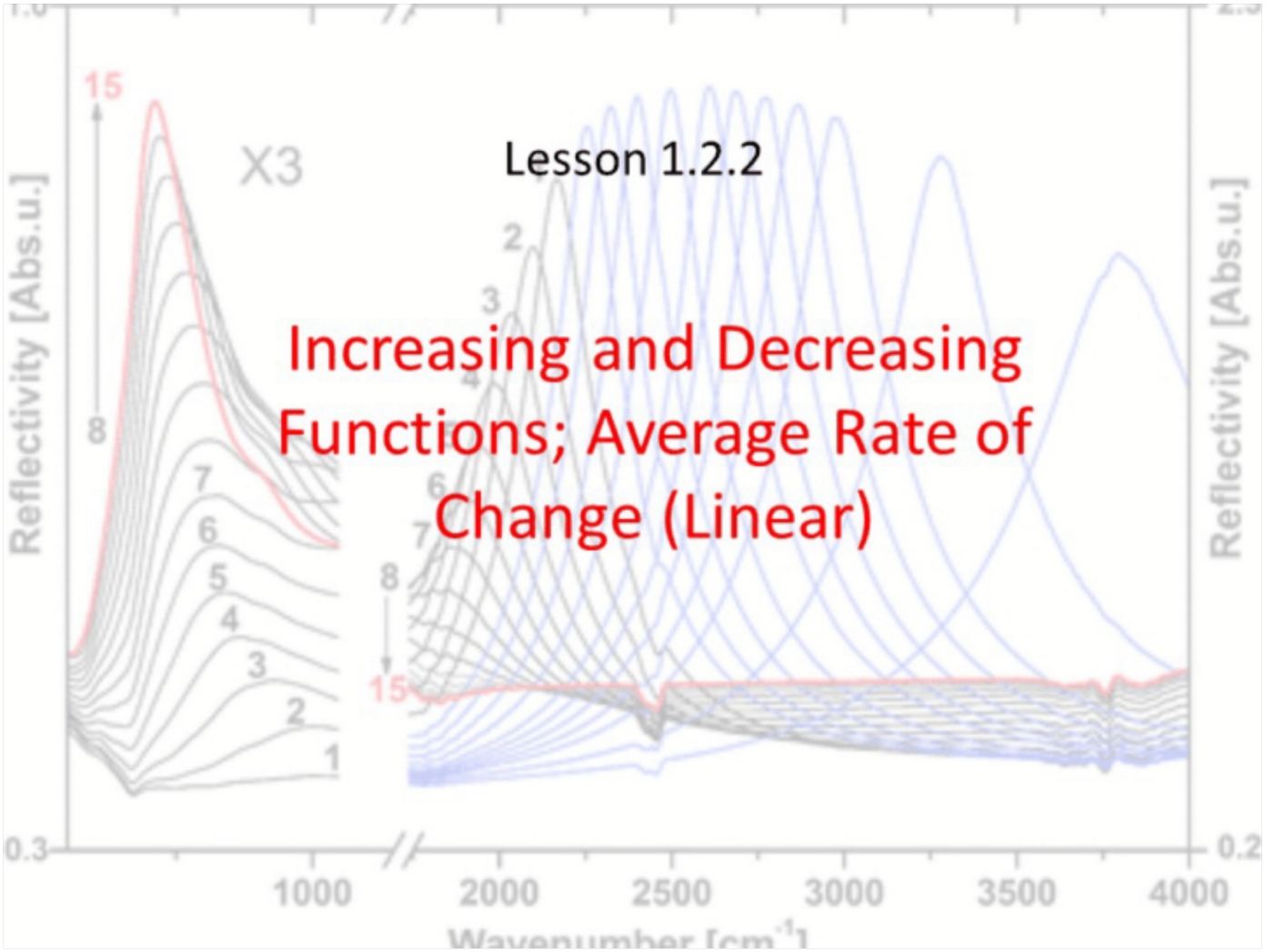

Lesson 1.2.2
Increasing and Decreasing Functions; Average Rate of Change (Linear)
Reflectivity [Abs.u.]
Reflectivity [Abs.u.]
X3
15
8
1
2
3
4
5
6
7
8
15
1000
2000
2500
3000
3500
4000
0.3
0.2
Wavenumber [cm-1]

Objective

Students will…

- Be able to determine whether a function is increasing or decreasing using graphs and algebraically.
- Be able to compute the average rate of change, or slope, and use it to write the equation of a linear line.

Increasing and Decreasing Functions

Functions are often used to model changing quantities. Thus, it's important to see and analyze where a function is **increasing** or **decreasing**.

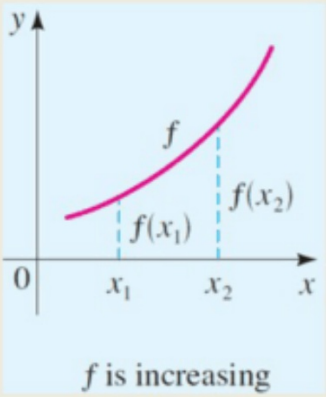
A function, say f is…

Increasing on an interval I if $f(x_1) < f(x_2)$ whenever $x_1 < x_2$ in I.
Decreasing on an interval I if $f(x_1) > f(x_2)$ whenever $x_1 < x_2$ in I.

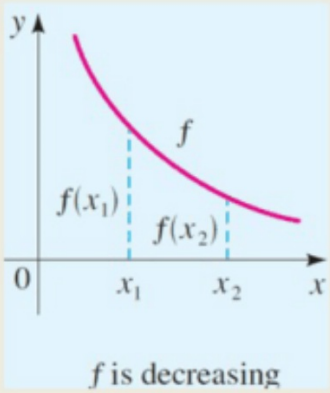
In other words, when a bigger number is **inputted**, the **output** of an **increasing** function is greater, while the **output** of a decreasing function is smaller.

Graphs of Increasing and Decreasing Functions

Increasing and decreasing functions can also be easily seen graphically.



f is increasing



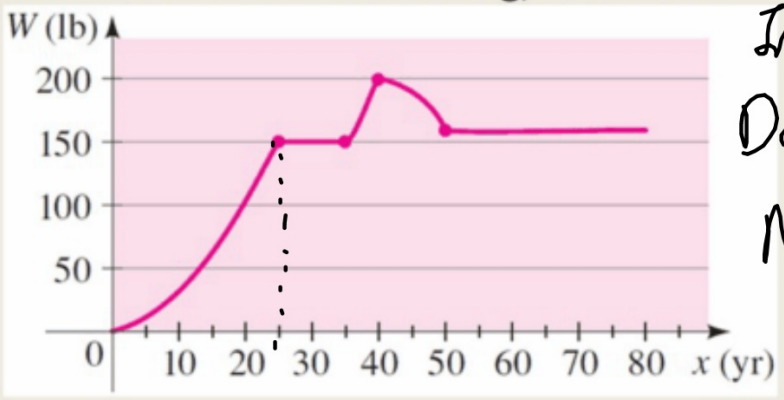
f is decreasing

Thus, when viewing the graph from **left to right**, if the graph is rising the function is increasing, and vice-versa.

"x"

Examples

Determine the intervals on which the function W is increasing and on which it is decreasing, or neither.



Inc: [0, 25], [35, 40]

Dec: [40, 50]

Nei: [25, 35], [50, 80]

Average Rate of Change (Linear)

Sometimes it is important to find how much a graph has increased or decreased within a certain interval. One of the most useful ways to analyze such change is calculating the **average rate of change**.

average rate of change: $\frac{f(b)-f(a)}{b-a} = \frac{change\ in\ y}{change\ in\ x} = \frac{y_2-y_1}{x_2-x_1} = \frac{rise}{run}$

As you can see the average rate of change is really the **slope** of the line connecting the **two endpoints** of a given interval.

Linear Functions

Functions with a constant (slope) rate of change is known as a linear function. Linear functions are represented in the form $y = mx + b$, where m is the average rate of change (slope), and b is the y- intercept (x=0). Note: X-intercept ($y=0$)

Ex. Identify the slope and the y-intercept of the following linear functions. Determine if the function is increasing or decreasing.

a. $f(x) = x + 1$

$m=1$, y-int: 1

Inc.

b. $f(x) = 2x + 11$

$m=2$ y-int: 11

Inc.

c. $f(x) = -5x - 9$

$m=-5$ y-int: -9

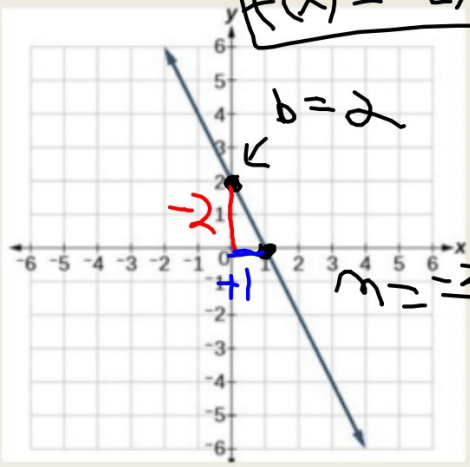
Dec.

$y = mx + b$

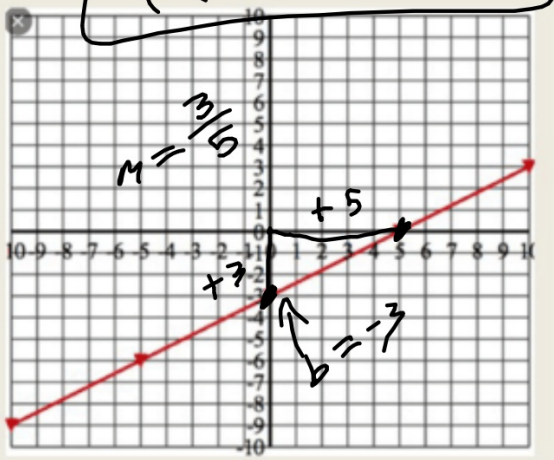
Example

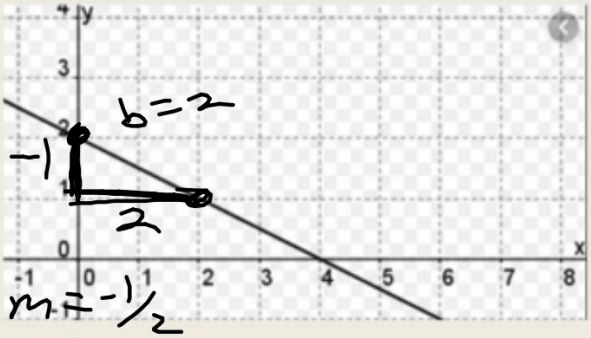
Write the linear function that is represented by the following graphs.

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

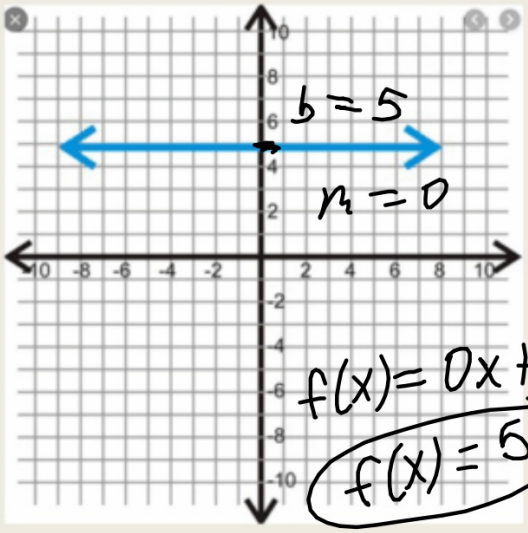


$f(x) = \frac{3}{5}x - 3$





$f(x) = \frac{-1}{2}x + 2$



$f(x) = 0x + 5$

$f(x) = 5$

Homework 8/20

Increasing/Decreasing and Slope WKSHT