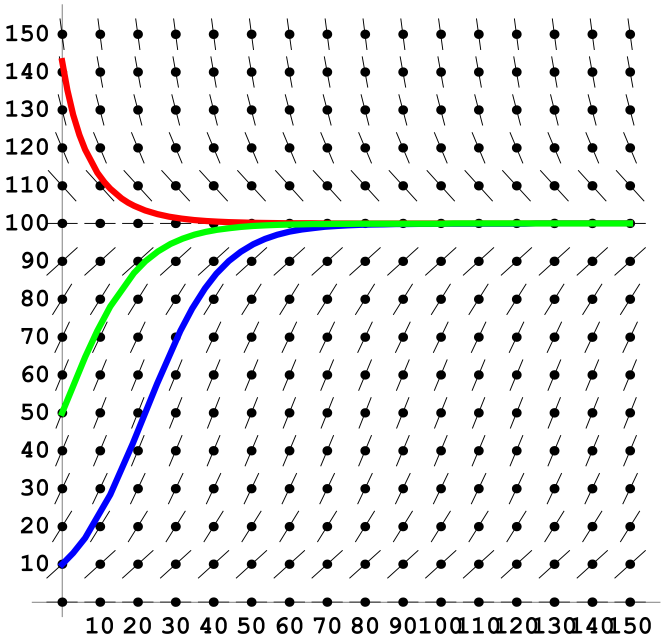
# 6.5 Population Growth

**Growth and Decay Equations** $\frac{dy}{dt} = ky$ and $y = y_0 e^{kt}$ where $k$ is the relative growth rate.

**Logistic Growth Model** $\frac{dP}{dt} = \frac{k}{M} P(M - P)$ and $P = \frac{M}{1 + Ae^{-kt}}$ $\rightarrow$ $A = \frac{M - P_0}{P_0}$

where $M$ is the carrying capacity, with constant $k$, and initial population $P_0$.

Here's an example of what a Logistic growth model might look like:




1. Find an equation for the population of Reedley, if the relative growth rate is 0.05, and the current population is 20, 000.

2. Find a logistic growth model if $k = 0.04$, $M = 240$, and $P(0) = 80$

**Find solutions to the following logistic differential equations in 3 – 5**

3. $\dfrac{dP}{dt} = 0.15P\left(1 - \dfrac{P}{120}\right)$

4. $\dfrac{dP}{dt} = 0.03P - 0.00006P^2$

5. $\dfrac{60}{P}\dfrac{dP}{dt} = 4 - \dfrac{P}{200}$

**Identify k, the carrying capacity, and $P_0$ for the following logistic differential equations in 6 and 7.**

6. $P(t) = \dfrac{550}{1 + e^{2.5 - 0.5t}}$

7. $P(t) = \dfrac{800}{1 + e^{-t}}$