Recall that the geometric series \( \sum_{n=0}^{\infty} a r^n \) 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?

\[
8 + 8(0.6) + 8(0.6)^2 + \ldots
\]

Geometric series \( a=8, \quad r=0.6 \), \(\left | \frac{r}{1-r} \right | < 1\)

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

2. Find the sum if it does exist, or state that there is no sum, and why.
   a. \( \sum_{n=0}^{\infty} \frac{1}{2} \left ( -\frac{3}{4} \right )^n \)

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

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

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

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

There is no sum.

(over →)
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 $V < V^*$.  

$b.$  

Instead of