Math 252 – Quiz #3

May 27, 2011 **Name:** _____

Instructor: Patricia Wrean

Total: 25 points

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1. A mass of 0.50 kg is attached to a spring of constant 8.0 N/m. Assume that there is no damping. The mass is released 6.0 cm below equilibrium with an upward velocity of 0.12 m/s. (6 points)

   a) Find the position of the mass as a function of time.
   b) State the period and amplitude of this motion.
   c) What is the magnitude of the instantaneous velocity of the mass when it passes through the equilibrium position?

2. Solve the following DE. (7 points)

$$x^2 y'' - 3x\,y' + 4y = \frac{1}{x}$$

Hint: use integration by parts for $\int x^n \ln x \; dx$.

3. Solve the following differential equation, given that $y(0) = -4$ and $y'(0) = 5$. Give the first five non-zero terms of the solution. (6 points)

$$y'' + \left(x^2 - 1\right) y = 0$$

4. Consider the power series solution to the following DE about the ordinary point $x = 0$. (6 points)

$$(x+1)y'' + xy = 0$$

a) For which values of x can we guarantee that the series converge?

b) Find the recurrence relation for the coefficients of the series. Do not bother to calculate any coefficients.