

Modularized Treatment of Pre-Calculus Courses at Drake University

Some mathematical ability is deemed necessary in several areas of study at Drake University. The mathematical background of students opting these areas ranges from none to adequacy, consequently, we have a large number of students, having been admitted to the University find they have a serious deficiency in mathematical training. Thus, we find it necessary to offer remedial courses. Every semester there are 60-100 students who need work in what is commonly called "Intermediate Algebra" and 200-400 students who need "College Algebra and Trigonometry."

One solution to the problem of providing the opportunity for students to correct a deficiency in their background would be to offer traditional courses in small sections. This method would require at least one third of our teaching capacity and necessitate a curtailment of other offerings. Some other method, in which we could use graduate assistants to advantage, was dictated.

A lecture-discussion type of presentation of the material was tried. Lectures were given twice per week and discussions, conducted by graduate assistants, were held twice per week, with 4-5 hourly tests and a final exam. Students did not like this mode of presentation and the staff did not like it either.

We then contrived our present mode of presentation, namely, modularized courses. The material to be presented has been subdivided into units which are designed to be completed in one week. On Monday the instructor gives a lecture (to a large group of up to 150 students) which covers the theory and techniques concerning the material in the Unit. On Tuesday, the instructor and graduate assistants are available to the students (in groups up to 4) for assistance in problem solving. On Wednesday, the student takes a test over the material of the Unit. If the student shows mastery of the material on the Wednesday test, he is through for that week, otherwise he receives further assistance on Thursday and takes a second test on Friday. The tests are scored in the following way:

Wednesday test:

85% - 10 points (No test Friday)
50% - 84%, 2 points (Test Friday)
0 - 49%, 0 points (Test Friday)

Friday test:

85% - 8 points
65% - 84%, 6 points
50% - 64%, 4 points
0 - 49%, 0 points

Each week, provision is made for those who are unable to take a test at the scheduled time. Also, for some units it is possible to take a third test over the Unit. (The third test is graded on the same basis as the second test and is used for improving the total points for the week.)

A "course" is made up of specified units, and the grade for that course is the average grade of the units making up that course - 90% for A, 80%-B, 70%-C, 60%-D, below 60% an F.

It is clear that this method of presentation is primarily concerned with developing manipulative skills traditionally associated with "College Algebra" and "Trigonometry". Thus, the objective of each unit is mastery of those techniques needed in subsequent courses.

Surveys of student opinion indicate that this method of presentation is preferable to the lecture-discussion utilized formerly. However, there is much regimentation in this procedure and some students find it difficult to fit into this regime.

For the Instructor, this presentation required an enormous amount of paper work - preparation of equivalent test forms for each unit, grading seemingly endless tests, recording scores, etc. Some of this work may be assigned to graduate assistants and some may be accomplished by use of the computer. (Tests for the units comprising the Intermediate Algebra course are currently generated by the computer.)

One of the advantages of this mode of presentation is the wide variety of options available to the student to remove his deficiencies in mathematical skills. Thus, he may opt for Trigonometry only, Finite Math only, College Algebra only or any combination.

Modules for Intermediate Algebra

1. Factoring
2. Fractions
3. Algebraic operations
4. Exponent rules of operation
5. Radical rules of operation
6. Scientific notation and logarithms (base 10)
7. Linear equations and Identities
8. Inequalities and word problems
9. Absolute value (Equations and inequalities)
10. Quadratic equations
11. Graphing of linear equations, relations and functions

Modules for Pre-Calculus

1. Sets, Algebraic operations, Integral exponents, Factoring
2. Fractions, Fractional exponents, Radicals
3. Ratio, Proportion, Linear equations and inequalities
4. Coordinate plane, Relations and functions, Lines and Linear equations
5. Functions, functional notation, graphs, systems of Linear equations and inequalities in 2 variables
6. Quadratic equations and inequalities, equations of quadratic form, irrational equations
7. Arithmetic and geometric progressions, binomial theorem for integral exponents
8. Exponential and logarithmic functions - basic properties and graphs
9. Use of logarithms for computation and linear interpolation
- 10A. Definition of trigonometric functions, functions of acute angles
- 11A. Right triangles
(A-B)
- 12A. Graphs of trigonometric functions, trigonometric identities
(A-B)
- 13A. Solution of Oblique triangles
- 14A. Inverse functions, trigonometric equations
- 10B. Determinants, matrices, systems of linear equations
- 11B. Systems of linear equations, inverse matrices
- 12B. Permutations and combinations
(A-B)
- 13B. Probability and mathematical expectation
(A-B)
- 14B. Conditional probability
(A-B)

Modules 1-9 are traditionally covered in "College Algebra", 10-14A are usual trigonometric topics and 10-14B Finite Mathematics Topics.

A student may select different combinations of modules depending on his background and objectives. Combinations which are available are:

Modules 1-9 (College Algebra)

Modules 10A-14A (Trigonometry)

Modules 10B-14B (Linear Systems and Probability)

Modules 10A, 11B, 12B, 13B, 14B (Right triangle Trigonometry and Probability)