MATH 172 **Fall, 2011** **Quiz #7** **Name:** M

Recall that the geometric series $\sum_{n=0}^{\infty} ar^n$ has a sum $S_\infty = a/(1-r)$ under a certain condition on r, which you should verify, and fails to exist otherwise.

1. A reproductive female in the oldest stage of development produces 8 offspring on average each year. Her annual survival rate is 60%. What is her expected lifetime production of offspring?

$8 + 8(0.6) + 8(0.6)^2 + \cdots$

geom series $a = 8$, $r = 0.6$ $|0.6| < 1$

$$S_\infty = \frac{a}{1-r} = \frac{8}{1-0.6} = \frac{8}{0.4} = 20$$

2. Find the sum if it does exist, or state that there is no sum, and why.

a. $\sum_{n=0}^{\infty} \frac{1}{2}(-\frac{3}{4})^n$

$a = \frac{1}{2}$ $r = -\frac{3}{4}$ $|\frac{-3}{4}| < 1$

$$\frac{a}{1-r} = \frac{1/2}{1-(-\frac{3}{4})} = \frac{1/2}{7/4} = \frac{1}{2}\cdot\frac{4}{7} = \frac{2}{7} \approx 0.286$$

b. $\sum_{j=0}^{\infty}(-\frac{3}{4})(\frac{4}{3})^j$

$a = -\frac{3}{4}$ $r = \frac{4}{3}$ $|\frac{4}{3}| > 1$

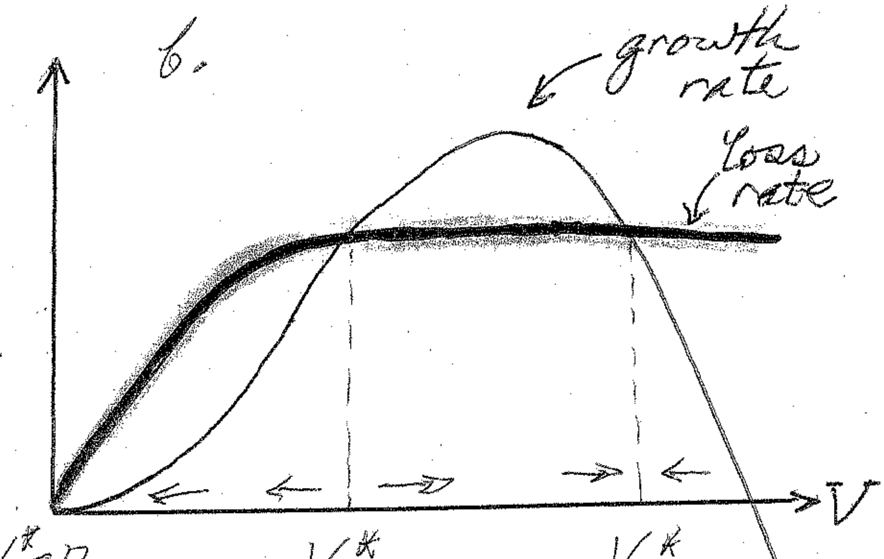
There is no sum.

(over $\rightarrow$)

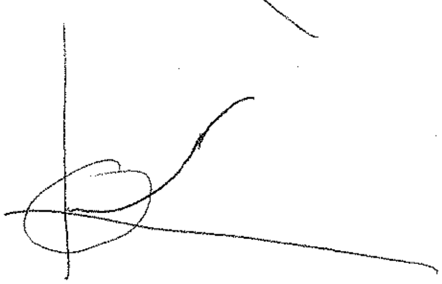
3. A victim population has a growth rate curve (light line) as shown.
   a. At low population levels the growth rate is not logistic; how is it different?
   b. Superimposed on this graph is a heavy curve indicating the loss rate due to moderate predation by a predator that exhibits a type II functional response. Label the equilibrium values for V^* on the graph, determine if each is stable or unstable, and indicate verbally or by arrows how V will change if it falls just slightly off each equilibrium value.

a. logistic growth rate curve is a perfect parabola; this has a slower than logistic growth rate for V near 0.

b.



$V^*=0$ stable $\quad V^*$ unstable $\quad V^*$ stable



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