I. Catalog Information

MATH 49B  Pre-Calculus Algebra  5 Unit(s)

(See general education pages for the requirement this course meets.)

Prerequisites: Mathematics 49A (with a grade of C or better) or satisfactory score on Calculus Readiness test within last calendar year.
Advisory: English Writing 100B and Reading 100 (or Language Arts 100), or English as a Second Language 172 and 173.

Five hours lecture.

Systems of equations and inequalities, vectors, lines and planes, sequences and series, polar coordinates.

II. Course Objectives

A. Graph trigonometric functions and their inverses and solve related equations
B. Explore the relationship between trigonometric functions and the complex numbers
C. Graph and analyze curves in polar coordinates; graph and analyze parametric equations
D. Explore matrices, matrix reduction, determinants, and (optional) matrix inversion in the context of solving systems of linear equations
E. Solve systems of inequalities and systems of non-linear equations
F. Perform operations with vectors in 2- and 3-space
G. Explore equations of lines and planes in 3-space, as well as, the graphs of surfaces
H. Develop and use the formulas for arithmetic and geometric sequences and series
I. Write proofs using mathematical induction and (optional) develop the binomial theorem
J. Investigate, throughout the course as applicable, how mathematics has developed as a human activity around the world

III. Essential Student Materials

Scientific calculator and graphing platform

IV. Essential College Facilities

None

V. Expanded Description: Content and Form

A. Graph trigonometric functions and their inverses and solve related equations
   1. Review basic trigonometric identities and from these develop additional relationships
   2. Solve trigonometric equations
   3. Graphs trigonometric functions and their inverses, exploring their respective domains and ranges
B. Explore the relationship between trigonometric functions and the complex numbers
   1. Convert complex numbers between rectangular and trigonometric form
   2. Explore De Moivre's theorem (optional)
C. Graph and analyze curves in polar coordinates; graph and analyze parametric equations
   1. Explore polar equations and conversion between rectangular and polar forms
   2. Graph polar equations
   3. Find the intersections of polar graphs both analytically and graphically
   4. Explore the polar equations of conic sections
5. Graph parametric equations and find intersections analytically and graphically

D. Explore matrices, matrix reduction, determinants, and (optional) matrix inversion in the context of solving systems of linear equations
   1. Use Gaussian elimination to solve linear systems
   2. Define and calculate the determinant of a matrix
   3. Use Cramer's Rule to solve linear systems (optional)
   4. Explore the algebra of matrices
   5. Find the inverse of a matrix (optional)
   6. Use matrix inversion to solve linear systems (optional)
   7. Explore partial fractions and their relationship to systems of equations

E. Solve systems of inequalities and systems of non-linear equations
   1. Solve systems of inequalities, representing solution regions graphically
   2. Solve non-linear systems

F. Perform operations with vectors in 2- and 3-space
   1. Explore the norm and direction of a vector with respect to a relationship between points in space
   2. Investigate the meaning of vector sums and differences
   3. Define and interpret vector scalar/dot product and projection
   4. Define and interpret vector cross product
   5. Calculate and interpret the angle between two vectors
   6. Define direction numbers and direction cosines

G. Explore equations of lines and planes in 3-space, as well as, the graphs of surfaces in space
   1. Represent lines in parametric and symmetric form
   2. Express the equations of planes in standard form
   3. Investigate distance formulas
   4. Find points of intersection
   5. Explore surfaces as the graphs of functions of two variables

H. Develop and use the formulas for arithmetic and geometric sequences and series
   1. Explore arithmetic sequences and series
   2. Explore geometric sequences and series
   3. Investigate infinite geometric series

I. Write proofs using mathematical induction and (optional) develop the binomial theorem

J. Investigate, throughout the course as applicable, how mathematics has developed as a human activity around the world; among the topics that may be used are:
   1. Music/Sound
   2. Force/Work
   3. Astronomy
   4. Finance
   5. Motion/distance
   6. Architecture
   7. Applications of historical or cultural interest

VI. Assignments
   A. Required readings from text
   B. Problem-solving exercises, some including technology

VII. Methods of Instruction
Lecture and visual aids;
Discussion of assigned reading;
Discussion and problem-solving performed in class;
In-class exploration of internet sites;
Quiz and examination review performed in class;
Homework and extended projects;
Guest speakers;
Collaborative learning and small group exercises;
Collaborative projects;
Laboratory experiences involving students in formal exercises of data collection and analysis;
Problem solving and exploration activities using software applications.

VIII. Methods of Evaluating Objectives

A. A selection among homework, quizzes, exploratory worksheets or labs, and group projects

B. A minimum of:
   1. Three one-hour written exams or
   2. Two one-hour written exams and projects

C. Two-hour comprehensive final exam

IX. Texts and Supporting References

A. Examples of Primary Texts and References