

CALCULUS AND A COMPUTATIONAL LABORATORY  
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The history of mathematics is replete with stimulations and challenges necessary to induce change. Today, one of the largest stimulations comes from the computer and computational science. The introduction of the computer in the calculus courses will give us a faster way of doing what we've been doing, with the additional opportunity that the student will be able to discover and explore concepts of the subject. The idea of an experimental approach to mathematics is not new. Inductive methods for generating a conjecture were used by Euler and Gauss ( see Grenander 1982 Chap 1 ). The notion of a of a mathematical laboratory based on microcomputers to test ideas and conjectures based on numerical evidence is described in an article of the September issue of the SIAM NEWS 1985 by Bruer and Zwas. This paper represents an application of several ideas stated in that article

Calculus courses represent the core of the university mathematics programs in science and engineering. Content for these courses will not change , however the use of the computer will allow one to better understand concepts via computer graphics and computational analysis. Eight to ten computational modules have been introduced into each of the three calculus courses. These modules represent lab assignments to be completed. The assignments emphasize concepts of approximation, relative error and exercises to illustrate the more important concepts of the calculus. With the emergence of new software, the Macintosh is now a "supercalculator". For a list of available software used in the lab see Appendix 1. One side benefit of the introduction of the lab is its' usefulness in remedial work. This particular usage is enhanced since beginning with this years freshman class, all entering cadets are required to purchase a Macintosh . Software is available thru the department to help cadets improve skills necessary to succeed in the mathematics courses. For a more detailed list of computer usage for calculus courses see **The Influence of Computers and Informatics on Mathematics and its Teaching**, ICMI Study Series, Cambridge Press 1986.

A major concern of those teaching the calculus is the emergence of symbolic algebra computer systems. These systems are having an impact on the nature and scope of the traditional calculus courses. These programs differentiate , integrate and do polynomial algebra together with many other operations. The day is not far off when this software will be available on hand-held calculators. More than ever, it will be important for the student to understand the concepts involved in the calculus.