1. A population of 100 banana loving fruit flies eats nothing but bananas. After 2 weeks of unlimited food supply and no predators, there are now 1000 fruit flies.
(a) Assuming an exponential growth model, how many fruit flies would there be after 5 more weeks?
(b) Suppose that the final population from part (a) is now living off a limited food supply of 4 pounds of bananas per week, and that 2 pounds of bananas per week are required to support a population of 350 fruit flies. According to the logistic model, with $k = 1.5$, what is the population of fruit flies after another 2 weeks.
(c) If a child starts killing 15 flies per day, how might we modify the logistic equation from part (b)?

2. Let $c > 0$. A differential equation of the form

$$\frac{dy}{dt} = ky^{1+c}$$

where $k > 0$ is called the doomsday equation becuase the exponent $1 + c$ is larger than 1.
(a) Find the solution of this model with $y(0) = y_0$.
(b) Show that there is a finite time, $t = T$ (doomsday) such that

$$\lim_{t \to T^-} y(t) = \infty$$

(c) A certain breed of rabbits has the growth term $ky^{1.01}$. If the population is initially 2 and there are 16 rabbits after 3 months, then when is doomsday?

3. The rate of change in the number of people at a dance who where a rumor is modeled by a logistic differential equation. There are 2000 people at the dance. At 9 pm 400 people have heard the rumor and the rate is increasing at 500 people per hour. Write the logistic model that satisfies this situation.

4. The population of bears in a national park is modeled by,

$$\frac{dP}{dt} = 5P - 0.002P^2$$

where P is the number of bears and t is time in years. Compute $\lim_{t \to \infty} P(t)$ and sketch the graph for the following initial conditions.
(a) $P(0) = 100$
(b) $P(0) = 1500$
(c) $P(0) = 3000$