Notes for lecture 2

1. Date: April 18th. This lecture is based on Sections 1 and 2 of Chapter 2 of the main textbook (see Chapter2.1.pdf and Chapter2.2.pdf file)
2. Section 2.1 deals with linear differential equations of the 1st order and deals with the following problems
    a. The method of integrating factor (see Lecture2.pdf file). The logics of the presentation is organized as follows.
        i. Linear equation with constant coefficients (which you already know how to solve) is explained from the standpoint of the integrating factor.
        ii. Linear equation with variable coefficients is then addressed. Here,
            1. First, the method is explained on specific examples in order to illustrate the idea of the integrating factor
            2. Then, the method is established in the general settings
    b. The method of variation of parameters (see Lecture2extras.pdf file). This is an alternative but frequently used method in solving linear differential equations (not only the 1st order).
3. Section 2.2 deals with separable equations.
    a. The concept is simple --- if the original equation can be rearranged so that the left hand side depends on y only, and the right hand side depends on x only then both these sides can be integrated independently.
    b. One point to bear in mind is that after the integration it is not always possible to represent the solution in the explicit form as $y = f(x)$. In this case we are happy to have the solution in the implicit form $\psi(x, y) = 0$, where $\psi(x, y)$ is a function of two variables (so setting it to zero implies the possibility of resolving it with respect to either y or x).
4. The illustration of the content is accompanied by examples. In addition, you can look at the sample problems (see SampleProblems2.pdf file)
5. In understanding the presentation content and in solving practical problems, the knowledge of calculus (integration of functions of single variable) is required. In this connection,
    a. Please brush up this knowledge (see you lectures from Computing Mathematics course that you took last semester).
    b. When computing integrals that look difficult to you, you can use Wolfram Alpha (a highly recommended system for doing symbolic(and not only) computations), see https://www.wolframalpha.com/examples/mathematics/calculus-and-analysis/
    c. Note that you can use Wolfram Alpha also for plotting graphs (not required but highly recommended), see https://www.wolframalpha.com/examples/mathematics/plotting-and-graphics/
    d. A short video from Khan Academy on separable equations https://www.khanacademy.org/math/differential-equations/first-order-differential-

equations#separable-equations can be recommended for reinforcing your knowledge.

    e. A short video from Khan Academy on homogeneous equations https://www.khanacademy.org/math/differential-equations/first-order-differential-equations/homogeneous-equations/v/first-order-homegenous-equations can also be recommended.

6. The deadline for submitting homework, Assignment 2 (refer to Assignment2.pdf) is April 25, 13:00.