1-22-2021 Notes, Calculus 1

Introduction to Calculus 1

Sankar Sitaraman – nature-lover.net/math

Math Dept, Howard University

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Outline

How to Study Math ?

1. LISTEN IN CLASS, TAKE NOTES, ASK QUESTIONS
2. STUDY EVERYDAY!
3. LEARN BY DOING
4. WORK WITH OTHER STUDENTS

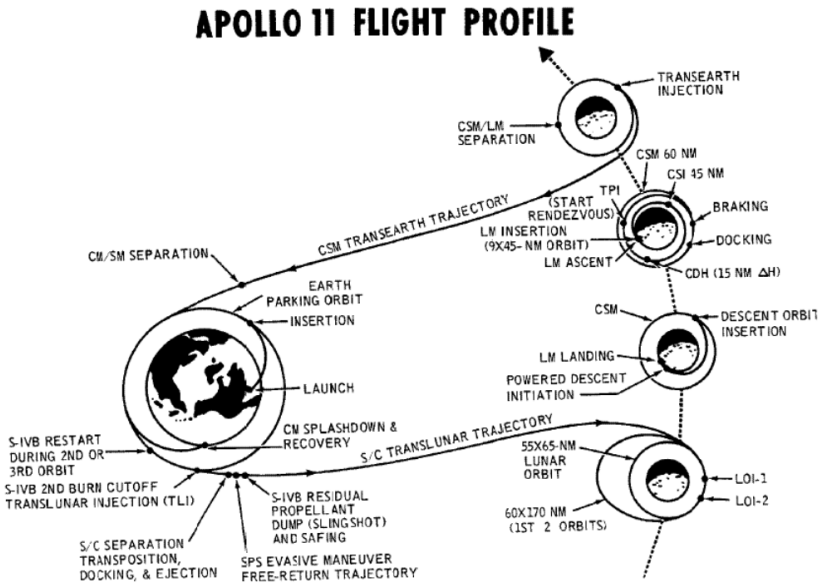
INTRODUCTION TO CALCULUS

In this course, we will mainly look at ways to do the following two things and their applications:

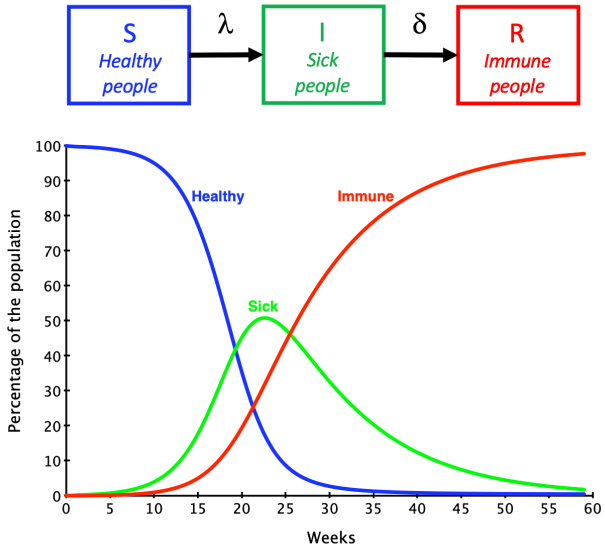
1. Derivative: Finds rate of change at an instant of a function that is changing continuously.
   Special Case (Application) : Derivative is the slope of the tangent of a curve at a point.
2. Integration:
   1. Adds up values of any function, in particular functions that change continuously.
      Special Case (Application) : Find area under a curve whose equation represents a curve.
   2. Find curve using slopes that are known at different points.

Two applications of Calculus

APOLLO 11 TRAJECTORY by Katherine Johnson



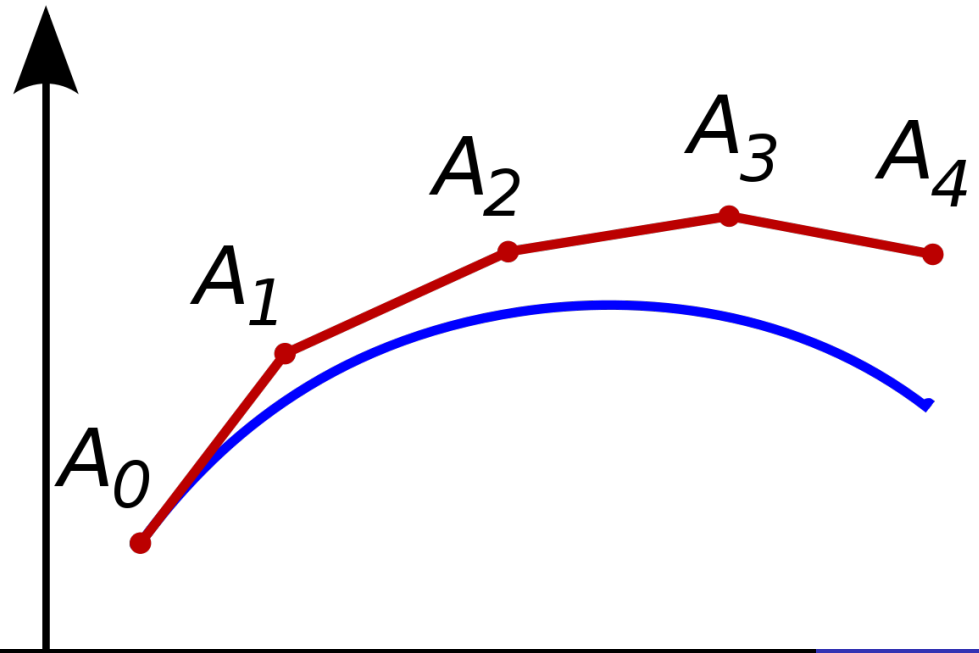
Model for Spread of Disease (such as coronavirus flu)



Schematic diagram of Euler's Method

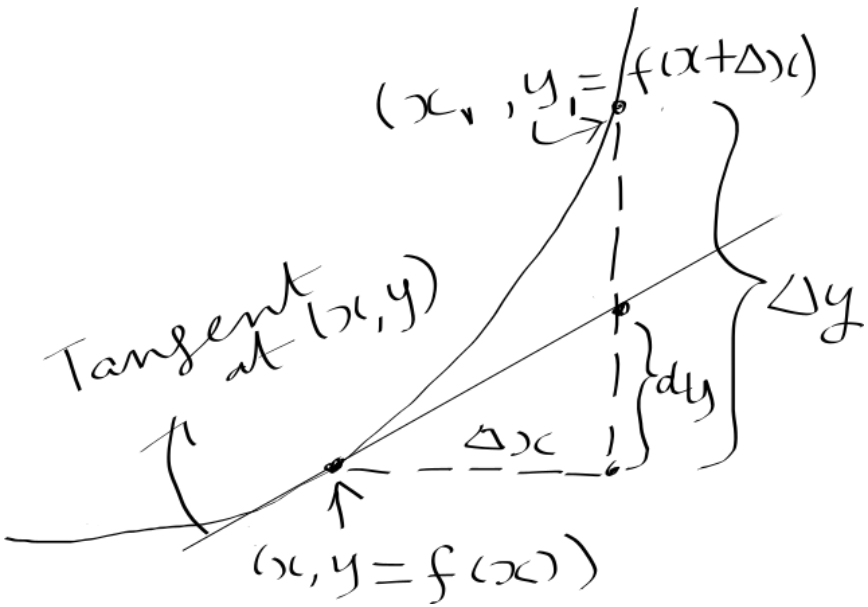
Euler's method is used in both applications mentioned above.

Basic idea: Suppose you know or you can figure out slope of a curve (approximately, at least) at certain points.
Then you can approximate the curve using line segments, each having slope as calculated above.



Approximating values using slopes

Idea: Slope can be used to APPROXIMATE value



From picture we see that slope of tangent $= dy/\Delta x$
dy is an **approximation for** Δy the *change in* y.
Basically we are using the tangent to approximate change.
We can approximate $(x + \Delta x, f(x + \Delta x))$ **by** $(x + \Delta x, f(x) + dy)$ *if* Δx *is small*