Fundamentals of Ecology ESS/BIO 148
Homework 3

Name________________________

Section________________________

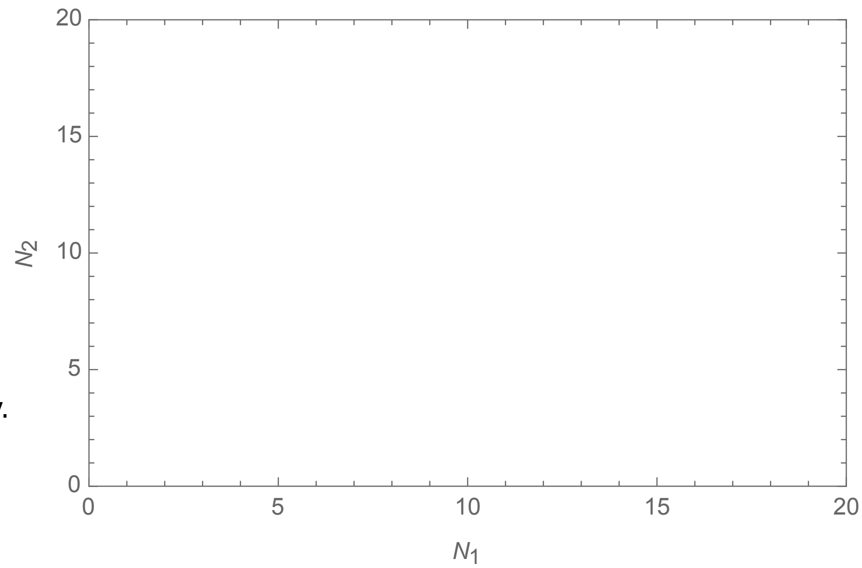
CLEARLY **Draw and Label** the isoclines and corresponding vector field for the following systems. **Label** where the isoclines intersect the x- and y-axes.
(use a ruler and make sure the isoclines intersect with the axis at the correct places!)

1)

$$\frac{dN_1}{dt} = 2N_1\left(1 - \frac{N_1 + 0.5N_2}{10}\right)$$

$$\frac{dN_2}{dt} = 2N_1\left(1 - \frac{N_2 + 5N_1}{10}\right)$$

If a population starts at $N_1 = 2$, $N_2 = 3$, where will it end up? Draw the trajectory.

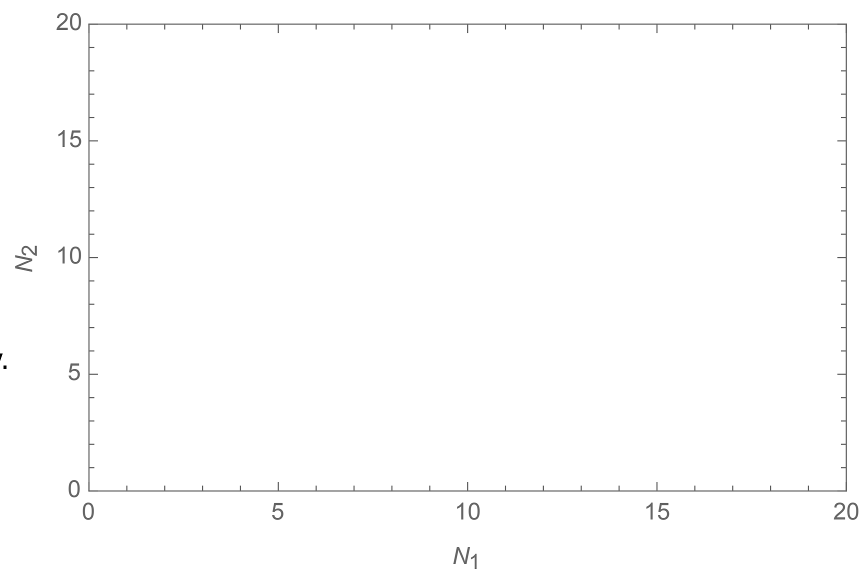


2)

$$\frac{dN_1}{dt} = 2N_1\left(1 - \frac{N_1 + 0.5N_2}{10}\right)$$

$$\frac{dN_2}{dt} = 2N_1\left(1 - \frac{N_2 + \frac{2}{3}N_1}{10}\right)$$

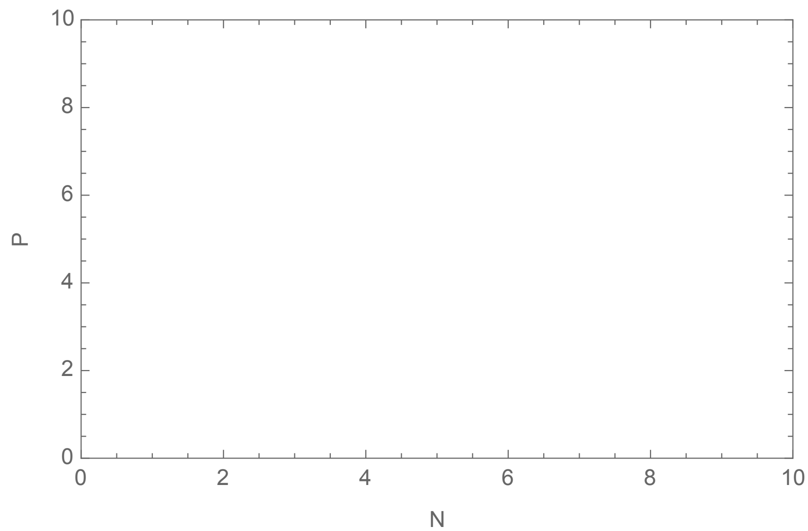
If a population starts at $N_1 = 10$, $N_2 = 5$, where will it end up? Draw the trajectory.



3) Assuming the growth rate of N is 2, the attack rate = 0.5, the conversion efficiency is 0.1, and the mortality rate is 0.2…

$$\frac{dN}{dt} = 2N - 0.5NP$$
$$\frac{dP}{dt} = 0.1 * 0.5 * NP - 0.2P$$

If a population starts at N=2, P=2,
where will it end up? Draw the trajectory.



4) Given the following dynamics for a disease in a population.

$$\frac{dS}{dt} = -\beta\frac{IS}{N}$$
$$\frac{dI}{dt} = \beta\frac{IS}{N} - \gamma I$$
$$\frac{dR}{dt} = \gamma I$$

Assuming: $\beta = 0.5$ and $\gamma = 2$, calculate R_0. What do you expect to occur?

Assuming: $\beta = 0.8$ and $\gamma = 0.5$, calculate R_0. What do you expect to occur?