Due: Wednesday, February 3 at the beginning of class (late homework will not be accepted)

Read Sections 0.1 and 0.2 (pages 1-23) and answer the following questions.

1. Explain the Principal of Superposition in your own words.

2. Explain Linear Independence in your own words.

3. What is a Cauchy-Euler equation and how do you solve it?

4. What is a particular solution to a nonhomogeneous differential equation.

5. Briefly explain the Method of Undetermined Coefficients in your own words.

6. (a). If the characteristic equation for a second order equation has the two real roots λ and $-\lambda$, why can we write the solution using exponentials $\{e^{\lambda t}, e^{-\lambda t}\}$ or using the hyperbolic functions $\{\sinh \lambda t, \cosh \lambda t\}$?

(b). Note that the roots for $u'' - 4u = 0$ are $2, -2$. Given the initial conditions $u(0) = 5$ and $u'(0) = 4$,

(i) Find the solution using the general solution in exponential form $u(t) = C_1 e^{2t} + C_2 e^{-2t}$

(ii) Find the solution using the general solution in hyperbolic form $u(t) = C_1 \cosh 2t + C_2 \sinh 2t$

Graph both solutions on your calculator to verify that they are, indeed, the same solution.

(iii) From parts *(i)* and *(ii)*, explain why it could be advantageous to write the general solution in hyperbolic form.