Example Drug Dosage Problem – Math151 – Answer

(a) The half-life allows us to find the elimination constant k since if there is N_0 mg in the body initially then he amount left at the time of the half-life (3 hours) is $N(3) = \frac{N_0}{2} = N_0 e^{-3k}$ so k = ln(2) / 3 and so at time 4 the amount of drug is $N(4) = N_0 e^{\frac{-4\ln(2)}{3}}$ so the fraction that remains is N(4) /N_0 = .4 and thus the fraction that decays between doses is .6

(b) The effective range for this patient is 400 to 1000 mg in the body so we need a dose D so that $400 < \frac{D}{1-a} < 100$ where a is the fraction that remains between each dose (so a=.4) Here $\frac{D}{1-a}$ is the equilibrium amount of drug that would be in the body after a long series of periodic doses each of size D. To ensure that just before each dose the amount in the body drops to 400 mg we need $\frac{D}{1-a}a = 400$ and with a=.4 this gives D=600 mg

(c) The loading dose should be $\frac{D}{1-a}$ which is 1000 mg.