INTRODUCTION TO ORDINARY DIFFERENTIAL EQUATIONS
MATH 119A
Winter Quarter, 2011

Nonlinear Dynamics and Chaos by Steven H. Strogatz

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PREREQUISITE: MAT 21-22 Lower Division Math Series

DESCRIPTION: The topic of Math 119 is *Ordinary Differential Equations*, (ODE). An ODE is an equation that involves a function $x(t)$ of one independent variable t, and its derivatives, the highest order derivative appearing being the *order* of the equation. The point is that the function x should depend on only one real variable t, so all derivatives are *ordinary* derivatives, not partial derivatives. When the function x is a vector valued function, we call the equations a system, and when x is a single function of one variable, we call the equation *scalar*.

ODE's are of fundamental importance to science. The reason, essentially, is that fundamental laws of science...of biology, physics, chemistry, geology,..., almost always come to us stated in terms of a *rates of change*; that is, in terms of *derivatives*. Thus to use a law of science to get a graph and make a prediction, one must first write down the ODE it implies, then solve it. Complicated ODE's cannot be solved by an explicit formula, but must be understood by clever reasoning, computer simulation, and by making analogies with simpler equations which can be solved explicitly. The simpler examples are extremely important and play a *fundamental role* because they give us an intuition and a theory for what is happening in important problems too complicated to solve in closed form. In this class we introduce and begin the theory of ODE's, the implications of the Laws of Science.