Instructions. The four problems below are take-home, due on the date above. Answer checks are expected. If maple assist is used, then please attach the maple output.

The remaining 20% of the exam is in class, 15 minutes, one problem, of a type similar to one of the problems below. Calculators, hand-written or computer-generated notes are allowed, including xerox copies of tables or classroom xerox notes. Books are not allowed.

Scores

Problem 1. Quadrature Equations.

Problem 2. Separable Equations.

Problem 3. Linear Equations.

Problem 4. Application.

Problem 5. In-class, Sept 13.

Average.

1. (Quadrature Equations) Solve by the method of quadrature the initial value problem $y''' = x + xe^{-x} - \sin 2x$, $y(0) = y'(0) = 0$, $y''(0) = 3$. Show all integration steps (by hand).

2. (Separable Equations) Solve the separable problem for the implicit and explicit solutions. Distinguish equilibrium and non-equilibrium solutions as needed.

$$2y' = \sin x - \tan x - 4y^2(1 - \sec x)\sin x.$$  

3. (Linear Equations) Solve the linear equation $2xy'(x) + 3y(x) = \sqrt{x}e^{-2x}$, $y(1) = 5$. Expected details include the factorization method and all integration steps (by hand).

4. (Application: Torricelli’s law) A water tank has the shape of $y = x^{4/3}$ revolved around the $y$-axis. The depth of the water is 10 feet. After 1 hour and 45 minutes, the drain hole at $(0,0)$ empties the tank to a depth of 6 feet. Find the additional time it takes to empty the tank. Ref: Exercise 1.4-52 and equation 1.4-(24).