Activity 4: Linear Systems, Gaussian Elimination

Names: _____ Date: October 8, 2009 Score: _____

Show you work for each of the following. You should submit one copy for your group. Feel free to ask your instructor for advice if you need it.

1. (4 pts) For the following systems of equations, find the augmented coefficient matrix. Use row reduction to determine if the system of equations has zero solutions, one solution, or infinitely many solutions. If there is one solution, find it. If there are infinitely many solutions, parametrize the set of solutions.

$$\begin{aligned} 1x + 2y + 3z &= 4 \\ 2x - y &= 0 \\ 5y + 6z &= 8 \end{aligned}$$

2. (6 pts) For which values of c does the following system of equations have no solutions? a single solution? infinitely many solutions? If there is a single solution, give it. If there are infinitely many solutions, parametrize them.

$$\begin{aligned} 4x + 2y &= 13 \\ 2x + cy &= 5 \end{aligned}$$

3. (10 pts) For which values of c does the following system of equations have no solutions? a single solution? infinitely many solutions? If there is a single solution, give it. If there are infinitely many solutions, parametrize them.

$$\begin{aligned} x + 2y + z &= 3 \\ 2x - y - 3z &= 5 \\ 4x + 3y - z &= c \end{aligned}$$

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4. (bonus) Consider the differential equation $\frac{d^3y}{dt^3} - 7\frac{dy}{dt} + 6y = 0$.

   (a) For what values of r does $y(t) = e^{rt}$ satisfy this differential equation?

   (b) If $e^{r_1 t}, e^{r_2 t}$, and $e^{r_3 t}$ all satisfy this differential equation, then $Ae^{r_1 t} + Be^{r_2 t} + Ce^{r_3 t}$ also satisfies the differential equation for any constants A, B, and C. (Can you explain why?) Find a solution to the differential equation that also satisfies the initial condition $y(0) = 1, y'(0) = 2, y''(0) = 3$.