HW 5 SARAH WARD

BHP

8.1 $\frac{\Delta P}{\Delta H} = m$ $X = x\text{-int}$

a. $\frac{dH}{dt} = rH - bHP$ $\qquad \frac{dP}{dt} = cHP - kP$

needs negative slope

$P = \frac{r}{b} - mH$

$y = mx + b$

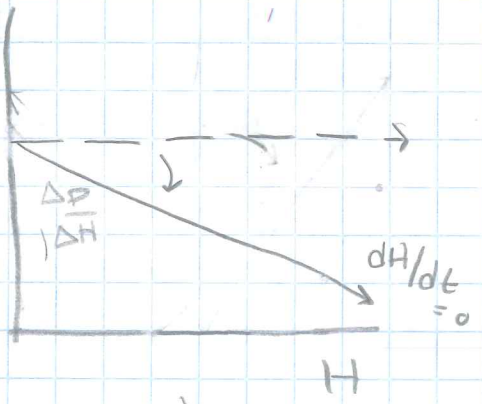
positive slope

$0 = cHP - kP$

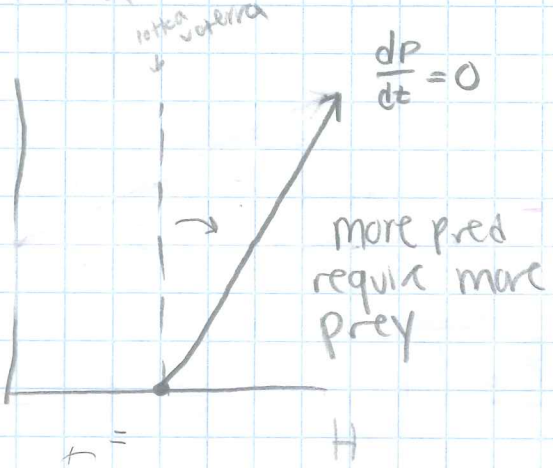
$H = \frac{k}{c}$

more pred = ↑ rate of predation

b.



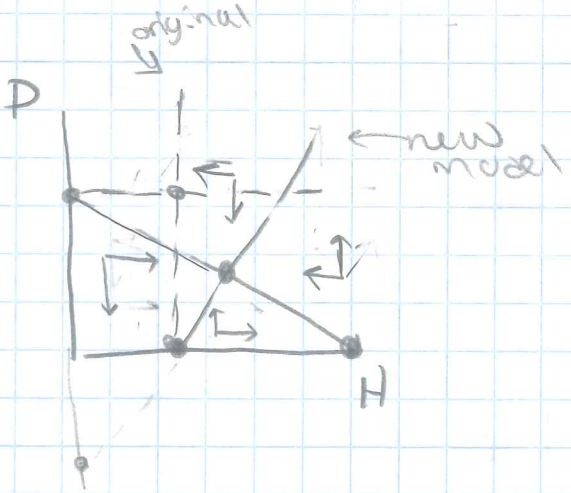
c.



equilibrium includes x intercept for dH/dt now.

d. $\begin{bmatrix} \frac{\partial f}{\partial H} & \frac{\partial F}{\partial P} \\ \frac{\partial G}{\partial H} & \frac{\partial G}{\partial P} \end{bmatrix}$

$\begin{bmatrix} + & 0 \\ 0 & - \end{bmatrix}$



trace → unknown w/ at eigenvalues

determinant → $- \cdot 0 =$ − negative

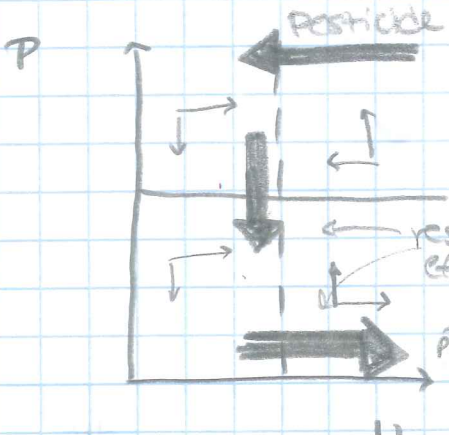
e. unstable

f. as Predator H's increase, rate of capture ↑ and population of H is linearly impacted.

↑P = ↓H. The system is unstable because at some point, too many predators will cause the prey to go extinct, then the predators will fail too.

8.3

$$\frac{dH}{dt} = rH - bHP \qquad \frac{dP}{dt} = cHP - kP$$



Spraying the pesticide decreased prey population below the equilibrium causing the predator population to fall.

So prey (pest) actually increased. Could be a time lag like lynx + hares. Predators can't respond as quickly as prey, so prey population explodes

8.4

$\frac{X}{H}$ = % of prey in refuge

a. $$\frac{dH}{dt} = rH - b\left(H - \frac{X}{H}\right)P \qquad \frac{dP}{dt} = c\left(H - \frac{X}{H}\right)P - kP$$

X = constant # of prey in refuge ← a

b. $$\frac{dH}{dt} = rH - bXP \qquad \frac{dP}{dt} = cXP - kP$$

$\frac{dH}{dt}$ $0 = rH - bXP$

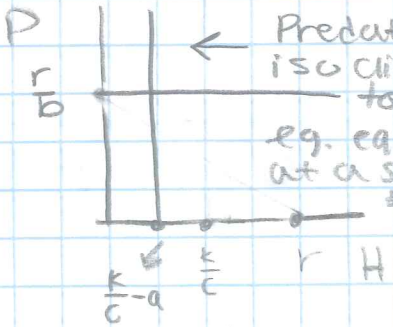
$bXP = rH$

$P = \frac{rH}{bX}$

$0 = cXP - kP$

$kP = cXP$

$X = \frac{k}{c}$



$P = \frac{rH}{b(H-a)}$?

$X = H - a$

$H = \frac{k}{c} - a$

↑ # of prey in refuge

↘ X (constant # of prey in refuge)

8.4 cont'd

C. refuges shift the stability of the population by changing the equilibrium points.

↓ Prey to eat means that a predator population is stable @ equilibrium at smaller numbers. If the population of predators exceeds that there aren't enough prey to sustain them because of the refuges.