Class 24: *Monday, October 31*

Population Models and Qualitative Analysis, Part 2

Reading: *Smith & Minton* Section 2.8, pp. 225-226.

We have looked at exponential and logistic growth models. Today we will discuss a model that is often used in cancer modeling and isn't an extension of the previous models. And, **Happy Halloween!**

Lab 6: Data and Population Models

Monday, October 31 and Tuesday, November 1.

In this lab you will investigate models we have seen previously and compare them to how the US population has changed over the past two centuries.

Quiz 7 There will be a quiz in lab on indeterminate forms.

Class 25: *Wednesday, November 2*

Stability of Equilibrium Values

The slope function $F(y)$ for a rate equation of the form $y' = F(y)$ can be used to find and classify equilibrium values. An equilibrium value of a rate equation is a value of $y(t)$ for which the slope function outputs zero. Equilibrium values can either be asymptotically stable or not asymptotically stable. An asymptotically stable value is a value such that if the solution function $y(t)$ becomes near this value at some time, it remains "near" this equilibrium value. In some sense, these are "attractive steady states" of the model. In other words, these are values of the solution which, in the long term, the solution tends to settle near. Not all equilibrium values are asymptotically stable, however. Understanding the long term qualitative behavior of rate equations is a very important technique for interpreting mathematical models.

Homework 9: *Smith & Minton* Section 6.6: 30, 32, 35, 36.

Class 26: *Friday, November 4*

Rate Equations, Slope Functions and Concavity

The slope function $F(y)$ for a rate equation of the form $y' = F(y)$ can also be used to find other properties of the solution of the rate equation. The first derivative of the slope function, $F'(y)$, can be used to find *inflection values.* A value $\hat{y}$ is an inflection value for a solution $y(t)$ of the rate equation if $\hat{t}$ is an inflection point of $y(t)$ and $y(\hat{t}) = \hat{y}$. An inflection point of a function $y(t)$ is a point where the second derivative y'' changes sign and the graph of the function changes concavity. We will use this information to sketch more accurate solution curves of rate equations and initial value problems.

Quiz 8 There will be a take home quiz handed out in class.

Homework 10: *Smith & Minton* Section 3.5: 10, 22, 24 (*You do not need to find the extrema.*), 51, 52.

Homework 9 due in the Math 114 Course Box by 5:00 pm.