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. [**16 Points**] Find all solutions of the following system of linear equations. Be sure to show all your steps!

$$\begin{array}{ccccccc} x_1 & + & 2x_2 & - & 2x_3 & = & -8 \\ 3x_1 & + & x_2 & + & 9x_3 & = & 1 \\ x_1 & & & + & 4x_3 & = & 2 \end{array}$$

2. [**16 Points**] Let $A = \begin{bmatrix} x-2 & 4 & 3 \\ 1 & x+1 & -2 \\ 0 & 0 & x-4 \end{bmatrix}$.

   (a) Compute $\det A$.

   (b) For which values of x is the matrix *not* invertible.

3. [**16 Points**] Solve the initial value problem: $y' - 4y = 6e^{4t} + 3,$ $y(0) = -2$.

4. [**16 Points**] Solve the initial value problem: $ty' - 3y = t^5$ $y(1) = 3$.

5. [**16 Points**] Solve the initial value problem: $y' = y^2(1+t),$ $y(0) = -2$.

6. [**20 Points**] A tank initially contains 300 gallons of a salt solution made by dissolving 30 pounds of salt in water. A solution containing 0.6 pounds of salt per gallon enters the tank at a rate of 5 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 5 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 $y(t)$.

   (d) How much salt is in the tank after $1/2$ hour?