Quiz 28

Name: _____ Key _____

You must show your work to get full credit.

The whirligig beetles (insects of the family Gyrinidae) are aquatic insects that live and breed in fresh water (See Figure 1[1]). The adults can fly and therefore beetles from one pond can colonize anther pond. Assume that we are in a region with many ponds (say Minnesota) and we have species of whirligig beetle breeds just once a year. Also assume

Probability that a pond with no beetles one year gets colonized the next year $= .3$

Probability that a ponds with beetles one year has no beetles the next year $= .1$
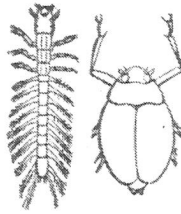

FIGURE 1. Drawing of an adult and larva of a whirligig beetle. Both adults and larva are predators on smaller aquatic life.

Let f_t be the proportion (that is the fraction) of ponds that have our species of whirligig beetle in them in year t.
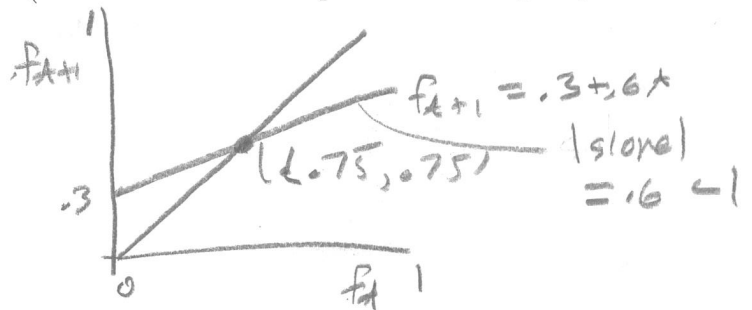
1. Write a difference equation for f_t.

Equation is $\underline{\Delta f = .3(1-f) - .1f}$

2. What is the equilibrium point for this equations?
$f^* = \underline{\quad .75 \quad}$

Set $\Delta f = .3 - .3f - .1f = 0$ and solve for f

$$-.4f = -.3$$
$$f = .75$$

3. Is this equilibrium point (stable) or **unstable**? (Circle one and draw picture showing why this is stable or unstable.)

$$f_{t+1} - f_t = .3(1-f_t) - .1f_t$$
$$f_{t+1} = .3 - .4f_t + f_t$$
$$= .3 + .6f_t$$

$f_{t+1} = .3 + .6t$

$(.75, .75)$

$|slope|$
$= .6 < 1$

4. In the long run what percentage of the ponds do you expect to have our species of whirligig beetle?

The percentage is $\underline{\quad 75\% \quad}$

[1]Figure from: https://en.wikipedia.org/wiki/Whirligig_beetle