DEPARTMENT OF MATHEMATICS
UNIVERSITY OF KANSAS
MATH 220 - Fall 2009 - EXAM II

Your Name: _____

On this exam, you may use a calculator, but no books or notes.

It is not sufficient to just write down the answers. You must explain how you arrived at your answers and how you know they are correct.

1   (30)   _____

2   (30)   _____

3   (30)   _____

4   (30)   _____

5   (30)   _____

6   (25)   _____(Bonus)

Total   (150)   _____

(1) **(30 points)** Solve the initial value problem

$$\left|\begin{array}{l} y'' - y' + 0.25y = 0 \\ y(0) = 2, y'(0) = a \end{array}\right.$$

Find the value of a that separates solutions that grow positively from those that eventually grow negatively.

(2) **(30 points)** Solve the initial value problem

$$\left|\begin{array}{l} y'' + 4y = t^2 + 3e^t \\ y(0) = 0, y'(0) = 2 \end{array}\right.$$

(3) (**30 points**) A mass weighing 3 lbs stretches a spring 1.5 in. If the mass is pushed upward, contracting the spring a distance of 1 in. and then set in motion with a downward velocity of 2 ft/sec. and if there is no damping, find the position u at any time t. Determine the frequency, the period, amplitude and the phase of the motion.

(4) (**30 points**) An undamped system with a mass that weighs 6 lbs., stretches a spring by 6 inches. The system is set in motion from equilibrium by an external force of $4\cos(7t)$ lbs. Determine the position at any time t. Is the motion periodic and if so, find its period.

(5) **(30 points)** Use the method of the Laplace transform to solve

$$\left| \begin{array}{l} y'' - 2y' + 2y = 0 \\ y(0) = 0, y'(0) = 1 \end{array} \right.$$

(6) (**Bonus problem 25 points**) NO PARTIAL CREDIT ON THE BONUS PROBLEM, I.E. ONLY FULL CREDIT OR NO CREDIT.

Compute the Laplace transform of the function

$$f(t) = te^{at} \cos(bt).$$

Justify your steps.