MAT 201E **Differential Equations Worksheet - 2**

1) Construct the second-order homogeneous differential equation that the roots of its characteristic equation are $\lambda_1 = \lambda_2 = 3$.

2) Write the following differential equation in a simple form $(\sin x \frac{d}{dx})^2 y = \sin x, \quad x \neq 0$.

3) Solve the equation $(\frac{1}{x}\frac{d}{dx})^2 y = 0, \quad x \neq 0$.

4) Consider the differential equations with one of the two roots of its characteristic equation is $\lambda_1 = 1-2i$. Write this second-order differential equation and then find the solution.

5) Show that two functions $\left\{\frac{1}{x}, \frac{1}{x^2}\right\}$ satisfy the differential equation $x^2y'' + 4xy' + 2y = 0$. Are these two functions construct a fundamental set of solutions ? Why?

6)Find the solution of the equation $x^2y'' + 3xy' - 3y = 0$ by using the transformation $x = e^t$.