2018-09-10 Mon
Chapter 0.1

Practicalities

- All information on the subject in https://www.maths.tcd.ie/~alberto.ramos/teaching/ma1e01_18/ma1e01/

Evaluation

1. 80% Written exam. 4/5 problems, no calculator/tables (try to solve tutorials/problems in the same conditions).
2. 20% Continuous Assessment. Two parts. If any of them missing the grade for CA is 0.
   - 10% Tutorials
     - Problems available in the WEB every Fri.
     - Solve the problems **before**. Hand solutions to your tutor. Ask any doubts (problems, classes) during the tutorials.
     - **Do not come/write to me about tutorial grades/absences**. Your tutor is in charge of this.
   - 10% Project
     - Groups between 2-5 people. When you decide group members **and** topic let me know. I will check that the topic is appropriate.
     - Target audience: Not me, but the rest of the class.
     - Project needs to go beyond what is covered in the lectures
     - Example projects at the WEB
     - Ask for help if needed. I can provide guidelines.
     - Details will follow.

Calculus

Historically

- Need to describe **motion**. How is motion possible?
- Calculus: provides methods for quantitative investigation of change.
- Main objective of the course: derivation/integration. **But** to understand this we need to master functions/limits

Functions

Intuitive idea

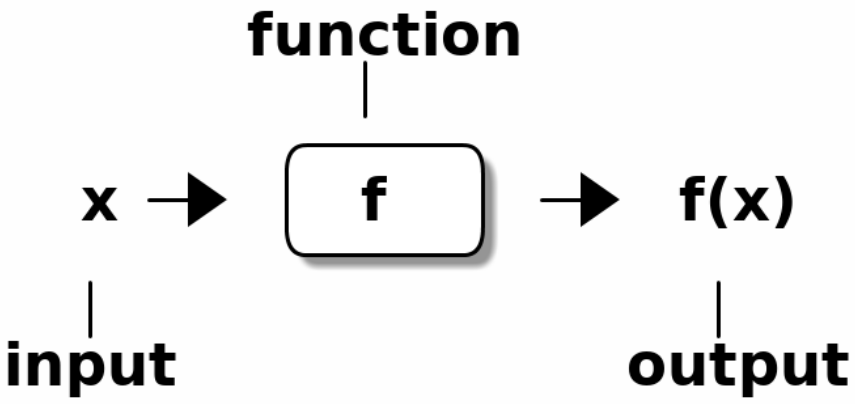
- How one quantity depends on another
  - Distance traveled by a free falling object is (established experimentally by Galileo!)

$$d(t) = \kappa t^2 \tag{1}$$

  - Position of earth orbiting around the Sun along the year
  - Volume of a box constructed from a rectangle of side L

$$V(x) = x(L - 2x)^2 \tag{2}$$

  - Graph of a function
  - Table of values (never exhaustive)
- Always think of functions as "machines". Three basic ingredients: input, the function, output.



Questions in calculus

- What is the velocity of an object after 2sec falling?
- How much distance travels the Earth in one year?
- How do I choose x to maximize the volume of the Box?

Domain of a function

Acceptable values for the input

- Not all numerical values acceptable for the independent variable. (What is the volume of the box for $x = -1$?)
- Possible values restricted for two main reasons

1. The function cannot be computed (natural domain)

$$f(x) = \sqrt{1 - x^2}; \qquad f(x) = \frac{1}{1 - x}\,. \tag{3}$$

   at $x = 1$.

2. Even if the value is possible **in principle**, the nature of the problem restricts some values. (i.e. x is a distance, and therefore always positive).

- Domain of a function: always be careful with operations that cannot be done
  - Square roots of negative numbers
  - Fractions with zero denominator
  - log of a negative numbers