MA 238-02 §3.1–3.7,4.1 §4.2,6.1,6.2	**Test #2**	*score*	**Name:** _____ **26 April 1999**

1. Find the general solution of $y'' - 2y' + y = 3e^{-x}$ by first solving the corresponding undriven equation, then using the method of undetermined coefficients. *(12 points)*

---

2. An object of mass 0.5 kg is attached to a suspended spring that has a Hooke's Law constant of 2 newtons/meter. The object is pulled down 1 meter from its equilibrium position and released from rest. If there is no damping, write the IVP that describes this system. Determine the equation of motion for the mass and the period of that motion. If the initial conditions were changed (say, but pulling the mass down further), how would that affect the period?. *(12 points)*

3. 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)*

---

4. Find the functions $f(t)$ whose Laplace transforms are as follows: *(6 points each)*

   (a) $\mathcal{L}[f](s) = \dfrac{3}{(s-4)^2}$

   (b) $\mathcal{L}[f](s) = \dfrac{se^{-3s}}{s^2+9}$

5. Use the definition of the Laplace transform to find the Laplace transform of e^{3t}. *(10 points)*

---

6. 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)*

Plot: test2maple01.eps

---

7. 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)*

Plot: test2maple02.eps