Math 34 Differential Equations Exam #1
December 4, 2003 SHOW ALL WORK

1.) A mass of 10 kg stretches a spring 3m. The mass is acted on by an external force of $3sin4t$ The mass is pushed upward 1m above its equilibrium position, and then set in motion in the upward direction with a velocity of 2 m/sec.

[10] 1a.) If there is no damping, formulate the initial value problem describing the motion of the mass.

Answer 1a.) ________________________________

[5] 1b.) If the mass moves in a medium that imparts a viscous force of 5 N when the speed of the mass is 9 m/sec, formulate the initial value problem desribing the motion of the mass.

Answer 1b.) ________________________________

2.) Circle T for True and F for False. In the first 4, assume $\mathcal{L}(f)$ and $\mathcal{L}(g)$ exist and c is a real number.

[2] 2a.) Suppose $\mathcal{L}(f)$ and $\mathcal{L}(g)$ exist. $\mathcal{L}(cf) = c\mathcal{L}(f)$

T F

[2] 2b.) Suppose $\mathcal{L}(f)$ and $\mathcal{L}(g)$ exist. $\mathcal{L}(fg) = \mathcal{L}(f)\mathcal{L}(g)$

T F

[2] 2c.) Suppose $\mathcal{L}(f)$ and $\mathcal{L}(g)$ exist. $\mathcal{L}^{-1}(cf) = c\mathcal{L}^{-1}(f)$

T F

[2] 2d.) Suppose $\mathcal{L}(f)$ and $\mathcal{L}(g)$ exist. $\mathcal{L}^{-1}(fg) = \mathcal{L}^{-1}(f)\mathcal{L}^{-1}(g)$

T F

[2] 2e.) The delta function is a function.

T F

[30] 3.) Use the LaPlace transform to solve the given initial value problem.

$$y'' + 2y = \begin{cases} 0 & t < 2 \\ 4e^{3t} & t \geq 2 \end{cases}, \quad y(0) = 8, \quad y'(0) = 0$$

Answer ______________________________

[4 x 12 = 48] 4.) Choose 4 of the following. Clearly indicate which problems you choose. You may do all the problems for possible partial credit.

A.) Use the definition and not the table to find the LaPlace transform of $f(t) = t$

Answer : ____________________

B.) Find the inverse LaPlace transform of $\frac{2s+1}{s^2+4s+20}$

Answer :____

C.) Evaluate $t * t^2$.

Answer :____

D.) Transform $4u'''(t) + u'(t) - 2u(t) = sin(t)$ into a system of first order differential equations.

Answer ____

E.) The following True/False problems refer to the equation $mu'' + \gamma u' + ku = F_0 cos(\omega t)$. Circle T for true and F for false.

[3] Ei.) Suppose $c_1 cos(3t) + c_2 sin3t$ is the solution to the homogeneous equation $mu'' + \gamma u' + ku = 0$, then resonance occurs if an external force of $F_0 cos(\omega t) = 4cos(3t)$ is applied.

T F

[3] Eii.) Suppose $c_1 cos(3t) + c_2 sin3t$ is the solution to the homogeneous equation $mu'' + \gamma u' + ku = 0$, then resonance occurs if an external force of $F_0 cos(\omega t) = 3cos(4t)$ is applied.

T F

[1] Eiii.) Suppose $c_1 e^{-3t} + c_2 te^{-3t}$ is the solution to the homogeneous equation $mu'' + \gamma u' + ku = 0$, then resonance occurs if an external force of $F_0 cos(\omega t) = 4cos(3t)$ is applied.

T F

[1] Eiv.) Suppose $c_1 e^{-3t} + c_2 te^{-3t}$ is the solution to the homogeneous equation $mu'' + \gamma u' + ku = 0$, then resonance occurs if an external force of $F_0 cos(\omega t) = 3cos(4t)$ is applied.

T F

[4] Ev.) If resonance does occur, then $lim_{t \to \infty} u(t) = 0$

T F