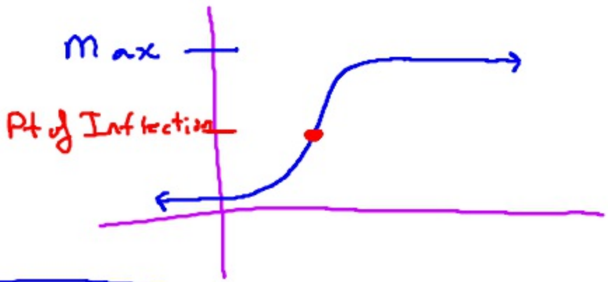
What you'll Learn About

- How to recognize a logistical growth differential equation

I am sick (Initial Value). Eventually everyone gets sick(Max). So what happens to the rate of people getting sick. People will get sick quickly, then it will be harder to find people that aren't sick yet (rate slows down-point of inflection) and eventually everyone gets sick.

This is similar to a rumor spreading or facebook/twitter accounts.



$$\boxed{\frac{dP}{dt} = kP(M-P)}$$

$\frac{dP}{dt}$ rate of growth of people getting sick

kp : directly proportional to the sick people

M - P : healthy people (Not sick yet)

Pt. of Inflection = $\frac{1}{2}$ Max

Remember directly proportional is just like P = 8.50h (Your pay is directly proportional to the amount of money you make which can change) That 8.50 is your k.

In 1985 and 1987, the Michigan Department of Natural Resources airlifted 61 moose form Algonquin Park, Ontario to Marquette County in the Upper Peninsula. It was originally hoped that the population P would reach carrying capacity in about 25 years with a growth rate of

$$\frac{dp}{dt} = .0003P(1000 - P)$$

Solve the differential equation with the initial condition P(0) = 61.

$$\frac{dP}{dt} = .0003P(1000-P)$$

$$\frac{A}{P} + \frac{B}{1000-P} = \frac{1}{P(1000-P)}$$

$A = .001 \quad B = .001$

Partial Fractions

$$\int \frac{dP}{P(1000-P)} = \int .0003\,dt$$

$$\int \frac{.001}{P} + \frac{.001}{1000-P} = \int .0003dt$$

$$.001\int \frac{1}{P} + \frac{1}{1000-P} = \int .0003dt$$

Divide by .001

$$\int \frac{1}{P} + \frac{1}{1000-P} = \int .3\,dt$$

$$-1\left(\ln P - \ln(1000-P) = .3t + C\right)$$

$$-\ln P + \ln(1000-P) = -.3t + C$$

$$\ln\left(\frac{1000-P}{P}\right) = -.3t + C$$

$$\frac{1000-P}{P} = e^{-.3t + C}$$

$$\frac{1000}{P} - \frac{P}{P} = e^{-.3t+C}$$

$$\frac{1000}{P} - 1 = e^{-.3t+C}$$

$$\frac{1000}{P} = Ae^{-.3t} + 1$$

$$\frac{1000}{Ae^{-.3t}+1} = P$$

$$\frac{1000}{Ae^{-.3(0)}+1} = 61$$

$$\frac{1000}{A+1} = 61$$

	$\frac{1000}{61} = A + 1$ $\frac{1000}{61} - 1 = A$ $15.393 = A$ $\boxed{\frac{dP}{dt} = .0003P(1000 - P) \qquad P = \frac{1000}{15.393e^{-.3t} + 1}}$ $P = \frac{1000}{Ae^{-1000(.0003)t} + 1}$