Homework for Lecture 17 of Dr. Z.'s Dynamical Models in Biology class

Email the answers (as a .pdf file) to

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by 8:00pm Monday, Nov. 3, 2025.

Subject: hw17

with an attachment hw17FirstLast.pdf

1. Find all the equilibrium points and stable equilibrium points of the following one-dimensional dynmaical system

$$\frac{dx}{dt} = -(x-1)(x-4)(x-7)(x-8) \quad .$$

2. (You can use Maple for the eigenvalues, but not for the Jacobian)

Find all stable equilibria of the 3-dimensinal dynamical system:

$$\begin{aligned}
\frac{dx}{dt} &= 1 - \frac{3x}{1+y+z} \quad , \\
\frac{dy}{dt} &= 1 - \frac{3y}{1+x+z} \quad , \\
\frac{dz}{dt} &= 1 - \frac{3z}{1+x+y} \quad .
\end{aligned}$$

3. Find all the the equilibria and stable equilibria of the 3-dimensinal dynamical system:

$$\begin{aligned}
\frac{dx}{dt} &= 1 - \frac{x}{1+y+z} \quad , \\
\frac{dy}{dt} &= 1 - \frac{y}{1+x+z} \quad , \\
\frac{dz}{dt} &= 1 - \frac{z}{1+x+y} \quad .
\end{aligned}$$

4. What are the equilibria, and stable equilibria of the Chemostat model with parameters $a_1 = 2$ and $a_2 = 5$?