I. **OVERVIEW**

The following information will appear in the 2009 - 2010 catalog

**MATH-121 Pre-Calculus 1**

Prerequisite: Satisfactory completion of MATH 90 or equivalent placement by MJC assessment process.

A one-semester College Algebra course or, together with Math 122, a two-semester Precalculus course sequence. Emphasis on algebra skills essential for success in calculus. Topics include: review of linear, quadratic, rational, radical, exponential, logarithmic equations and graphs; systems of equations and inequalities (linear and nonlinear); functions and graphs; synthetic division; complex roots of polynomials; the Fundamental Theorem of Algebra; applications of exponential and logarithmic equations; sequences and series; mathematical induction; combinatorics. Field trips are not required. Course is applicable to the associate degree. General Education:

CSU-GE - B4
IGETC Category: IGETC - 2M

II. **LEARNING CONTEXT**

Given the following learning context, the student who satisfactorily completes this course should be able to achieve the goals specified in Section III, Desired Learning:

A. **COURSE CONTENT**

1. **Required Content:**

   a. Algebra Review
      
      i. Radicals; Rational Exponents
      
      ii. Polynomials and Rational Expressions

      iii. Completing the Square; the Quadratic Formula

   b. Equations and Graphs
      
      i. Topics from Algebra and Geometry

      ii. Solving Equations

      iii. Setting up Equations: Applications

      iv. Inequalities

      v. Rectangular Coordinates; Graphs; Circles

      vi. Lines

      vii. Linear Curve Fitting
c. Functions and Their Graphs
   i. Functions
   ii. Graphing Techniques: Transformations
   iii. Operations on Functions; Composite Functions
   iv. Mathematical Models: Constructing Functions

d. Polynomial and Rational Functions
   i. Quadratic Functions; Curve Fitting
   ii. Polynomial Functions
   iii. Rational Functions
   iv. Synthetic Division
   v. The Real Zeros of a Polynomial Function
   vi. Complex Numbers; Quadratic Equations with a Negative Discriminant
   vii. Complex Zeros; Fundamental Theorem of Algebra

e. Exponential and Logarithmic Functions
   i. One-to-One Functions; Inverse Functions
   ii. Exponential Functions
   iii. Logarithmic Functions
   iv. Properties of Logarithms; Curve Fitting
   v. Logarithmic and Exponential Equations
   vi. Compound Interest
   vii. Growth and Decay
   viii. Logarithmic Scales

f. Systems of Equations and Inequalities
   i. Systems of Linear Equations: Substitution and Elimination
   ii. Systems of Linear Equations: Matrices
   iii. Systems of Linear Equations: Determinants
   iv. Matrix Algebra
   v. Systems of Nonlinear Equations
   vi. Systems of Inequalities
2. **Recommended Content:**

   a. Probability

B. **ENROLLMENT RESTRICTIONS**

1. **Prerequisites**

   Satisfactory completion of MATH 90 or equivalent placement by MJC assessment process.

2. **Requisite Skills**

   *Before entering the course, the student will be able to:*

   a. Graph lines and find the equation of a line, given sufficient information.

   b. Determine the domain and range of a given function.

   c. Given a relation between two variables, determine if the relation is a function.

   d. Add, subtract, multiply, divide, or compose two given functions.

   e. Find the inverse of a given function.

   f. Graph linear, quadratic, absolute value, and simple cubic functions using transformations.

   g. Graph quadratic functions by determining and using the vertex and stretching constant.

   h. Solve systems of linear equations in two or three variables by choosing the most effective method for the given problem.

   i. Solve linear, quadratic, absolute value, and rational inequalities.

   j. Solve quadratic equations with real and complex solutions by completing the square and using the quadratic formula.

   k. Graph exponential and logarithmic functions using transformations.

   l. Solve exponential and logarithmic equations.
m. Simplify expressions using the properties of logarithms.

n. Identify the equations for and sketch the graphs of conic sections.

o. List a requisite number of terms of a given arithmetic, geometric, or recursive sequence.

p. Determine the general term of a given arithmetic or geometric sequence.

q. Determine the sum of a fixed number of terms of an arithmetic or geometric series, and determine the sum of an infinite geometric series when it exists.

r. Solve problems involving permutations, combinations, and probability.

s. Add, subtract, multiply, and divide complex numbers.

C. HOURS AND UNITS

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<tr>
<th>INST METHOD</th>
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D. METHODS OF INSTRUCTION (TYPICAL)

Instructors of the course might conduct the course using the following method:

1. Lecture

2. Discussion

3. Demonstration of mathematical techniques

4. Guided practice

5. Homework assignments

E. ASSIGNMENTS (TYPICAL)

1. EVIDENCE OF APPROPRIATE WORKLOAD FOR COURSE UNITS

Time spent on coursework in addition to hours of instruction (lecture hours)

   a. Daily homework assignments requiring approximately two hours per class hour
   b. Ongoing review of flashcards or study sheet
   c. Preparation for examinations, several times during the term
   d. Preparation for final exam

2. EVIDENCE OF CRITICAL THINKING

Assignments require the appropriate level of critical thinking

   a. Given a fourth degree polynomial with integer coefficients, use the Rational Roots Theorem, the Fundamental Theorem of Algebra, and synthetic division to find the complete factorization of the polynomial over the complex number system.
   b. Graph a given rational function, citing details including the domain of the function, the equations
of its vertical and/or horizontal asymptotes, coordinates of all intercepts, and intervals on which
the function is increasing and decreasing.

F. TEXTS AND OTHER READINGS (TYPICAL)


III. DESIRED LEARNING

A. COURSE GOAL

As a result of satisfactory completion of this course, the student should be prepared to:

Effectively manipulate algebraic expressions and solve various types of equations as will be encountered
in a first-semester calculus course. By significantly strengthening their algebra skills, students successfully
completing this course will be far better prepared for the rigors and mechanics of calculus.

B. STUDENT LEARNING GOALS

Mastery of the following learning goals will enable the student to achieve the overall course goal.

1. Required Learning Goals

   Upon satisfactory completion of this course, the student will be able to:

   a. exhibit the connection between radicals and rational exponents.
   b. add, subtract, multiply, and divide polynomial and rational expressions.
   c. solve quadratic equations by factoring, completing the square, or using the quadratic formula.
   d. solve linear, quadratic, absolute value, and rational equations and inequalities.
   e. solve applied problems of the above types.
   f. graph functions via tables of values, transformations, and coordinate-wise operations.
   g. add, subtract, multiply, divide, and compose functions.
   h. calculate the two forms of the difference quotient for a given function.
   i. construct functions to model given problems.
   j. graph quadratic, polynomial, and rational functions.
   k. find all roots (real and complex) of a polynomial by using synthetic division.
   l. state and effectively use the Fundamental Theorem of Algebra.
   m. find the inverse of a given one-to-one function.
   n. graph exponential and logarithmic functions.
   o. apply the properties of logarithms to various problems.
   p. solve exponential and logarithmic equations.
   q. solve problems involving compound interest, exponential growth and decay, Newton’s Law of
      Cooling, and logarithmic scales.
   r. classify sequences as arithmetic, geometric or neither.
s. calculate general terms and finite sums for arithmetic and geometric sequences and series, and, when possible, calculate the sum of an infinite geometric series.

t. prove theorems using the Principle of Mathematical Induction.

u. solve probability problems using the Fundamental Principle of Counting, permutations, and combinations.

v. solve systems of equations and inequalities (linear and nonlinear)

IV. METHODS OF ASSESSMENT (TYPICAL)

A. FORMATIVE ASSESSMENT

1. Midterm exams (excluding the following formats: multiple choice, open book, take home)

2. Quizzes

3. Homework assignments

4. Participation

B. SUMMATIVE ASSESSMENT

1. Comprehensive 2 to 3 hour Final Exam (excluding the following formats: multiple choice, open book, take home)