Chapter 8 Review Questions

I. Solve the differential equation.

1. $\frac{dh}{dt} = 5 - 16t^2$, where $h(3) = -11$
2. $\frac{dy}{dx} = e^{-x}$, where $y_0 = 10$ when $x_0 = 0$
3. $\frac{dy}{dx} = 2(1-y)$, where $y_0 = 2$ when $x_0 = 0$
4. $\frac{dx}{dt} = -2x$, where $x(1) = 5$
5. $\frac{dy}{dx} = y(1-y)$, where $y_0 = 2$ when $x_0 = 0$
6. $\frac{dy}{dx} = x^2y^2$, where $y_0 = 1$ when $x_0 = 1$

II. a) Find the equilibria of the differential equation

b) Graph $\frac{dy}{dx}$ as a function of y, and use the graph to discuss the stability of the equilibria.

c) Compute the eigenvalues associated with each equilibrium and discuss the stability of the equilibria.

7. $\frac{dy}{dx} = (3-y)(2-y)$
8. $\frac{dy}{dx} = y(1-y)(y-2)$ (Allee Effect)
9. $\frac{dy}{dx} = 0.75(0.2-y)$ (Single Compartment Model)
10. $\frac{dy}{dx} = 0.65y(1-y) - 0.3y$ (Levins Model)

III. Miscellaneous

11. If a drug is being administered intravenously, the amount of a drug present in your system can be modeled by the differential equation $\frac{dM}{dt} = q - rM$, where q and r are positive constants.

a) If $M_0 = 0$, solve for M as a function of t.

b) Find $\lim_{t\to\infty} M(t)$