Quiz 4

1. a. see H.W. 4

   b. $\dfrac{dc^*}{dt} = -k^* c^{*3}$, at $t=0$ $c^* = c_0^*$

   $\Rightarrow \dfrac{dc^*}{c^{*3}} = -k^* dt \Rightarrow -\dfrac{1}{2} c^{*-2} \Big|_{c_0^*}^{c^*} = -k^* \Big|_0^t$

   $\Rightarrow -\dfrac{1}{2}\left(\dfrac{1}{c^{*2}} - \dfrac{1}{c_0^{*2}}\right) = -kt$

   $\Rightarrow \dfrac{1}{c^{*2}} = \dfrac{1}{c_0^{*2}} + 2kt = \dfrac{1+2kt\,c_0^{*2}}{c_0^{*2}}$

   $\Rightarrow c^* = \left(\dfrac{c_0^{*2}}{1+2kc_0^{*2}t}\right)^{1/2}$

   $r_p = -\dfrac{1}{m_{cat}}\dfrac{dM}{dt} = k_p c^* kM$

   $\Rightarrow \dfrac{dM}{M} = -m_{cat}\,k_p k c_0^*\left(1+2kc_0^{*2}t\right)^{-1/2} dt$, at $t=0$, $M=M_0$

   $\Rightarrow \ln\dfrac{M}{M_0} = -m_{cat}\,k_p k c_0^* \dfrac{\left(1+2kc_0^{*2}t\right)^{1/2}}{k c_0^{*2}} = -m_{cat}\dfrac{k_p}{c_0^*}\left(1+2kc_0^{*2}t\right)^{1/2}$

   $\Rightarrow X = \dfrac{M_0-M}{M_0} = 1 - \dfrac{M}{M_0} = 1 - \exp\left(-m_{cat}\dfrac{k_p}{c_0^*}\left(1+2kc_0^{*2}t\right)^{1/2}\right)$

2. see class notes