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**TEST # 2:**

Please show all your work in the test. Guessed answers are NOT acceptable. Open book. You may use calculators. Good luck!

(40 pt) 1) Find general solutions of the following differential equations:

a)  $y'' + 4y = 0$

b)  $y'' - 4y' + 4y = 0$

c)  $y^{(4)} - 4y'' + 4y = 0$

d)  $y''' - y'' = 0$

(15 pt) 2) Find a general solution to  $y'' + 4y' + 5y = 0$ , and the solution for which  $y(0) = 0$  and  $y'(0) = 3$ .

(15 pt) 3) Find a general solution to  $y'' - 5y' = 25x^2 + 3$ , using the method of undetermined coefficients.

(15 pt) 4) Solve by variation of parameters the nonhomogeneous equation

$$y'' - 2y' + y = \frac{4e^x \ln x}{x^3}, \quad x > 0$$

(15 pt) 5) The motion of a spring-mass system is governed by the initial value problem:

$$\begin{cases} \frac{d^2x}{dt^2} + 9x = 0 \\ x(0) = -3 \\ x'(0) = 12 \end{cases}$$

For this motion determine its:

- a) angular frequency
- b) amplitude
- c) phase
- d) period