Linear Algebra: Reactor Concentrations

The following system of equations is designed to determine concentrations (in $\frac{g}{m^3}$) in a series of coupled reactors as a function of the amount of mass input to each reactor (in $\frac{g}{day}$):

$$15c_1 - 3c_2 - c_3 = 4000$$
$$-3c_1 + 18c_2 - 6c_3 = 1500$$
$$-4c_1 - c_2 + 12c_3 = 2400$$

a) Determine (via MATLAB) the matrix inverse, then solve the system.
b) Matt Labb obtained $c_{ML} = [300 \quad 250 \quad 300]'$. Compute the 1-norm, 2-norm, and ∞-norm of the error vector between Matt Labb's solution and the solution from (a) $(e = c_{part\ a} - c_{ML})$.
c) Determine how much the rate of mass input to Reactor 3 must be increased to induce a $10\ \frac{g}{m^3}$ rise in the concentration of Reactor 1.
d) How much will the concentration in Reactor 3 be reduced if the rate of mass input to Reactors 1 and 2 is reduced by $500\ \frac{g}{day}$ and $250\ \frac{g}{day}$, respectively?