Immune System Steady-State Simulation

The problem is describing the immune response triggered by encountering foreign antigens. This response is called the CTL (Cytotoxic T Cell) response. Suppose that (z), which are CTL Cells, eliminates infected cells. There are 4 variables: unifected cells (x), infected cells (y), free virus particles (v) and CTL cells (z). The equations are:

*x’=λ-dx-Bxv*

*y’=Bxv-ay-pyz*

*v’=ky-uv*

*z’=c-bz*

For this problem I am to create a Simulink Model and Matlab script using the following variables:

***λ=*1; d=0.01; a=0.05; B=0.005; p=1; k=50; u=5; b=0.05**.

**Problem 1)** Let c=0. If c=0 then this will produce no CTL response. This basically gives an example of what would happen if there was no immune system. Make a Simulink model representing this simulation and determine the steady-state value by running the simulation and by running the “trim” function in matlab. The variables are:

x(0)=10;

y(0)=1;

v(0)=1;

z(0)=0

\*\* These are the initial conditions inside the integrator block in Simulink

Problem 2) Go back to “Part 1” and linearize the system using the “linmod” function in matlab around the steady-state result from “Part 1”

Notes:

\*\*\* I have been working on this problem for some time and still having problems. I am having problems with my Simulink model, so I really need help on that one. I ran model with a step response of 0. The research that I have done on using the “trim” function, show that my trim function should look something similar to [vss,u,y,dx]=trim(‘CTLprob’,‘[xinit,yinit,vinit,zinit]’). CTLprob is the name of my simulink model in this particular case. In Problem 2), I expect the [A,B,C,D]= linmod(‘CTLprob’,vss,[])?? Vss is the column vector of the steady state values and I just need to find the matrices of A,B,C & D. I really need help on powering through this problem if you can help.

\*\*If you think you have a better way of solving Problem 1 or 2 than what I described above, by all means help.