MAP 2302 Diff-E-Qs **Test 3** 1 Nov 2006

Directions: Show **ALL** work for credit; Give **EXACT** answers when possible; Start each problem on a **SEPARATE** page; Use only **ONE** side of each page; Be neat; Leave margins on the left and top for the **STAPLE**; Calculators can be used for graphing and calculating only; Nothing written on this page will be graded;

1. The nonhomogenous ODE $y'' - y' - 6y = 30e^t$ has a corresponding homogenous ODE with general solution $C_1e^{3t} + C_2e^{-2t}$.
   (a) Use undetermined coefficients to find a particular solution.
   (b) Use variations of parameters to find a particular solution.
2. Solve the IVP $y'' + 5y' - 6y = 60\sin 2t;\ y(0) = 0;\ y'(0) = 11$
3. True or False and a brief reason why or why not.

   Problems (a)-(e) concern a spring mass system decribed as follows: A mass of 10 kilograms stretches a spring 4.9 meters. The mass is acted on by an external force of $10\sin 3t$ newtons and moves in a medium that imparts a viscous force of 6 newtons when the speed of the mass is 3 meters/second. The mass is released 1/2 meter below the equilibrium with no initial velocity. [Use $g = 9.8$ for the acceleration due to gravity, and the textbook's convention for the positive u direction.]
   (a) The constant $\gamma = 1/2$.
   (b) The spring constant of the system is $k = 20$.
   (c) The initial position is $u(0) = 0.5$.
   (d) The initial velocity is $u'(0) = 3$.
   (e) The transient solution can be written in the form $R\cos(3t - \delta)$.
   (f) The ODE $y'' + y' + \sin y = 0$ is linear.
   (g) The correct method of undetermined coefficient guess for solving $y'' - 2y' + y = e^t$ is $y(t) = At^2e^t$.
   (h) The correct method of undetermined coefficient guess for solving $y'' - 2y' + y = t^2 + 5$ is $y(t) = At^2 + B$.
   (i) If you multiply the mass m of an undamped spring-mass system by two, the the natural frequency ω_0 is reduced by one half.
   (j) If the characteristic polynomial to the spring mass system $mu'' + \gamma u' + ku = 0$ has roots $a \pm bi$ then the quasi frequency of the system is b.
4. Given that $y_1(t) = t^3$ is a solution to $t^2y'' - ty' - 3y = 0$ use reduction of order [via $y(t) = v(t)t^3$] to find a second linearly independent solution.