MATH 172 Fall, 2011 Quiz #8 Name: M2

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. Compute the equilibrium point (u^*, v^*) of the two-variable discrete model

$$\begin{aligned} u_n &= 3u_{n-1} - 2v_{n-1} - 4 \\ v_n &= 5u_{n-1} - 3v_{n-1} - 28 \end{aligned}$$

$$\begin{cases} u^* = 3u^* - 2v^* - 4 \\ v^* = 5u^* - 3v^* - 28 \end{cases}$$

$$\times(-2)\begin{cases} 4 = 2u^* - 2v^* \\ 28 = 5u^* - 4v^* \end{cases}$$

$$\begin{cases} -8 = -4u^* + 4v^* \\ 28 = 5u^* - 4v^* \end{cases}$$

$$20 = u^*$$

$$4 = 40 - 2v^*$$
$$2v^* = 36$$
$$v^* = 18$$

$$(u^*, v^*) = (18, 20)$$

2. A patient is given a 60 mg dose of a drug at regular intervals. In the time in between the drug declines to 15% of the amount present.
   a. At the time of the third dose (two time intervals) how much of the second dose remains? $60(.15) = 9$
   b. How much of the original dose remains? $60(.15)^2 = 1.35$
   c. Including the third dose, how much drug is in the bloodstream?
   $60 + 60(.15) + 60(.15)^2 = 70.35$
   d. What is the long term amount of drug in the bloodstream assuming that the dose continues to be repeated?
   $\sum_{n=0}^{\infty} 60(.15)^n$ $\quad |.15| < 1$
   $$= \frac{60}{1-0.15} = \frac{60}{0.85} = 70.59$$
   e. If 70 mg of the drug is neeeded to be effective, but above 75 mg is fatal, is this dosing pattern effective and safe?

   At a long term level of 70.59 (above 70) it is effective and (below 75) it is safe.