

Math 242, Exam 1, Spring, 2017 11:40 class

Write everything on the blank paper provided. **You should KEEP this piece of paper.** If possible: return the problems in order (use as much paper as necessary), use only one side of each piece of paper, and leave 1 square inch in the upper left hand corner for the staple. If you forget some of these requests, don't worry about it – I will still grade your exam.

The exam is worth 50 points. Each problem is worth 10 points. Please make your work coherent, complete, and correct. Please CIRCLE your answer. Please **CHECK** your answer whenever possible.

The solutions will be posted later today.

No Calculators or Cell phones.

- (1) Solve the initial value problem $\frac{dy}{dx} = e^{-y}(2x - 4)$, $y(5) = 0$. Express your answer in the form $y = y(x)$. Please check your answer.
- (2) As part of his summer job at a restaurant, Jim learned to cook up a big pot of soup late at night, just before closing time, so that there would be plenty of soup to feed customers the next day. He also found out that, while refrigeration was essential to preserve the soup overnight, the soup was too hot to be put directly into the fridge when it was ready. (The soup had just boiled at 100 degrees C, and the fridge was not powerful enough to accommodate a big pot of soup if it was any warmer than 20 degrees C). Jim discovered that by cooling the pot in a sink full of cold water, (kept running, so that its temperature was roughly constant at 5 degrees C) and stirring occasionally, he could bring the temperature of the soup to 60 degrees C in ten minutes. How long before closing time should the soup be ready so that Jim could put it in the fridge and leave on time? When you do this problem use Newton's Law of cooling which states that the rate at which an object cools is proportional to the difference between the temperature of the object and the ambient temperature. Set up an initial value problem. Solve the initial value problem.
- (3) (a) State the Existence and Uniqueness Theorem for first order Differential Equations.
(b) What does what does (a) tell you about the Initial Value Problem

$$(x + y) \frac{dy}{dx} = x^2 + y^2 \quad y(1) = -1?$$

- (4) Find the general solution of the Differential Equation $x \frac{dy}{dx} + 2y = x^2 - x + 1$. Please check your answer.
- (5) The acceleration of a car is proportional to the difference between 350 ft/sec and the velocity of the car. If this car can accelerate from 0 to 50 ft/sec in 5 seconds, how long will it take for the car to accelerate from rest to 150 ft/sec? Set up an initial value problem. Solve the initial value problem.