Math 3301 **Homework Set 6** **10 Points**

Undetermined Coefficients, Part II

For problems 1 & 2 use the method of undetermined coefficients to determine the general solution to the given differential equation.

1. $y'' - 4y' + 20y = 3\mathbf{e}^{2t} + 2\cos(4t) - \sin(4t)$

2. $y'' - 7y' + 12y = 4\mathbf{e}^{3t} + 60t\,\mathbf{e}^{-2t}$

3. Solve the following IVP using the method of undetermined coefficients.

$$y'' - 3y' = 36t^3 - 9\mathbf{e}^{6t} - 5 \qquad y(0) = -2, \quad y'(0) = 0$$

For problems 4 & 5 write down the guess that we'd need to use with the method of undetermined coefficients to find the particular solution. Do not attempt to find the actual particular solution.

4. $36y'' - 36y' + 13 = 4t\cos\left(\frac{1}{3}t\right) + \mathbf{e}^{\frac{1}{2}t}\sin\left(\frac{1}{3}t\right) - \left(3 + t^2\right)\sin\left(\frac{1}{3}t\right)$

5. $y'' - 8y' + 16y = \mathbf{e}^{4t} + \sin(8t) - 10t\mathbf{e}^{4t} - 12t$

Variation of Parameters

6. Use the method of variation of parameters to find the solution to the following differential equation.

$$y'' + 9y = 2\cos(3t)$$

7. Use the method of variation of parameters to find the solution to the following IVP.

$$2y'' + 5y' - 3y = 8 - 11\mathbf{e}^{6t} \qquad y(0) = 2, \quad y'(0) = -1$$

Vibrations

For problems 8 – 11 any solutions containing both a sine and a cosine must be combined into a single cosine. Any decimal work should be to at least the 4th decimal place.

8. A 6 lb object will stretch a spring 18 inches by itself. The mass has no damping and is initially displaced 9 inches upwards from its equilibrium position with an initial velocity of 3 in/sec upwards. Determine the displacement at any time *t*.

9. A 12 kg object will stretch a spring 45 cm by itself. The mass has a damper hooked up that exerts critical damping and it is released from its equilibrium position with an initial velocity of 15 cm/sec upward. Determine the displacement at any time *t*.

10. Take the system from #8 and hook up a forcing function of the form $g(t) = 7\sin(3t) + 2\cos(3t)$. Determine the displacement at any time *t*. Does the system experience resonance?

11. Take the system from #9 and hook up a forcing function of the form $g(t) = -58\sin(2t)$. Determine the displacement at any time *t*.