MA 238-02 §3.1–3.7,4.1 §4.2,4.4,6.1	**Test #2**	*score*	**Name:** _____ **22 November 1999**

1. Find the general solution of $y'' + 2y' + 5y = e^{-2t}$ by first solving the corresponding undriven equation, then using the method of undetermined coefficients. *(12 points)*

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2. Is it possible for $\{e^t, sin(t)\}$ to form a basic set of solutions on the interval $[0, 4]$ for a differential equation of the form $y'' + a(t)y' + b(t)y = 0$ where $a(t)$ and $b(t)$ are both continuous on $[0, 4]$? Explain. *(7 points)*

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3. A rod of negligible mass is suspended from a high ceiling on a pivot. Your job is to estimate the length of the rod, but the only tools you have available are a 1kg mass and a stopwatch. So you attach the mass to the end of the rod and find that, with a small displacement, the resulting pendulum completes 8 swings in 20 seconds. Estimate the length of the rod and explain how you arrive at your answer. *(10 points)*

4. Consider the equation $y'' + y = \sec t$ $(-\frac{\pi}{2} < t < \frac{\pi}{2})$. Begin the variation of parameters method to find the general solution, but you may stop once you have computed $u_i'(t)$ and $u_2'(t)$ in the interest of saving time. *(12 points)*

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5. Use the definition of the Laplace transform to find the Laplace transform of e^{2t}. Be sure to evaluate the improper integral carefully so your work can be followed. State the s-interval over which the transform exists. *(10 points)*

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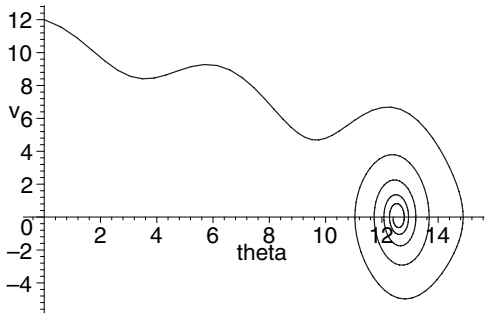
6. Find the Laplace transform of the solution of the IVP $y'' + y' + 2y = \sin(t)$, $y(0) = 1$, $y'(0) = -1$. *(10 points)*

7. The orbit diagram for a pendulum is given below. Describe the motion of the pendulum and the IVP that produced the orbit diagram (linear or non-linear, damped or undamped, estimate the initial conditions, tumbles over top of pivot or not – if so how many times, etc.). *(10 points)*



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8. The graph of θ versus t for a pendulum is given below. Describe the motion using ideas from the previous problem. Then sketch the orbit diagram for this motion *(12 points)*