

Math 34, First Midterm Exam
Fall, 2003

Instructions: Show your work. Your work will be judged for correctness, completeness, clarity and orderliness.

- (1) Derive the solution to the first order linear differential equation:

$$y' + p(t)y = f(t),$$

where p and f are assumed to be continuous functions.

In exercises 2 – 3, decide whether each differential equation is linear, separable, autonomous, exact, or none of these. If the equation is linear, separable, autonomous, or exact, then solve the equation, or the initial value problem, using an appropriate method.

(2) $y' - y^3e^x = 0$.

(3) $y' = 2y(1 - y), \quad y(0) = 1/2$.

- (4) (a) A tank contains 100 gal. of salt/water solution. The initial amount of salt in the tank is 50 oz. Pure water flows into the tank at a rate of 3 gal. per minute, and well mixed salt/water solution flows out at the same rate. Find the amount of salt in the tank at all times $t > 0$.
- (b) The salt/water effluent from the tank in part (a) flows into a second tank, also containing 100 gal., and salt/water solution flows out of this tank at the same rate of 3 gal. per minute. The second tank initially contains pure water, no salt. Find the amount of salt in the second tank at all times $t > 0$.