

**MAT 250
Exam #3
Fall 2004**

Choose any 5 of the 7 problems below to work. Cross out the 2 problems you've elected not to do!

Name:

1	20	
2	20	
3	20	
4	20	
5	20	
6	20	
7	20	
Total	100	
Curve		
Grade		

1) Determine the equation of motion for an undamped mass-spring system at resonance governed by $\frac{d^2y}{dt^2} + 9y = 2\cos 3t$, $y(0) = 1$, $y'(0) = 0$. (This can be solved using either the Method of Undetermined Coefficients or Laplace Transforms.)

2) Express the function using unit step functions: $f(t) = \begin{cases} 3 & , 2 < t < 5 \\ t^2 & , t > 5 \end{cases}$

3) Solve using the method of Laplace transforms:
 $y'' + y = u(t-3)$, $y(0) = 0$, $y'(0) = 1$

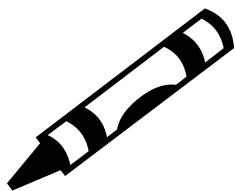
4) Solve for $Y(s)$, the Laplace transform of the solution $y(t)$ to the initial value problem: $y'' - 3y' + 2y = \cos t$, $y(0) = 0$, $y'(0) = -1$

5) Find $\mathcal{L}^{-1}\{F\}$ given that $F(s) = \frac{5s^2 + 34s + 53}{(s+3)^2(s+1)}$.

6) Rewrite the initial value problem using a new function $y(t)$ so that the initial conditions are at $t = 0$ (do not solve): $z'' + 5z' - 6z = 21e^{t-1}$, $z(1) = -1$, $z'(1) = 9$

7) Use $\mathcal{L}^{-1}\left\{\frac{d^n F}{ds^n}\right\}(t) = (-t)^n f(t)$, where $f = \mathcal{L}^{-1}\{F\}$, to compute $\mathcal{L}^{-1}\{F\}$ for

$$F(s) = \ln\left(\frac{s-4}{s-3}\right).$$



Show your work neatly.