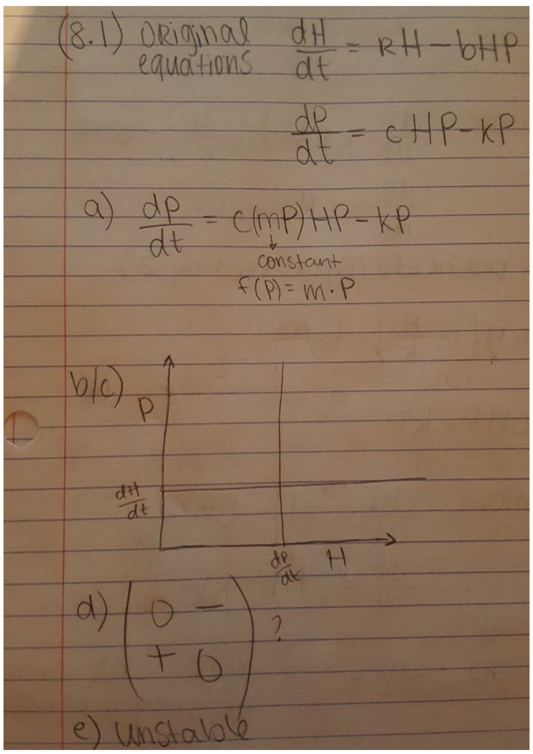
BI 471/571: Population Ecology

Problems 5: predator-prey

Due 5/13/2016

1. Hastings Problems 8.1, 8.3, 8.4

8.1)



(8.1) Original equations $\frac{dH}{dt} = RH - bHP$

$\frac{dP}{dt} = cHP - kP$

a) $\frac{dP}{dt} = c(mP)HP - kP$

constant

$f(P) = m \cdot P$

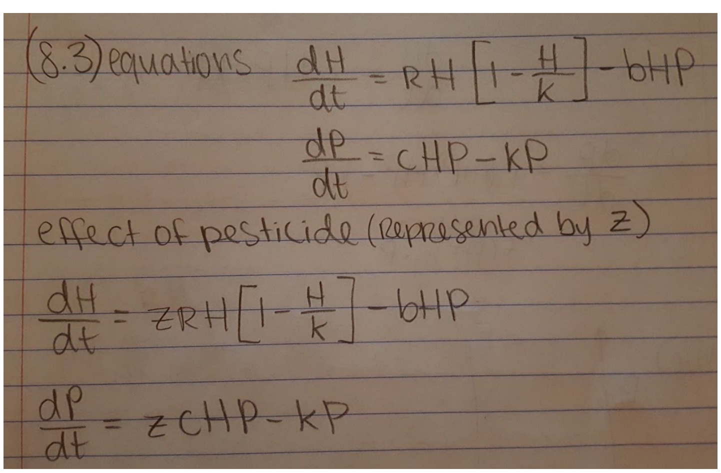
b/c)



d) $\begin{pmatrix} 0 & - \\ + & 0 \end{pmatrix}$ ?

e) unstable

8.3)



(8.3) equations $\frac{dH}{dt} = RH\left[1 - \frac{H}{k}\right] - bHP$

$\frac{dP}{dt} = cHP - kP$

effect of pesticide (represented by z)

$$\frac{dH}{dt} = zRH\left[1 - \frac{H}{k}\right] - bHP$$

$$\frac{dP}{dt} = zcHP - kP$$

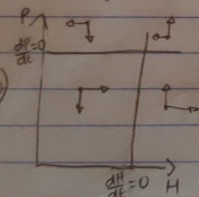
8.4) (8.4) equations $\frac{dH}{dt} = RH - bHP$

$$\frac{dP}{dt} = cHP - kP$$

prey refuge

a) $\frac{dH}{dt} = RH - b(1-E)HP$ where E is amount of prey in refuge

$$\frac{dP}{dt} = \underbrace{c(1-E)}_{\text{change in pred pop b/c of change in prey density}}HP - kP$$




b) $\frac{dH}{dt} = R\cancel{H} - b(1-E)\cancel{H}P = 0$ $P = R/b(1-E)$ $>0 \uparrow$ $<0 \downarrow$

$\frac{dP}{dt} = c(1-E)H\cancel{P} - k\cancel{P} = 0$ $H = k/c(1-E)$ $>0 \rightarrow$ $<0 \leftarrow$

c) Refuges definitely help keep prey pop stable, thus creating pred pop stability

2.