

Crafton Hills College Course Outline

1. **Discipline:** Mathematics
2. **Department:** Physical Sciences/Mathematics
3. **Course Title:** College Algebra
4. **Course I.D.:** MATH 102
5. **Prerequisite(s):** MATH 095 or eligibility for MATH 102 as determined through the CHC assessment process

Corequisite(s): None

Departmental Recommendation(s): None

6. **Semester Units:** 4

7. **Minimum Semester Hours:**

Lecture: 64 Lab: 0 Clinic: 0 Field: 0

8. **Need for the Course:**

- A. MATH 102 is associate degree applicable, satisfies the CSU general education requirement in area B4, Mathematics and the IGETC requirement in area 4, Mathematical Concepts and Quantitative Reasoning.
- B. MATH 102 satisfies prerequisite requirements for several subsequent courses.
- C. MATH 102 provides background for applications where exponential or logarithmic equations become models from studies as diverse as finance, population growth, pH, and radioactive decay.
- D. MATH 102 may be needed as an employment prerequisite.

9. **Goals for the course:**

This course is intended to prepare students to use mathematical concepts and quantitative reasoning at a collegiate level. MATH 102 provides students with the knowledge and skills applicable to and required in studies other than mathematics, including business, architecture, and some of the natural and social sciences.

10. **Catalog Description:**

Study of logarithms, sequences, series, mathematical induction, the Binomial Theorem, graphing conic sections, inverse functions, operations with radicals, systems of quadratic equations, and solving systems of three or more linear equations in three or more variables by

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matrices, and determinants; introduction to graphing rational functions, and the theory of equations. MATH 102 and MATH 151, maximum UC credit one course.

11. Schedule Description:

Study of logarithms, sequences, series, mathematical induction, the Binomial Theorem, graphing conic sections, inverse functions, operations with radicals, systems of quadratic equations, and solving systems of three or more linear equations in three or more variables by matrices, and determinants; introduction to graphing rational functions, and the theory of equations.

12. Entrance Skills:

A. Requisite Skills

Upon entering this course, students must be able to:

1. Define the set of complex numbers
2. Factor
3. Simplify rational expressions
4. Apply the laws of exponents to rational exponents and relate to radicals
5. Write radicals in standard form
6. Solve equations of the following types:
 - a. Quadratic
 - b. Absolute value (first degree)
 - c. Radical equations including quadratic in form and extraneous roots
 - d. Rational expressions involving different denominators and extraneous roots
7. Use set and interval notation
8. Apply the definition of relations, polynomial functions up to degree 3, and rational functions in order to
 - a. Use function notation to evaluate functions
 - b. Determine domain and range
 - c. Perform the four arithmetic operations
 - d. Compose functions
 - e. Find inverses
 - f. Determine if functions are even or odd
9. Solve and graph inequalities
10. Use one and two variables to construct a variety of models that represent a wide range of hypothetical applications,
11. Use the distance formula and mid-point formula
12. Graph simple functions and their translations using major features
13. Solve systems of equations in three variables using substitution and linear combinations

B. Recommended Skills: None

13. Course Objectives:

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

- A. State the definition of a function and:
1. Compose functions
 2. Graph exponential functions
 3. Determine the inverse of an exponential function
- B. Define logarithms for both natural and all positive bases and:
1. Apply the properties of logarithms including:
 - a. $\log_b(xy) = \log_b x + \log_b y$
 - b. $\log_b x^n = n \log_b x$
 - c. $\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$
 - d. $\log_b 1 = 0$
 - e. $\log_b b = 1$
 - f. $b^{\log_b x} = x$
 2. Transform logarithmic to exponential and exponential to logarithmic form of an expression
 3. Use the change base formula including natural logarithms
 4. Graph logarithmic functions
 5. Solve exponential and logarithmic equations
 6. Develop suitable exponential and logarithmic models for applications, such as
 - a. pH problems
 - b. Radioactive decay
 - c. Compound interest
 - d. Richter scale
 - e. Population growth
- C. Use sequences and series to:
1. Define sequence and series, including using sigma (Σ) notation to define series
 2. Find a specific term
 3. Determine the general term
 4. Define arithmetic sequences and:
 - a. Identify the common difference
 - b. Find the sum of n terms
 5. Define geometric sequences and:
 - a. Identify the common ratio
 - b. Find the nth partial sum
 - c. Determine the infinite sum and explain the conditions for its existence
 6. Expand binomial expressions using the Binomial Theorem including:
 - a. Finding a specified term
 - b. Finding the coefficient for a specific term
 7. Prove theorems using mathematical induction
- D. Graph conic sections of the form $Ax^2 + Cy^2 + Dx + Ey + F = 0$ including:

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1. Lines
2. Parabolas to locate:
 - a. Vertex
 - b. Focus
 - c. Directrix
 - d. Axis of symmetry
3. Circles to determine the:
 - a. Center
 - b. Radius
4. Ellipses to determine the:
 - a. Center
 - b. Foci
 - c. Vertices
 - d. Length of major and minor axis
5. Hyperbolas to determine the:
 - a. Center
 - b. Foci
 - c. Vertices
 - d. Asymptotes
 - e. Length of the major and conjugate axis
 - f. Equation of the asymptotes
- E. Solve systems of equations including:
 1. Quadratic systems (especially conics)
 2. Linear systems of at least three variables :
 - a. By Gaussian elimination
 - b. Using Cramer's Rule
- F. Characterize rational functions $f(x) = \frac{P(x)}{Q(x)}$ by determining
 1. Symmetry
 - a. With respect to the y-axis (even functions)
 - b. With respect to the origin (odd functions)
 2. Intercepts
 3. Domain and range
 4. Horizontal and vertical asymptotes
- G. Determine symmetry with respect to the x-axis for relations
- H. Apply the theory of equations to:
 1. Evaluate polynomials using the remainder theorem
 2. Use the factor theorem as an aid in factoring
 3. Determine potential rational roots using the rational root theorem
 4. Determine possible number of positive and negative roots using Descartes' rule of signs
 5. Determine upper and lower bounds for roots

14. Representative Texts and Instructions Materials:

Sullivan, M.(2005). *College Algebra (7/e)*. Upper Saddle River, NJ: Pearson Prentice Hall.

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Sisson, P. (2003). *College Algebra*. Charleston, SC: Hawkes Publishing.

Larson, R. Hostetler, R. (2006). *College Algebra Concepts and Models (5/e)*. Boston: Houghton Mifflin.

Cohen, D. (2006). *College Algebra (6/e)*. Pacific Grove, CA: Brooks/Cole Thomson.

Dugopolski, M. (2003). *College Algebra (3/e)*. San Francisco: Pearson Addison Wesley.

Lial, M. Hornsby, J. Schneider, D. (2005). *College Algebra (9/e)*. San Francisco: Pearson Addison Wesley.

Video tapes that cover the topics of this course are available in the Learning Resource Center and at the Reserve Desk in the library.

15. Course Content:

A. Functions:

1. Determining functional composition
2. Graphing of exponential functions
3. The inverse of an exponential function

B. The definition of logarithms and their properties including

1. $\log_b(xy) = \log_b x + \log_b y$
2. $\log_b x^n = n \log_b x$
3. $\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$
4. $\log_b 1 = 0$
5. $\log_b b = 1$
- 6.. $b^{\log_b x} = x$
7. Transformations from logarithmic to exponential and exponential to logarithmic form of an equation
8. Transformations of logarithms to alternate bases
9. Graphing logarithmic functions
10. Solving exponential and logarithmic equations
11. Developing suitable exponential and logarithmic models for phenomenon

C. Sequences and series:

1. Definition
2. Specific terms
3. The general term
4. Arithmetic sequences:
 - a. Definition
 - b. Common difference
 - c. The sum of n terms (S_n)
5. Geometric sequences:

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- a. Definition
 - b. Common ratio
 - c. The n th partial sum
 - d. The infinite sum and the conditions for its existence
- 6. Mathematical induction
- 7. The binomial expansions using the Binomial Theorem:
 - a. A specified term
 - b. The coefficient for a specific term
 - c. Pascal's Triangle
- 8. The use of sigma (Σ) notation to define series
- D. Graphing equations of the form $Ax^2+Cx^2+Dx+Ey+F=0$
 - 1. Lines
 - 2. Parabolas to locate:
 - a. Vertex
 - b. Focus
 - c. Directrix
 - d. Axis of symmetry
 - 3. Circles to determine the:
 - a. Center
 - b. Radius
 - 4. Ellipses to determine the:
 - a. Center
 - b. Foci
 - c. Vertices
 - d. Length of major and minor axis
 - 5. Hyperbolas to determine the:
 - a. Center
 - b. Foci
 - c. Vertices
 - d. Asymptotes
 - e. Length of the major and conjugate axis
 - f. Equation of the asymptotes
- E. Solving systems of equations including:
 - 1. Quadratic systems (especially conics)
 - 2. Linear systems of at least three variables :
 - a. By Gaussian elimination
 - b. Using Cramer's Rule
- F. Characterizing rational functions $f(x) = \frac{P(x)}{Q(x)}$ by determining
 - 1. Symmetry
 - a. With respect to the y-axis (even functions)
 - b. With respect to the origin (odd functions)
 - 2. Intercepts
 - 3. Domain and range
 - 4. Horizontal and vertical asymptotes
- G. Determining symmetry with respect to the x-axis for relations
- H. Theory of equations

1. Evaluating with the remainder theorem
2. Using the factor theorem as an aid in factoring
3. Determining potential rational roots using the rational root theorem
4. Determining possible number of positive and negative roots using Descartes' rule of signs
5. Determining upper and lower bounds for roots

16. Methods of Instruction

This course will combine lecture and demonstration, class discussion, working problems and reading. A computer tutorial lab component as well as other Math Center activities may be incorporated into the class. Students will be required to show their work. They may also be asked to participate in class demonstrations, quizzes, tests, and other classroom activities.

17. Assignments and Methods of Evaluation:

Students will be required to do homework assignments of two hours homework per hour of lecture. Students will be directed to show their work and write using proper mathematical notation. Homework will consist of problems chosen from the textbook, supplemental materials, or computer software. Students may also be asked to complete computer assignments, software enhanced assignments, quizzes or projects, participate in in-class demonstrations, or other classroom activities. At least three examinations must be given, one of which must be a comprehensive final exam. Not all testing may be assigned as take home examinations.

Comprehensive final exam	25%-40%
Tests and quizzes	30%-70%
Homework	0%-15%
Projects and other activities	0%-15%

18. Distributed Education Methods of Instruction: None