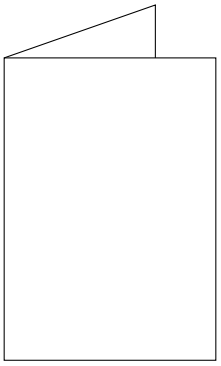
Mathematics 352
Exam 1

March 4, 2013; 60 minutes Name: _____

This exam is closed book; you can use a calculator (*not* a cell-phone calculator) but no other electronic aids or printed references. *If the wording or intent of any question is unclear, please ask me to clarify.* I am not trying to confuse you with the problem statements.

You can use your own paper or the provided blank copy paper. Please write your name on each page you hand in. Show all your reasoning and all pertinent calculations. *Give all answers in exact form. Decimal approximations of any accuracy will not receive full credit.*

When you have finished the exam, place this cover sheet on top of it and fold the packet in half *the long way, with your name facing out.*



Question	Points	Score
1	25	
2	25	
3	25	
4	25	
Total:	100	

Good luck!

1. Consider the differential equation
$$y' - 3y = -9t.$$
   (a) (20 points) Find the general solution to this differential equation, using any method you like.

   (b) (5 points) Find the particular solution to the differential equation whose graph passes through the point $(2, 13)$.

2. (25 points) Using any method you like, find a solution to the initial value problem
$$y' = 2xy^2, \quad y(2) = 1.$$
   (You need not express your answer in the form $y = f(x)$.) Are there more solutions than the one you found? Explain.

3. A tank holds 200 L of brine that contains 10 kg of salt. Now pure water runs into the tank at a rate of 5 L/min and the well-stirred mixture drains out of the tank at the same rate.
   (a) (15 points) Determine the amount of salt in the tank after 30 min.

   (b) (10 points) How long will it take for the amount of salt to drop to 1 kg?

4. Say as much as you can about the existence and uniqueness of solutions to the following initial value problems. Do not attempt to find any solutions. Answer in complete sentences.
   (a) (15 points) $y' + 2xy = 0, \quad y(0) = 1$

   (b) (10 points) $y' = e^{2y} \cos 2x, \quad y(\pi/2) = 0$