• Instructor: He Wang wang.he1@husky.neu.edu
• Office hours: M,W 3:00pm-4:30pm, at 527 Nightingale Hall.
• Lectures: 4:35 pm – 5:40 pm MWR, Robinson Hall 107.

1. About the Syllabus:

Read the Syllabus carefully!!

Materials:
• Text book + EWA(Enhanced Web Assin),
• Class Packet(2015Fall),
• Calculator(Only TI-83, TI-83plus, TI-84, or TI-84plus)

Using Blackboard:
• Syllabus,
• Solutions to quiz reviews, quizzes, homework...
• My class notes
• ...

2. Question: How to be good at mathematics?
Answer:
.....
Practice!! : (Examples,) Quiz reviews, Homework, EWA
.....
3. Prerequisites and Backgrounds:

All of these are in the Chapter 1 of the book. We will have Quiz 1 tomorrow. The problems are similar with Quiz1 Review in the Class Packet. It is about the prerequisite for this class.

Numbers:
• Real numbers $\mathbb{R}$: 3, $-2/5$, $\sqrt{2}$, $\sqrt[3]{5}$, $5^{\frac{1}{3}}$, π, $\mathbf{e}$, ...

Functions:
▶ *How to describe a function?*
1. Numerically(using numbers), 2. Algebra(using formula), 3. Graph

Example: $f(x) = 2x + 1$.

▶ *Very important examples:* (algebra)
• Linear functions $f(x) = kx + b$. Slope?
• Exponential functions $f(x) = a \cdot b^x$, for $a \neq 0$, $b > 0$.
• Logarithmic (log) function $f(x) = \ln(x)$.

- Logistic function $f(x) = \dfrac{L}{1 + Ae^{-Bx}}$ for $L > 0, A > 0$ (will be reviewed in class).
- Quadratic function $f(x) = ax^2 + bx + c$. how to factor?
- Cubic function $f(x) = ax^3 + bx^2 + cx + d$.

▶*Properties of a function:*
Addition, subtraction, multiplication, division, **composition** of functions,
graph of a function, increasing or decreasing, concave-up, concave-down...

3. Measure of Change over an interval

- $f(x)$ is a function. $x_0 < x_1$ are **two** input values.

- **Change**

$$\boxed{\text{change} = f(x_1) - f(x_0)}$$

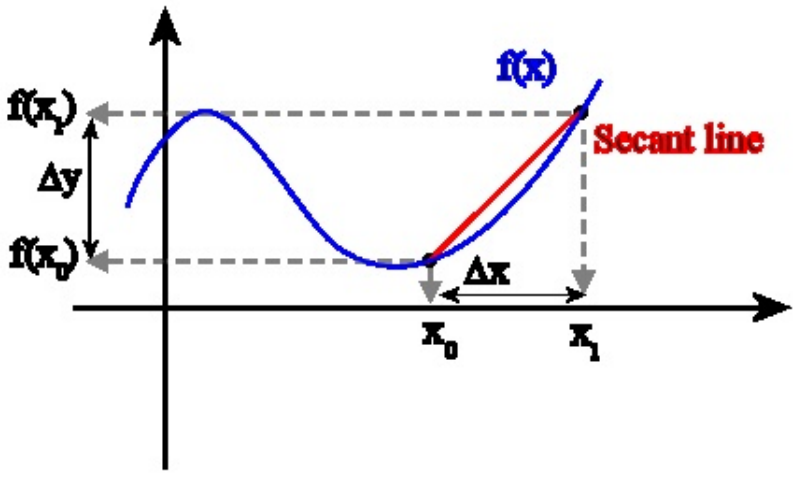
- **Percentage Change**

$$\boxed{\text{percentage change} = \frac{f(x_1) - f(x_0)}{f(x_0)} \cdot (100\%)}$$

- **Average rate of Change**

$$\boxed{\text{average rate of change} = \frac{f(x_1) - f(x_0)}{x_1 - x_0}}$$

If I put a box surround some thing, that means we need to memorize it.



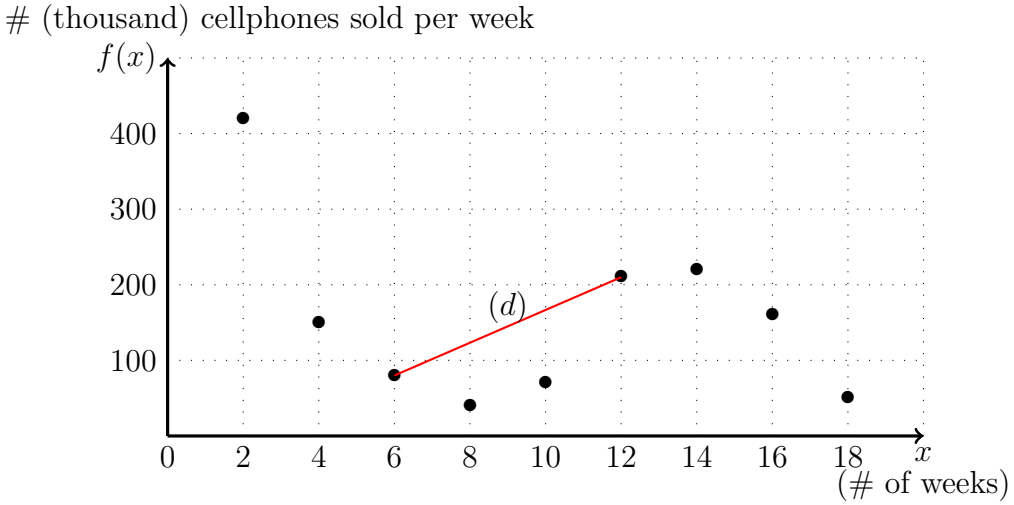
$$\boxed{\text{average rate of change} = \text{slope of the secant line}}$$

4. Example. The following table gives the number (in thousands) of cellphones sold per week after it is released. Show work and give **units** for each answer.

$x = \#$ of weeks	2	4	6	8	10	12	14	16	18
# (thousand) cellphones sold per week	420	150	80	40	70	210	220	160	50

(a). **Draw and label axes appropriately.** Indicate the scale on each axis. Then plot the data.

Answer:



(b). According to the table, what is the *change* in cellphones sold per week from the 6 weeks to the 12 weeks?

Answer:

change $= f(12) - f(6) = 210 - 80 = 130$ thousands cellphones per week.

(c). According to the table, what is the *percentage change* in cellphones sold per week from the 6 weeks to the 12 weeks? Round to two decimal places.

Answer:

$$\text{percentage change} = \frac{f(12) - f(6)}{f(6)} \cdot (100\%) = \frac{210 - 80}{80} \cdot (100\%) = 162.50\%$$

(d). According to the table, what is the *average rate of change* in in cellphones sold per week from the 6 weeks to the 12 weeks? Round to two decimal places.

Answer:

$$\text{average rate of change} = \frac{f(12) - f(6)}{12 - 6} = 21.67 \text{ thousands cellphones per week per week.}$$

(e). Draw and label a line segment through two of the points that you plotted in part (a) whose slope is given by the answer to part (d).

Answer: The red line in the graph.

Extra Example: (algebraically)

If the function $P(x) = x^2 - 4x + 10$ describes the total profit in millions dollors of a company earned corresponding x, which is the number of years after it founded. Compute the *change, the percentage change, and the average rate of change* between $x_0 = 3$ and $x_1 = 7$, including units.

(a) change $= P(7) - P(3) = 31 - 7 = 24$ millions dollors

(b) percentage change $= \dfrac{P(7) - P(3)}{P(3)} \cdot (100\%) = \dfrac{24}{7} \cdot (100\%) = 342.85\%$

(c) average rate of change $= \dfrac{P(7) - P(3)}{7 - 3} = 6$ millions dollors/year

Homework:
Section 2.1: 9,17,18,22a,
Read project description in Class Packet.

Remark: About the Optimization projects:
Organize your own group (6 students in a group) for the Optimization projects. Choose a representative for your group. Please give me the names of the members in your group before the class in Sept.14.
I will group the rest of students who don't have a group in Sept.14 after class.

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[1] Pictures comes from http://clas.sa.ucsb.edu/staff/lee/