1. Given that $\frac{dP}{dt} = \sqrt[3]{P}$ and $P(0) = 100$, use Euler's Method with $\Delta t = 2$ to obtain an estimate for $P(10)$.

t	P	$\frac{dP}{dt} = P^{1/3}$	$P_{new} \approx P + \left(\frac{dP}{dt}\right) \cdot \Delta t$
0	100	4.64	100 + 4.64(2)
2	109.28	4.78	109.28 + 4.78(2)
4	118.85	4.92	118.85 + 4.92(2)
6	128.68	5.05	128.68 + 5.05(2)
8	138.78	5.18	138.78 + 5.18(2)
10	149.13		

$P(10) \approx 149.1$

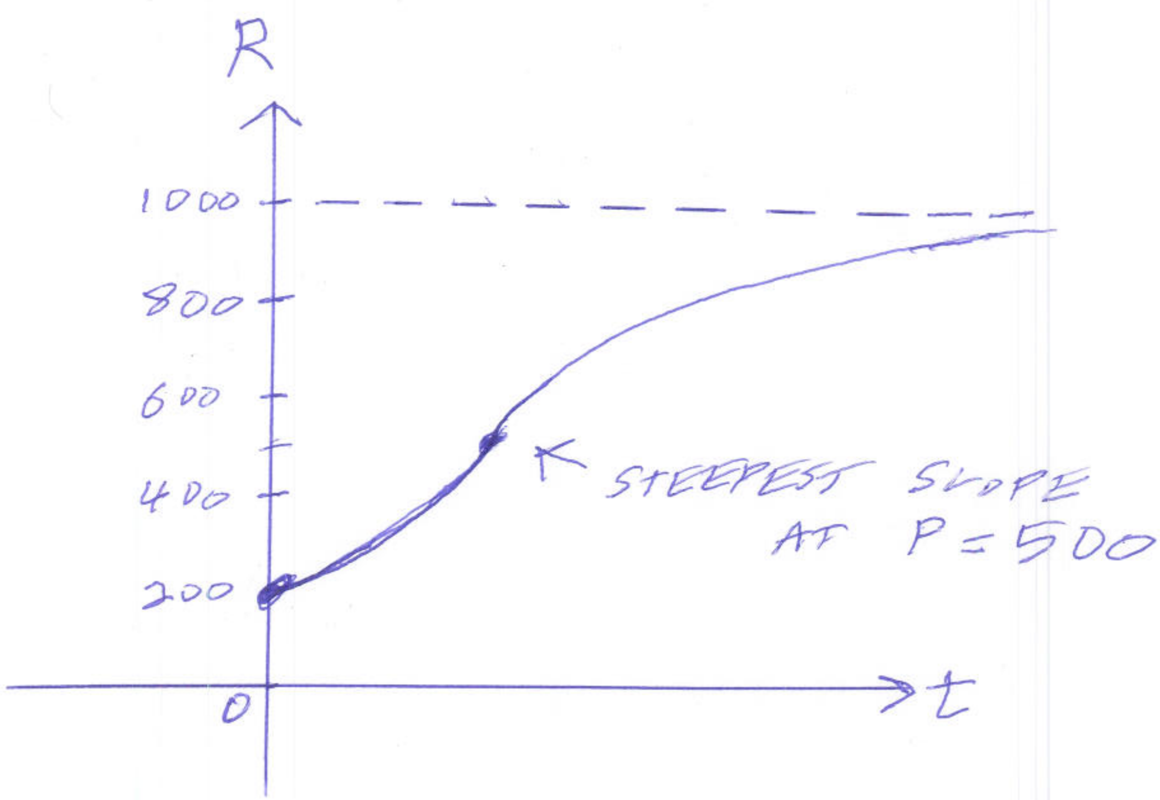
2. Suppose that 200 rabbits are released on Lady Tottington's estate, and that the population of these rabbits grows logistically with an intrinsic growth rate of 4% per month and a carrying capacity of 1000 rabbits.

   (a) Let R represent the number of rabbits on her estate t months after the initial release. Determine a differential equation with initial condition to model this population of rabbits.

$$\frac{dR}{dt} = 0.04R\left(1 - \frac{R}{1000}\right)$$

$$R(0) = 200$$

   (b) Sketch a plausible graph for this population of rabbits.



3. The population of a town is currently 600, but is projected to grow by 30 people per year from now on.

   (a) Determine a differential equation with initial condition to model this town's population. Use P for the population t years from now.

$$\frac{dP}{dt} = 30$$

$$P(0) = 600$$

   (b) Find an explicit formula for this town's population.

$$P = 30t + 600$$

4. The population of a town t years from now is given by P. Suppose that the population of the town is currently 400.

(a) Determine a mathematical model which best describes this town's population if it grows at a continuous rate of 8.5% per year.

$$\frac{dP}{dt} = 0.085P$$

$$P(0) = 400$$

(b) Determine a mathematical model which best describes this town's population if it grows at an annual rate of 8.5% per year.

$$P(n) = P(n-1) + 0.085P(n-1)$$
$$= 1.085P(n-1)$$

$$P(0) = 400$$

(c) Find an explicit formula for P using each of your models above and use it to predict the population 10 years from now.

(a) $P(t) = 400e^{0.085t} \Rightarrow P(10) \approx 936$

(b) $P(n) = 400(1.085)^n \Rightarrow P(10) \approx 904$

5. Suppose that the population of a town is always growing at a rate which is proportional to the population itself. Suppose further that the population is currently 500 and is growing at a rate of 25 people per year. Find a differential equation with initial condition to model the population of this town. Use P for the population t years from now.

$$\frac{dP}{dt} = K \cdot P$$

$$25 = K \cdot 500$$

$$K = \frac{25}{500} = 0.05$$

$$\boxed{\begin{gathered} \frac{dP}{dt} = 0.05P \\ P(0) = 500 \end{gathered}}$$