Name:_____

Section:_____

I.1-I.2		II	
I.3-I.4		III	
		IV	
		Total	

MA 2051 B 2013 – Test 2

Instructions: Do your work on this paper. Put your **name** and **section number** above. Work neatly. Show your work. **JUSTIFY YOUR ANSWERS.**[1] Brains only — no calculators, books, scrap paper, etc.

12 pts each **I.** Find a *general solution* of the given differential equation; if initial conditions are given, find the *solution of the initial-value problem* as well. Use results of other problems whenever possible. **Bonus:** +1 for each solution checked.

1. $2y'' - 3y' + y = 0$, $y(0) = 2$, $y'(0) = 1$.

2. $2y'' - 3y' + y = 2x - 1$.

[1] "Justify your answers" requires providing enough justification to permit a Calc IV student to follow your work without having taken this course. You can assume that such a student could look up specialized terms and definitions as needed.

Name:_____

3. The spring-mass model $mx'' + kx = 0$, $x(0) = x_i$, $x'(0) = 0$.

4. $4x'' + 36x = 3\cos 2t$.

Name:_____

18 pts **II.** Use your solution to problem 3, part I, the spring-mass model, to:

1. Show that the period of motion of the mass is independent of the initial displacement of the mass.
2. Show that the maximum displacement of the mass *does* depend upon the initial displacement of the mass. Does the maximum displacement depend upon anything else?

Name:_____

17 pts **III.** A brick of mass 6 kg hangs from the end of the spring. When the mass is at rest, the spring is stretched by 7 cm. The spring is then stretched an additional 2 cm and released from rest.

1. Find an expression for the spring constant k; recall that $g = 9.8$ m/s^2. (You need not calculate the actual value of k. Just write an expression I could evaluate with a calculator.)
2. Suppose this spring-mass system is subject to damping; i.e., the governing equation has the form $mx'' + px' + kx = 0$, where p is the damping coefficient. What is the smallest value of p that just prevents the mass oscillating? (You need not calculate the actual value of p. Just write an expression I could evaluate with a calculator.)

Name:_____

17 pts **IV.** Recall the approximate pendulum equation $L\theta'' + g\theta = 0$; L is the length of the pendulum, $g = 9.8$ m/s^2. Find an expression for L that gives the pendulum a period of exactly 2 seconds. How should I change that length to increase the period to 4 seconds?