1. Given the time varying system below:

$$\dot{x} = \begin{bmatrix} -1 & e^{2t} \\ 0 & -1 \end{bmatrix} x$$

   a. Find the fundamental matrix of the system.
   b. Find the state transition matrices for the system.
   c. What is the time domain solution if the system is unforced with initial condition $x(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$?
   d. With the input $u(t)$ and the same initial condition in part c, what is the general time domain solution? (You don't need to expand the integral.)

2. Now with the state space of your own project:
   a. What are the input and output?
   b. What are the states and their initial conditions?
   c. What is the time domain solution of your system?
   d. Simulate your system and plot the states and output in Matlab.