NAME ______________________ Id. No, ______________________

Problem	Score
I.(20)	
II.(20)	
III.(20)	
IV.(20)	
V.(20)	
Total	

MA 366

First Examination, Wilkerson 1:30PM Section

60 minutes, Sept. 27, 2001, Univ. 317

Do all your work on the question sheets. Work as well as answers will be used to compute the score on each problem. Calculators are NOT allowed. NO BOOKS OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper. Problems are 20 points each unless noted.

I. (first order linear method) Suppose that $ty' - 2y = t$ for $t > 0$. Solve for $y(t)$. Then find the solution such that $y(1) = 0$. Finally, for this y, calculate $y(3)$.

II. Suppose that a tank initially contains 100 gallons of a salt water solution with a concentration of 1 lbs/gallon. The tank is to be flushed by running brackish water with a concentration of .1 lbs of salt per gallon into the tank at a rate of 3 gallons/min and the well stirred solution exits the tank at the rate of 2 gallons/min. Finally, one gallon of water per minute evaporates.

(a) First write the first order differential equation that predicts the amount $A(t)$ of salt in the tank at time t.

(b) Solve this differential equation and calculate the concentration of the solution in the tank after 10 minutes.

(c) What is the limiting concentration of salt in the tank as $t \to \infty$?

III. Use the "separation" method to solve these first order equations with the initial values given:

(a) $y' = 1/((y-1)(y-2))$, with $y(0) = 3/2$? What is the limit of $y(t)$ as $t \to +\infty$? For $t \to -\infty$?

(b) $y' = ty^2$, with $y(0) = 1$

IV. Give the general solution to these linear constant coefficient differential equations. Then solve the initial value problem. That is, find a solution that fits the indicated initial values.

(a) $y' - 2iy = 0$, $y(0) = 2$.

(b)(repeated roots) $(D-3)^2 y = 0$, $y(0) = 1$, $y'(0) = 1$

(c)(complex roots) $(D^2 + 2D + 5)y = 0$, $y(0) = 0$, $y'(0) = 1$.

(d) $(D-1)(D+1)y = 0$, $y(0) = 0$, $y'(0) = 1$

V.Misc.problems.

(a)(annihilators) For $y = 1 + e^t + t^2 e^{-t}$, find a non-trivial constant coefficient linear differential equation $P(D)y = 0$ for which y is a solution.

(b)(linear independence of functions) Prove without Wronskians that the functions $\{1, t, t^2\}$ on the interval $I = (-1, 1)$ are linearly independent functions. That is, if there are constants $A,\ B,\ C$ so that $A + Bt + Ct^2$ is zero for all $t \in (-1, 1)$, then each of $A,\ B,\ C$ are zero.