Last Updated: 05/03/01

Instructor: Professor Peter A. Rejto.
Lecture: 11:15 a.m – 12:10 a.m., MWF  Mech. Eng 102
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Homework: Homework will be assigned in class and collected a week after the assignment.
Tests: We will have a test on Friday February, 16, on Friday March 16, and on Friday, April 13.
Makeup Test: As per Senate and Math. Department policies, written documentation etc, required. For those who qualify, there will be a uniform makeup test. Time: Tuesday, April 24, 10:10 am – 11:00 am. Place: EE/Csci 2260. On Monday, April 23, please sign up for the makeup test with Professor Rejto by giving him your name and student number on a sheet of paper.
Incompletes: As per senate and Math. Department policies, written documentation etc, required. Note that arrangements have to be made before the Final!
Record keeping: If there is a discrepancy between your records and ours, please let us know it immediately, but not later than two weeks. In any case we shall not adjust our records after two weeks.
Drop Date: If you drop this course before the end of the second week, no mention of this course will appear on your transcripts.

Grading:

Homework/Project 30%
Tests 1 – 2 – 3 30%
Final Examination 40%

COMPREHENSIVE FINAL EXAMINATION,
THURSDAY MAY 10, 4:00 pm – 6:00 pm, Mech. Eng. 102
Math 4606 (Advanced Calculus) Spring 2001
APPROXIMATE SCHEDULE AND SUGGESTED HOMEWORK

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List of Homework as of update on p. 1

Sec 1.3: 7
Sec 1.2: 6, 7
Prove Theorem 7 in Chapter 1
Sec 1.2; 10, 11, 13, 22, 23
Sec 1.3; 4, 5, 6, 17
Additional Problem 1.
Challenge Problem 1.
Additional Problem 2.
Prove Theorem 1, Chapter 2.
Sec 2.2, 1, 3, 5, 7, 9.
Additional Problems 3 and 4.
Sec 2.2, 12, 13.
Sec 3.2, 1, 3, 9.
Sec 3.2, 10.
Additional Problem 8.
Additional Problem 9.
Additional Problem 10.

Formulation of the Additional Problems.

Additional Problem 1. Let $a_1$, $a_2$ and $a_3$ be three non-zero vectors in $\mathbb{R}^2$. Prove that they are linearly dependent.
Additional Problem 2. Let $L$ be a given positive number and define the sequence of intervals $I_n$: $I_0 = [-L, L]$ and $I_1 = [-\frac{L}{2}, 0]$ or $I_2 = [0, \frac{L}{2}]$. In general,

$$\text{if } I_n = [a_n, b_n] \text{ then } I_{n+1} = \left[a_n, \frac{a_n + b_n}{2}\right] \text{ or } \left[\frac{a_n + b_n}{2}, b_n\right].$$

Next for a given interval $I$, let $|I|$ denote the length of $I$. Prove that, for each $n$,

$$|I_n| \leq \frac{1}{2^n}(2L).$$

Additional Problem 3. As usual let $C(R^n, R^m)$ denote the class of continuous functions mapping $R^n$ into $R^m$. Give three linearly independent functions in $C(R^n, R^m)$.

Additional Problem 4. Show that the functions, $1, x, x^2$ are continuous.

Additional Problem 5. Let the function $f$ mapping $R^2$ into $R^1$ be defined by $f(x) = x^2$ and for a given $R$ let the closed disk $D(0, R)$ be defined by,

$$D(0, R) = \{ (x, y) : x^2 + y^2 \leq R^2 \}.$$ 

Prove that for each $R$ the function $f$ is uniformly continuous on the closed disk $D(0, R)$.

Additional Problem 6. Extend the function $g$ of Problem 2.2.9 by defining it to be 1 at each point where the original function $g$ is not defined. Prove that this extended function, $g_e$, is not continuous.

Additional Problem 7. Let $g_e$ be any extension of the function $g$ of Problem 2.2.9. Prove that this extended function, $g_e$, is not continuous.

Additional Problem 8. Show that Problems 2.2.12 and 2.2.13 imply Theorem 2.13.

Additional Problem 9. Let $p$ be a polynomial of degree 3 and let $p'(0) = 0$ and $p''(0) > 0$. Prove that $p(x)$ has a local minimum at $x = 0$. In other words, prove that there is an interval, $(-\delta, \delta)$ such that

$$\min_{x \in (-\delta, \delta)} p(x) = p(0).$$

Additional Problem 10. Prove Taylor’s Theorem, that is to say prove Theorem 3.15 of the text. Note that there is typo in the text.

Challenge Problem 1. For a given function $f$, mapping $D(f) \in R^1$ into $R^1$, define its upper coordinate set $U_f$ by

$$U_f = \{ (x, y) : x \in D(f), y \geq f(x) \}.$$ 

Prove that $f'' > 0$ implies that the set $U_f$ is convex.