Mathematics 172

**Quiz 29** Name: Key

***You must show your work to get full credit.***

Let a predator population size, $P(t)$, and victim population size $V(t)$ be related by the system

$$\frac{dV}{dt} = 0.8V\left(1 - \frac{V}{200}\right) - 0.2VP = V\left(.8\left(1-\frac{V}{200}\right) - .2P\right)$$

$$\frac{dP}{dt} = -1.5P + 0.01VP. = P(-1.5 + .01V)$$

**1.** Draw the $V$, $P$ plane with $V$ the horizontal axis and $P$ the vertical axis showing the lines where $\frac{dV}{dt} = 0$ and where $\frac{dP}{dt} = 0$ and arrows showing the direction of motion.

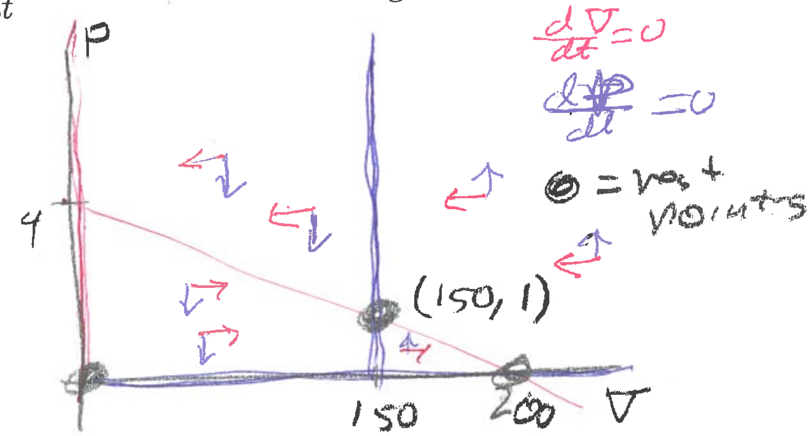
$\frac{dV}{dt} = 0$ when $V = 0$

or $(*)$ $.8\left(1 - \frac{V}{200}\right) - .2P = 0$

$\frac{dP}{dt} = 0$ when $P = 0$

or $V = \frac{1.5}{.01} = 150$

Intercepts of $(*)$ are $V = 200$, $P = \frac{.8}{.2} = 4$




**2.** What are the rest points?

when $V = 150$ in $(*)$

$.8\left(1 - \frac{150}{200}\right) - .2P = 0$

$.8\left(\frac{1}{4}\right) - .2P = 0$

$P = \frac{.2}{.2} = 1$

The rest points are: (0, 0), (200, 0), (150, 1)

**3.** What are stable rest points?

The stable points are: (150, 1)

**4.** If $V(0) = 195$ and $P(0) = 1$ estimate $V(132)$ and $P(132)$.

$V(132) \approx$ 150 $P(132) \approx$ 1