1. What is a system of differential equations?

2. What does a solution to a system of differential equations look like?

3. What does an equilibrium solution to a set of differential equations look like?

4. Given a potential solution to a system of differential equations, how do you test to see if what you are given is indeed a solution?

5. Consider the system of differential equations

\[
\frac{dx}{dt} = 2 - x - y, \quad \frac{dy}{dt} = -y.
\]

(a) Find the constant solution(s) for the system.

(b) Find the horizontal and vertical nullclines for this system, and make a rough sketch of the fluid flow in the \((x, y)\)-plane. Is/are the constant solution(s) stable?
6. Which of the following are solutions to the previous set of differential equations? Clearly show or explain why or why not.

(a) \( x(t) = 0, \ y(t) = 2 \)

(b) \( x(t) = e^{-t}(1 - t) + 2, \ y(t) = e^{-t} \)

(c) \( y(t) = 0 \)

(d) \( x(t) = e^{-t}(1 - t) + 2, \ y(t) = -e^{-t} \)

(e) \( y(t) = -e^{-t} \)

(f) \( x(t) = e^{-t}(3 - t) + 2, \ y(t) = e^{-t} \)

For extra practice with phase portraits and vertical and horizontal nullclines, work problems 17-20 on page 113 of section 2.6 of your text. If you do not have the text, I have a few photocopies. Solutions will be available tomorrow during my office hours from 4-6.