Math 134
(Differential/Integral Calculus)
Detailed Syllabus

Mathematics

- Line functions and polynomials.
- Exponential functions and logarithmic functions.
- Interpolation of data.
- Compromise lines through data.
- Limits
- Continuity
- Dominant terms in the global scale.
- How to write exponential and logarithm functions in terms of the natural base e .
- While line functions post a constant growth rate, exponential functions post a constant percentage growth rate.
- How to construct a function with a prescribed percentage growth rate.
- The instantaneous growth rate f'[x] as the limiting case of the average growth rates (f[x+h] - f[x])/h.
- Calculation of f'[x] for functions f[x] like x^k, e^x, and Log[x].
- Why Log[x] is the natural logarithm and why e is the natural base for exponentials.
- What it means when f'[x] is positive or negative.
- Max-min.

Science and Math Experience

- Reading plots.
- Linear models.
- Japanese economy cars versus American big cars.
- Data analysis and interpolation.
- Data analysis of U.S. national debt and U.S. population in historical context including plots of yearly growth and the effect of immigration on the growth of the U.S. population.
- Cigarette smoking and lung cancer correlation.
- Global scale of quotients of functions studied by looking at dominant terms in the numerators and denominators.
- Recognition of exponential data, exponential data fit, carbon dating, credit cards, compound interest, effective interest rates, financial planning, decay of cocaine in the blood, underwater illumination, inflation.
- Relating the plots of f[x] and f'[x].
- Using a plot of f'[x] to predict the plot of f[x].
- Visualizing the limiting process by plotting f'[x] and (f[x+h] - f[x])/h on the same axes and seeing the plots coalesce as h closes in on 0.
- Spread of disease model.

Mathematics

- Instantaneous growth rates in context.
- The derivative as the instantaneous growth rate.
- Chain rule.
- Product rule as a consequence of the chain rule.
- Instantaneous percentage growth rate 100 f'[x]/f[x] of a function f[x].
- What it means when f'[x] is not equal to 0 for x = a.
- Why f[x] is not as big (or small) at x = a unless f'[a] = 0.

Science and Math Experience

- Another look at why exponential growth dominates power growth and why power growth dominates logarithmic

growth.
- Compound interest.
- Making functions with prescribed instantaneous percentage growth rate.
- Why a good representative plot of a given function f[x] usually includes all x's at which f'[x] = 0.
- Max-Min in one or two variables.
- Using the derivative to get best least squares fit of data by smooth curves.
- Fitting of Space shuttle O-ring failure data as a function of temperature and using the result to explain why the Challenger disaster should have been predicted in advance.
- Designing the least cost box to hold a given volume.
- Analysis of an oil slick at sea.
- Analysis of what happens to x^k/e^x as x advances from 0 to Infinity.
- Calculation of interest payments resulting from buying a car on time.
- Managing an inheritance.
- Wal-mart sales.
- Pollution elimination, data analysis.
- Newton's law of cooling.
- Pressure altimeters.

Mathematics

- Integrals defined as area measurement as done in E. Artin's MAA notes written in the 1950's. Approximations by trapezoids.
- If f[t] is given by f[x] = g[t] dt, then f'[x] = g[x].
- The fundamental formula f[x] - f[a] = f'[t[dt]].
- Area
- Measurements based on the fundamental formula:
- Accumulated growth.
- Using the chain rule and the fundamental formula to see why f'[u[x]] u'[x] dx = f'[u] du and using this fact to transform one integral into another.

Science and Math Experience

- Integrals of functions given by data lists.
- Using known area formulas for triangles, trapezoids and circles to calculate integrals.
- Trying to break the code of the integral by taking selected functions g[x], putting f[x] = g[t] dt and plotting (f[x + h] - f[x])/h and g[x] on the same axes for small h's.
- Estimating the acreage of farm field bordered by a river.
- Very brief look at the "indefinite integral", g[x] dx.
- Measuring area between curves.
- Measurements of accumulated growth.
- Filling water tanks.
- Harvesting corn.
- Voltage drop.
- Another look at linear dimension.
- Present value of a profit-making scheme.
- Catfish harvesting.
- Using transformations to explain Mathematica output.
- Expected life of light bulbs and how long to set the guarantee on them.

Mathematics

- Integrals defined as area measurement as done in E. Artin's MAA notes written in the 1950's. Approximations by trapezoids.
- If f[t] is given by f[x] = g[t] dt, then f'[x] = g[x].
- The fundamental formula f[x] - f[a] = f'[t[dt]].
- Area
- Measurements based on the fundamental formula:
- Accumulated growth.
- Using the chain rule and the fundamental formula to see why f'[u[x]] u'[x] dx = f'[u] du and using this fact to transform one integral into another.

Science and Math Experience

- Integrals of functions given by data lists.
- Using known area formulas for triangles, trapezoids and circles to calculate integrals.
- Trying to break the code of the integral by taking selected functions g[x], putting f[x] = g[t] dt and plotting (f[x + h] - f[x])/h and g[x] on the same axes for small h's.
- Estimating the acreage of farm field bordered by a river.
- Very brief look at the "indefinite integral", g[x] dx.
- Measuring area between curves.
- Measurements of accumulated growth.
- Filling water tanks.
- Harvesting corn.
- Voltage drop.
- Another look at linear dimension.
- Present value of a profit-making scheme.
- Catfish harvesting.
- Using transformations to explain Mathematica output.
- Expected life of light bulbs and how long to set the guarantee on them.

All Distance Calculus courses are offered via the Computer Science and Mathematics Department at Suffolk University - Beacon Hill, Boston, MA 02108
Questions? Write to: info@distancecalculus.com
Ph: 617.497.6645, Fax: 617.497.2116