B.E. International Program

Faculty of Economics, Thammasat University

Course Outline

MA 216 Calculus for Social Science 1

Semester: 2/2011 (9 January – 20 May 2012)

Instructor: Dr. Phanida Saikhwan
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Time: Wednesday & Friday, 8.00-9.30 hrs.

Room: 303, Faculty of Economics, Thaprachan

Course Objective:

Calculus has influenced nearly every branch of natural and social sciences, since its invention about three hundred years ago. Calculus is not only one of the most beautiful ideas in the history of human thought, but also one of the most useful and influential. This course is designed to give students the basic quantitative skill of single-variable calculus. The course covers the reviews of functions, graphs and limits, differentiation, application of derivatives, integration and introduction to multi-variable calculus. Students will not only learn to solve the problem but also learn the concepts behind to enhance understanding and minimise memorising.

Reading lists:

In addition of attending lectures and following handouts and assignments, students are recommended to consult textbooks for further examples and alternative explanations. The class discussion will follow **Hoffman and Bradley** which gives a number of examples related to economics as well as other fields. Other books given are also suitable. If you already have a similar book, it is not absolutely necessary to acquire another one.

1. **Hoffman, L.D., and Bradley, G.L.,** *Calculus for Business, Economics, and the Social and Life Sciences*, 9th edition, McGraw Hill, 2007. (Recommended)
2. **Haeussler, E.F.Jr., Paul, R.S., and Wood, R.,** *Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences*, 11th edition, Prentice Hall, 2006.
3. **Goldstein, L.J., Lay D.C., and Schneider, D.L.,** *Calculus and Its Applications,* 9th edition, Prentice-Hall International Editions.

4. **Sydsaeter, K. and Hammond, P.J.,** *Mathematics for Economic Analysis,* Prentice Hall, 2002.
5. **Klein, M.,** *Mathematical Methods for Economics*, 2nd Edition
6. **Simon, C., and Blume L.,** *Mathematics for Economists*, Norton & Company, 1994.
7. **Chiang, A.,** *Fundamental Methods of Mathematical Economics*, 3rd Edition, McGraw-Hill, 1984.

Grading:

There will be 4 quizzes during classes which will be announced before hand, a midterm examination and a final examination. The course grades will be determined as following:

Quizzes and homework	10%
Midterm	40% (February 29, 2012, 08.00-09.30)
Final	50% (May 12, 2012, 13.30-16.30)

Tentative Schedule

Week/Section	Topic
1/1-2	**1. Functions, Graphs, and Limits**
2/3-4	Function of a single variable, the graph of a function, linear function, functional models, limits, One-side limits and continuity
3/5-6	**2. Differentiation: Basic Concepts**
4/7-8	The derivative, techniques of differentiation, Product and Quotient rules,
5/9-10	higher-order derivatives, the chain rule, marginal analysis and approximations using increments, implicit differentiation and related rates
6/11-12	**3. Additional Applications of the Derivatives**
7/13-14	Increasing and decreasing functions, relative, extrema, concavity and points of inflection, curve sketching, optimisation
8	***Midterm examination***
9/15-16	**3. Additional Applications of the Derivatives** (continue)
10/17-18	**4. Exponential and Logarithmic Functions** Exponential and logarithmic function, differentiation of logarithmic and exponential functions, additional exponential models
11/19-20	**5. Integration**
12/21-22	Anti-differentiation: the indefinite integral, integration by substitution, the definite integral and the fundamental theorem of calculus, applied definite integration: area between curves and average value, additional applications to business and economics
13/23-24	**6. Additional topic in Integration**
14/25-26	Integration by parts, integral table, improper integrals,
15/27-28	**7. Introduction to Calculus of Several Variable**
16/29-30	Functions of several variables, partial derivatives
	Final examination

!!!!! Familiarise yourself with this. !!!!!

!!!!! This is what you will be given in your examination. !!!!!

Formulas

Differentiation

We assume that u is a differentiable function of x.

$$\frac{d}{dx}(c) = 0 \qquad \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$\frac{d}{dx}\left(x^n\right) = n\,x^{n-1} \qquad \frac{d}{dx}\left(u^n\right) = n\,u^{n-1}\frac{du}{dx}$$

$$\frac{d}{dx}\left[c\ f(x)\right] = c\,f'(x) \qquad \frac{d}{dx}(\ln u) = \frac{1}{u}\frac{du}{dx}$$

$$\frac{d}{dx}\left[f(x) \pm g(x)\right] = f'(x) \pm g'(x) \qquad \frac{d}{dx}\left(e^u\right) = e^u\frac{du}{dx}$$

$$\frac{d}{dx}\left[f(x)g(x)\right] = f(x)g'(x) + f'(x)g(x) \qquad \frac{d}{dx}(\log_b u) = \frac{1}{(\ln b)u} \cdot \frac{du}{dx}$$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{\left[g(x)\right]^2} \qquad \frac{d}{dx}\left(a^u\right) = a^u(\ln a)\frac{du}{dx}$$

Newton's Approximation Method:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \qquad \text{where } n = 0, 1, 2, \ldots$$

Integration

$$\int k\,dx = kx + C \qquad \int\left[f(x) \pm g(x)\right]dx = \int f(x)\,dx \pm \int g(x)\,dx$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C,\ n \neq -1 \qquad \int [u(x)]^n du = \frac{u^{n+1}}{n+1} + C$$

$$\int e^x dx = e^x + C \qquad \int e^u du = e^u + C$$

$$\int kf(x)dx = k\int f(x)dx \qquad \int \frac{1}{u}du = \ln|u| + C,\ u \neq 0$$

Integration by Parts

$$\int f(x)g'(x)dx = f(x)g(x) - \int f'(x)g(x)dx, \quad \int u\,dv = uv - \int v\,du$$