Monday August 28

Class 2:

Proportionality and Linear Functions

Early scientists looked for simple relationships between the variable quantities they studied. Perhaps the simplest such relationship is *proportionality*. A function whose output (dependent) variable changes proportionately to changes in its input (independent) variables is said to be *linear*. *Local approximation* of more general functions by linear ones is the key idea of the Calculus.

Week 1 Homework Due

Preparing for Class 3

Reading: *CiC Handouts* pp.27-30, available at the M114 homepage, follow the CiC link you find there.

Homework:*H-H* pp. 11-12: #10, 13, 14, 19, 20; See the next page for problems on line equations.

There will be labs this week, but no associated writing assignment. We will introduce you to the computers, the programs we will be using, and to some of our use of the TI-83 calculator. The final lab assignments will be made public before our *first* lab meeting, Wednesday August 30/Thursday August 31

Wednesday August 30

Class 3:

Linear Functions and Piecewise Linear Functions

We now understand that a function whose output (dependent) variable changes proportionately to changes in its input (independent) variables is really just a *linear function.* *Local approximation* of more general functions by linear ones is *the key idea* of the Calculus. Many approximations of complicated functions in different branches of science are achieved by using *piecewise* linear functions.

Quiz 1 on Functions (especially linear functions). Quizzes are generally take-home, distributed on Wednesday, to be handed in at the beginning of the next regularly scheduled class time, Friday.

The following problems are taken from pages 33,38,39 of *Calculus In Context*, J. Callahan, et al, W.H. Freeman and Company, NY, 1995.

Problem 1 on Line Equations: Consider the function $y = -\frac{2}{3}x + 5$.

(a) Sketch the graph of this function. Label each axis and mark a scale of units on it. Indicate the slope of the line, its $y-$intercept, and its $x-$intercept.

(b) Choose an initial value x_0 for x, find the corresponding value y_0 for y and express the function in the form $y - y_0 = m \cdot (x - x_0)$.

Problem 2 on multipliers of line equations.

(a) Suppose $y = f(x)$ is a linear function with multiplier $m = 3$. If $f(2) = -5$, what is $f(2.1)$? $f(2.0013)$? $f(1.87)$? $f(922)$?

(b) Suppose $y = G(x)$ is a linear function with multiplier $m = -2$. If $G(-1) = 6$, for what value of x is $G(x) = 8$? $G(x) = 0$? $G(x) = 5$? $G(x) = 491$?

(c) Suppose $y = h(x)$ is a linear function with $h(2) = 7$ and $h(6) = 9$. What is $h(2.046)$? $h(2 + a)$?

Class 4:

Introduction to Scientific Modeling

A mathematical *model* of a phenomenon is an abstract representation of it designed to capture certain features of interest. The Calculus was developed to analyze models involving *rates of change*. An *empirical* model is developed by studying the results of experiments. Newton's Law of Cooling is an example of an empirical model involving rates of change and proportionality. Today we will consider a mathematical model which involves rate equations.