

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?

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

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

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

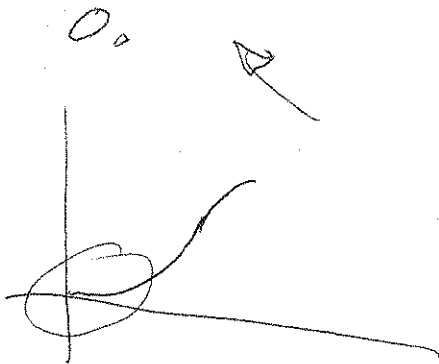
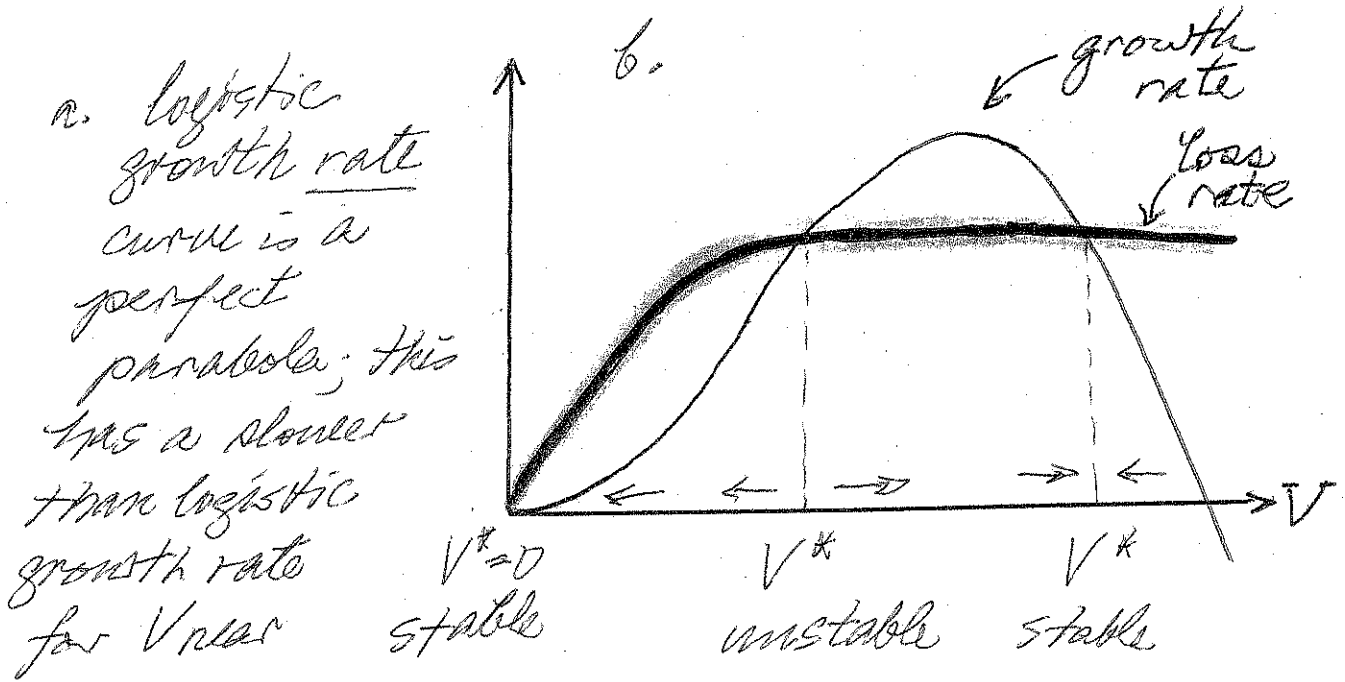
$$\frac{a}{1-r} = \frac{\frac{1}{2}}{1 - \left(-\frac{3}{4}\right)} = \frac{\frac{1}{2}}{\frac{7}{4}} = \frac{1}{2} \cdot \frac{4}{7} = \frac{2}{7} \approx 0.286$$

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

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

There is no sum.

3. A victim population has a growth rate curve (light line) as shown.
- At low population levels the growth rate is not logistic; how is it different?
  - 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.



instead of

