

Differential Equations: Calculus AB

Lesson Plan 1: Introduction to unit

Overview

This is planned as a short lesson, something like 30 minutes. The reason is that in the first half we will be reviewing the test from the previous unit.

Learning Objectives

- Place of unit in the scheme of things taught in this semester.
- Motivation for the subject.
- Description of the unit content.
- First intro of unit project.
- Some terms we will use.

Prior Knowledge needed

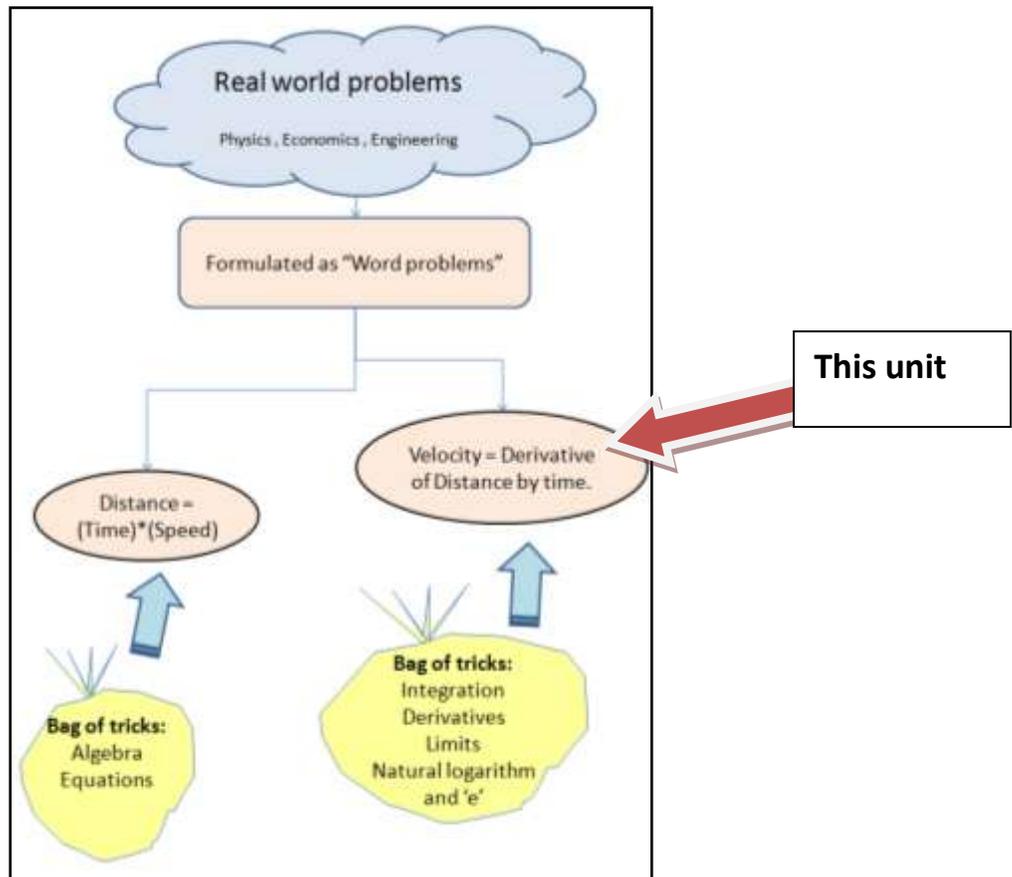
The students should be familiar by this stage in the semester with the concepts of derivatives, and integration. Those will be used (and reinforced) throughout this short unit.

Instruction and activity

1. **Unit name:** Differential Equations.
2. **Place of unit in the scheme of things taught in this semester.**

See picture below. Draw something like that on the board, starting from the top, branching to the left side (which they know), then the bag-of-tricks they already learned (Integration, derivatives, etc), and then show them that it will be brought to good use in this section!

(The picture is from my PowerPoint slides file).



3. **Motivation for the subject:** Many of the real world problems lead to differential equations.

OPTIONAL (I would skip it) : give a motivating problem like the following example:

You want to buy a new car, so you decide to invest each month P dollars into a special saving account. You do it by continuously dropping every hour a nickel into your piggy-bank.... This account earns r percent interest per month, compounded continuously. How much money will you have in the account after a year? Two years?

In a differential equation form:

Denote the amount in the account as y . Every month, the change in this amount is the interest gained (which is r times y) plus the extra P dollars we put in.

$$dy/dt = r*y + P$$

This is a differential equation!!

As mentioned, I would not give this example. Might be too intimidating to students who had hard time with Compound-interest subject, so why bring bad-memories...

4. **Description of unit content:** Hand-out the unit-plan page (Table). It has also homework due dates, web-site.

5. **Some terms we will use:**

Differential equation: Equation contains derivatives of the unknown function y . E.g: $y'' + 5y' + y = 3x^2 + 7$

Order of equation: The index of the highest derivative involved.

Linear differential equation: No terms like $y*y''$, or $(y'')^2$. Things which involve x are allowed: x^2*y'' is okay.

6. Just a **warm up for tomorrow**, and similar to homework (connecting prior knowledge): Let students do it on their own, and then check solutions together.

Question: Which of the followings is a solution of the differential equation

$$y'' - y = 0$$

- a. $y = \sin(x)$ b. $y = 4e^{-x}$ c. $y = Ce^x$

Answer: Both (b) and (c) are valid solutions.

Conclusions from this exercise:

- There might be **multiple solutions** for a differential equation. This makes sense, as differential equation tells us only about the 'difference' between things, not about what they actually are.
- You will be using your differentiation knowledge (and integration) in this unit!
- The **solution is a FUNCTION**.

7. **Wrap-up** : Place of unit and structure of unit; Unit-project ; Differential equations terms. **General solution, multitude of solutions; Verifying solution. Solution is a function.**
8. **Homework:** P. 409 : 1, 2, 4, 5, 8, 13, 14, 15. Start work on homework in class last 10 minutes!

====End====