Instructions. Answer each of the questions on your own paper. Be sure to show your work so that partial credit can be adequately assessed. *Credit will not be given for answers (even correct ones) without supporting work.* Put your name on each page of your paper.

1. [8 Points] Determine if each of the following equations is separable (**Yes** or **No**), and/or linear (**Yes** or **No**). Record your answers in the following table. Do **not** try to solve the equations.

Equation	Separable	Linear
$y' = \dfrac{t+1}{yt}$		
$y' = \dfrac{yt}{t+1}$		
$y' = \cos(ty)$		
$y' - ty = t^3$		

2. [17 Points Each] Solve each of the following initial value problems. Be sure to show all of your work.

   (a) $y' = 3t^2y^2, \quad y(0) = 1$

   (b) $y' + 2y = e^{2t} - e^{-2t}, \quad y(0) = 2$

   (c) $ty' + 3y = 4t, \quad y(1) = 3$

3. [10 Points]

   (a) Write the complex number $e^{3\pi i/2}$ in rectangular form $x + iy$.

   (b) Determine the polar expression $z = re^{i\theta}$ (i.e., find r and θ) for the complex number $z = 2 + 2i$.

4. [15 Points] Apply Picard's method to compute the approximations $y_0(t)$, $y_1(t)$ and $y_2(t)$ to the solution of the initial value problem

$$y' = t^2 + 2y, \quad y(0) = 1.$$

5. [16 Points] A tank initially contains 1000 gallons of fresh water. A solution containing 0.2 pounds of salt per gallon enters the tank at a rate of 10 gallons per minute. A drain is opened at the bottom of the tank through which the well stirred solution leaves the tank at the same rate of 10 gallons per minute. Let $y(t)$ denote the amount of salt (in pounds) which is in the tank at time t.

   (a) What is $y(0)$?

   (b) Write the differential equation that $y(t)$ must satisfy.

   (c) Solve the differential equation to find $y(t)$.