Illinois Mathematics & Computer Science Articulation Guide

Prepared by IMACC-ISMAA Joint Task Force

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Technology Statement

The appropriate use of technology is an essential part of many mathematics courses. Effective and strategic usage of technology by both students and faculty is highly encouraged. As is emphasized in AMATYC's Position Statement on the Use of Technology in the Teaching and Learning of Mathematics (2007), technology should be used to enhance the study of mathematics but should not become the main focus of instruction. The amount of time that students spend learning how to use computers and calculators effectively must be compatible with the expected gain in learning mathematics. Computer software, especially packages appropriate for demonstration or visual representation of mathematical concepts, is strongly recommended. The use of calculators in any pre-algebra level course is best determined by departmental philosophy at the local level.

Standards Statement

In 1995 the American Mathematical Association of Two Year Colleges (AMATYC) published Crossroads in Mathematics: Standards for Introductory College Mathematics Before Calculus. The Illinois Mathematics Association of Community Colleges and the Mathematical Association of America are among the professional organizations that have reviewed and endorsed the philosophy and spirit of Crossroads in Mathematics. In the preface to Crossroads, Don Cohen, Editor, writes:

This document is intended to stimulate faculty to reform introductory college mathematics before calculus. These standards are not meant to be the "final word." Rather they are a starting point for your actions.

Any Joint Task Force of the Illinois Mathematics Association of Community Colleges (IMACC) and the Illinois Section of the Mathematical Association of America (ISMAA) is encouraged to use the Crossroads document as a starting point for their deliberations concerning possible modifications of the Illinois Mathematics and Computer Science Articulation Guide.

In addition, Beyond Crossroads: Implementing Mathematics Standards in the First Two Years of College (2006) is an important document to consider for the first two years of mathematics undergraduate education. Joint Task Force members are encouraged to review this and all relevant standards documents in revising this guide, including the Common Core State Standards and the Illinois Learning Standards.

College Algebra Statement

While College Algebra and Precalculus courses are taught at post-secondary institutions where needed, these courses should not fulfill general education or quantitative literacy requirements. The content and instructional pedagogy applied in these courses should continue to be reviewed with the goal of preparing students to be successful in calculus and other courses that depend on a similar level of knowledge, rigor, and maturity. Adjustments to these courses should attempt to build upon appropriate changes in the K12 curriculum that are a part of state-wide efforts to advance achievement for all students and, in particular, to smooth the transition from school to college.

Departments are advised not to attempt to design and teach college algebra and pre-calculus courses with the dual purpose as preparation for calculus and meeting goals for quantitative literacy and general education requirements. Expectations for mastery of the objectives considered essential preparation for subsequent calculus courses must take priority and time constraints, together with cognitive demands on the student group to be served, suggest such dual purpose courses are not likely to be successful.

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5BI. Combined Basic and Intermediate Algebra

5-6 semester hours

Prerequisite: "B" or better in the prerequisite course or appropriate placement

Note: See Technology Statement in the Introduction

This course is designed to be a combination of basic and intermediate algebra. Students must earn a grade of "C" or better in order to progress to transfer-level mathematics courses. Although emphasis should be placed on techniques and manipulations, problem solving and logical reasoning should be a main thread throughout the course. Much effort should be given to utilize instruction that will provide students with needed techniques and also enable students to reason and make the connections that are involved in the learning of mathematics. The instruction should emphasize the connections between verbal, numerical, symbolic and graphical representations of the concepts being taught wherever possible. The appropriate use of technology, such as a graphing calculator, is strongly encouraged. This course is appropriate for students who have been very successful in the prerequisite course or received a strong placement score.

Course Content

1. Review arithmetic operations.
2. Review the properties of real numbers.
3. Solve linear equations and inequalities including absolute value equations and inequalities.
4. Graph linear and non-linear equations, including applications.
5. Introduction to functions, identifying range and domain, and graphing functions, including linear, quadratic, and absolute value.
6. Write equations of lines.
7. Operations with polynomials, factoring polynomials, solving quadratic equations and applications.
8. Solve systems of linear equations and applications in two and three variables.
9. Operations involving rational expressions; solving rational equations and applications.
10. Simplification and operations of radical expressions; solving radical equations and applications.
11. Introduction to complex numbers and elementary operations involving complex numbers.
12. Solve quadratic equations and inequalities, including rational inequalities.
13. *Introduction to exponential and logarithmic functions; solving and modeling applications.

Course Objectives—The student will be able to:

1. Use the terms, definitions, and notation of basic algebra.
2. Perform arithmetic operations with real numbers, complex numbers, and algebraic expressions including polynomials, rational expressions, and radical expressions.
3. Solve linear, rational, radical, absolute value, *logarithmic and *exponential equations in one and two variables with application of domain and range.
4. Solve linear inequalities and compound inequalities in one and two variables.
5. Factor polynomials, including binomials and trinomials, and identify prime polynomials.
6. Use various methods to solve quadratic equations, including the quadratic formula.
7. Write equations of lines and determine if lines are parallel or perpendicular.
8. Use graphs to identify solutions to linear equations and inequalities in one and two variables, as well as systems of equations and inequalities in two variables. 9. Solve systems of linear equations in two and three variables.
9. *Apply laws of logarithms and exponents to simplify logarithmic and exponential expressions and to solve equations and applications.
10. Graph quadratic, *exponential, and *logarithmic functions.
11. Solve applications involving linear expressions, equations and inequalities, rational equations, radical equations, and systems of equations.
12. Identify and solve applications involving direct, inverse and/or joint variation.

*Optional topics depending on number of semester hours available

6. Preparatory Mathematics for General Education (PMGE)

3-6 semester hours

Prerequisite: Basic Algebra with a "C" or better or appropriate placement

(If a 5 or 6 hour version is offered with appropriate content, the pre-requisite must be: Arithmetic or Pre-Algebra with a "C" or better or appropriate placement)

Note: See Technology Statement in the Introduction

This course is designed to be a second course in algebra and serves as a prerequisite for General

Education Statistics, General Education Mathematics, Quantitative Literacy, or Elementary Mathematical

Modeling. Students wishing to enroll in courses other than these courses should take Intermediate Algebra. Students may also take Intermediate Algebra upon completion of this course if they choose to pursue courses beyond general education mathematics. The primary goal of this course is to enable students to develop conceptual understanding and problem solving competence at the intermediate algebra level. This course emphasizes conceptual understanding and modeling rather than procedures. However certain procedures are essential to the study of algebra and they will be included.

Course Content

This course focuses on developing mathematical maturity through problem solving, critical thinking, data analysis, and the writing and communication of mathematics. Students will develop conceptual and procedural tools that support the use of key mathematical concepts in a variety of contexts. The instruction should emphasize the connections between verbal, numerical, symbolic and graphical representation of the concepts being taught whenever possible. Emphasis should be placed on modeling and problem solving, with techniques and manipulations covered in context. The appropriate use of technology, such as a graphing calculator, is strongly encouraged. Note: The three strands of the course are Algebra, Functions, and Modeling. Each strand must be covered but colleges are free to determine the amount of time spent on each strand. The strands together with their descriptions are taken from the Core Standards.

Algebra Overview

Seeing Structure in Expressions

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Arithmetic with Polynomials and Rational Expressions

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

Creating Equations

- Create equations that describe numbers or relationships

Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations
- Represent and solve equations and inequalities graphically

Functions Overview

Interpreting Functions

- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations

Building Functions

- Build a function that models a relationship between two quantities
- Build new functions from existing functions

Linear, Quadratic, and Exponential Models

I. Mathematics General Education Courses

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2. General Education Mathematics

3-4 semester hours

Prerequisites: Intermediate Algebra with a grade of C or better or Preparatory Mathematics for General Education (PMGE) with a grade of C or better

Note: See Technology Statement in the Introduction

Focuses on mathematical reasoning and the solving of real-life problems, rather than on routine skills and appreciation. Three or 4 topics are studied in depth, with at least 3 chosen from the following list: geometry, counting techniques and probability, graph theory, logic/set theory, mathematical modeling, mathematics of finance, game theory, linear programming and statistics. The use of calculators and computers are strongly encouraged.

Course Content

Three or four topics, chosen from the following list, are to be studied in depth. Mathematical modeling and/or projects is strongly recommended to be included as part of the course. The regular use of calculators and computers is strongly encouraged.

1. Counting techniques and probability
2. Game theory
3. Geometry (additional topics beyond the prerequisite)
4. Graph theory
5. Linear programming
6. Logic and set theory
7. Mathematical modeling
8. Mathematics of finance
9. Statistics

Due to the diversity in the way the General Education Mathematics course can be designed, the objectives below are general in nature and yet the learning outcomes must be specific to the topics chosen.

When designing this course, the specific learning outcomes for the topics selected must satisfy at least one of the course objectives listed below.

Course Objectives—The student will be able to:

1. interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
2. represent mathematical information symbolically, visually, numerically, and verbally.
3. use arithmetic, algebraic, geometric, and statistical methods to solve problems.
4. estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
5. recognize the limitations of mathematical and statistical models.

Notes

This course is designed to fulfill general education requirements. It is not designed as a prerequisite for any other college mathematics course. This course focuses on mathematical reasoning and the solving of real-life problems.

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2. General Education Mathematics

3-4 semester hours

Prerequisites: Intermediate Algebra with a grade of C or better or Preparatory Mathematics for General Education (PMGE) with a grade of C or better

Note: See Technology Statement in the Introduction

Focuses on mathematical reasoning and the solving of real-life problems, rather than on routine skills and appreciation. Three or 4 topics are studied in depth, with at least 3 chosen from the following list: geometry, counting techniques and probability, graph theory, logic/set theory, mathematical modeling, mathematics of finance, game theory, linear programming and statistics. The use of calculators and computers are strongly encouraged.

Course Content

Three or four topics, chosen from the following list, are to be studied in depth. Mathematical modeling and/or projects is strongly recommended to be included as part of the course. The regular use of calculators and computers is strongly encouraged.

1. Counting techniques and probability
2. Game theory
3. Geometry (additional topics beyond the prerequisite)
4. Graph theory
5. Linear programming
6. Logic and set theory
7. Mathematical modeling
8. Mathematics of finance
9. Statistics

Due to the diversity in the way the General Education Mathematics course can be designed, the objectives below are general in nature and yet the learning outcomes must be specific to the topics chosen.

When designing this course, the specific learning outcomes for the topics selected must satisfy at least one of the course objectives listed below.

Course Objectives—The student will be able to:

1. interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
2. represent mathematical information symbolically, visually, numerically, and verbally.
3. use arithmetic, algebraic, geometric, and statistical methods to solve problems.
4. estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
5. recognize the limitations of mathematical and statistical models.

Notes

This course is designed to fulfill general education requirements. It is not designed as a prerequisite for any other college mathematics course. This course focuses on mathematical reasoning and the solving of real-life problems.

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4. Elementary Mathematical Modeling

3-4 semester hours

Prerequisites: Intermediate Algebra with a grade of C or better or Preparatory Mathematics for General Education (PMGE) with a grade of C or better

Note: See Technology Statement in the Introduction

Focuses on mathematical reasoning through the active participation of students in building a knowledge base of numerical, geometrical, and symbolic representations of mathematical models. Includes inductive and deductive reasoning, mathematical proof, mathematical modeling in problem solving. Topics may include: sequences and series in modeling; variables and functions; graphical, tabular, and formulaic representation of algebraic functions; algebraic functions in modeling; logarithmic scales, logarithmic functions and exponential functions in modeling. This course incorporates the use of graphing calculators or computational software.

Course Content

1. Inductive and deductive reasoning in problem solving
2. Mathematical proof
3. Mathematical modeling as problem solving
4. *Sequences and series in modeling
5. *Variables and functions
6. *Algebraic functions in modeling
7. *Logarithmic scales
8. *Logarithmic functions in modeling
9. *Exponential functions in modeling

*Optional topics—a significant number of these should be included in the course, but not all are required.

Course Objectives—The student will be able to:

1. represent and solve problems using appropriate numerical, geometrical, and symbolic representations of models and state implied assumptions in modeling a problem solving situation.
2. use mathematically correct vocabulary and symbolism to communicate orally—and in writing: problem statements, problem-solving methods, and interpretations of the solutions to problems.
3. formulate a conjecture using inductive reasoning, support a conjecture using deductive reasoning, and refute a conjecture with a counter-example.
4. estimate solutions and perform order-of-magnitude comparisons to test the reasonableness of solutions or determine the best answer possible with the information available.
5. represent mathematical relationships using formulas, tables, and graphs.
6. solve problems by using graphing calculators or computers to create mathematical models.

Notes

The focus is on mathematical reasoning through the active participation of students in solving interesting and challenging problems. The course integrates the use of graphing calculators and personal computers as problem solving tools, and emphasizes learning mathematics by doing mathematics so that students can build their own knowledge base of numerical, geometrical, and symbolic models. At the same time, students should acquire the mathematical “habits of mind” necessary to use mathematics in their subsequent course work, their jobs, and their personal lives.

5. Calculus Sequence

10-15 semester hours

Prerequisite: College Algebra and Trigonometry (separately or combined) with grade(s) of “C” or better; or Elementary Functions with a grade of “C” or better. For the sequence, each course in the sequence (with a “C” or better) is the prerequisite for the next course.

Note: See Technology Statement in the Introduction

This sequence of courses is specifically designed for students majoring in Mathematics, Physics, or Engineering. These courses are a rigorous treatment of introductory Calculus topics and include thorough coverage of definitions and proofs of key theorems.

Course Content

1. Limits and continuity
2. Definition of derivative; rate of change, slope
3. Derivatives of polynomial and rational functions
4. The chain rule
5. Implicit differentials
6. Approximation by differentials
7. Higher order derivatives
8. Curve sketching
9. Rolle's theorem; mean-value theorem
10. Applications of the derivative
11. Anti-derivative
12. The definite integral
13. The fundamental theorem of calculus
14. Area, volume, other applications of the integral
15. The calculus of the trigonometric functions
16. Logarithmic and exponential functions
17. Techniques of integration, including numerical methods
18. Indeterminate forms; L'Hospital's rule
19. Improper integrals
20. Parametric equations
21. Polar coordinates and equations
22. Equations and graphs of conic sections
23. Sequences and series; convergence tests; Taylor series
24. Vectors in 2 and 3 dimensions; vector operations
25. Coordinate systems
26. Lines and line segments; distance between points
27. Transformation of coordinates; translations and rotations
28. Planes and lines in space
29. Surfaces; quadric surfaces
30. Cylindrical and spherical coordinates
31. Space curves (optional)
32. Functions of more than one variable; partial derivatives
33. The differential; directional derivatives; gradients
34. Double and triple integrals; evaluation and applications

Course Objectives—The student will be able to:

1. find limits of functions.
2. apply the definition of derivative to a function.
3. find derivatives of functions using the fundamental rules for differentiation.
4. find derivatives of functions using the product, quotient, and chain rules.
5. find higher-order derivatives of functions.
6. apply the techniques of implicit differentiation.
7. apply the Mean Value Theorem.
8. solve applications using differentiation, including optimization and related rates.
9. apply the techniques of differential Calculus to curve sketching.
10. find an anti-derivative of a function.
11. apply the Fundamental Theorem of Calculus.
12. solve applications using integrals, including areas between curves and volumes of solids of revolution.
13. apply the techniques of numerical integration.
14. apply more advanced techniques of integration, including integration by parts, trigonometric substitution, partial fractions, and improper integrals.
15. find limits using L'Hospital's Rule.
16. determine the convergence of a series using the appropriate test.
17. find the radius of convergence of the power series representation of a function.
18. find the Taylor series representation of a function.
19. apply the techniques of Calculus to functions in parametric form.
20. apply the techniques of Calculus to functions in polar coordinates.
21. find the derivative of a vector-valued function.
22. find the integral of a vector-valued function.
23. find partial derivatives of functions of several variables.
24. apply the techniques of partial differentiation to find differentials, directional derivatives, and gradients for functions of several variables.
25. find double and triple integrals of functions of several variables in rectangular, polar, cylindrical, and spherical coordinate systems.
26. solve applications using multiple integrals.
27. perform operations on vectors in space.
28. find equations for lines and planes in space.
29. solve application problems involving vectors and vector-valued functions.
30. solve optimization problems involving functions of several variables.
31. describe and use the quadric surfaces and other basic surfaces in space.

Notes

The analytic geometry-calculus topics are relatively standard across the state universities and community colleges, but the sequencing of the topics may vary widely from institution to institution. Therefore, students are strongly advised to begin and complete the entire analytic geometry/calculus sequence at one institution.

6. Differential Equations

3-4 semester hours

Prerequisite: At least Calculus II with a grade "C" or better Note: See Technology Statement in the Introduction

The course must cover linear equations of the first order; linear equations with constant coefficients; the general linear equation; variation of parameters; undetermined coefficients; linear independence; the Wronskian; exact equations; separation of variables; and applications. In addition, the course must cover at least two or three of the following topics: systems of linear differential equations; solution of Laplace transforms; existence and uniqueness of solutions; solution by power series; oscillation and comparison theorems; partial differential equations; boundary value problems; numerical methods; and stability of solutions.

Course Content

The specified topics are considered a standard for the course. It is recommended that at least two or three of the further topics be included.

1. Specified Topics
   A. Linear equations of first order
   B. Linear equations with constant coefficients
   C. The general linear equation
   D. Variation of parameters
   E. Undetermined coefficients
   F. Linear independence; the Wronskian
   G. Exact Equations
   H. Separation of variables
   I. Applications
2. Further Topics
   A. Systems of linear differential equations
   B. Solution by Laplace transforms
   C. Existence and uniqueness of solutions
   D. Solution by power series
   E. Oscillation and comparison theorems
   F. Partial differential equations
   G. Boundary value problems
   H. Numerical methods
   I. Stability of solutions

Course Objectives—The student will be able to:

Classify differential equations and determine appropriate methods of solution for those types studied in this course.

1. Construct direction fields for first-order differential equations.
2. Solve first order differential equations by various elementary methods such as separation of variables, integrating factors, and substitutions.
3. Solve higher order homogeneous (and certain non-homogeneous) linear ordinary differential equations having constant coefficients.
4. Use variation of parameters to solve higher order non-homogeneous linear ordinary differential equations.
5. Apply numerical methods to obtain approximate solutions of first order differential equations.
6. Model natural processes that evolve in time.
7. Use calculators and computers to generate solution curves and approximate solutions to differential equations.

7. Introduction to Linear Algebra

3-4 semester hours

Prerequisite: Calculus II with a grade of “C” or better

Note: See Technology Statement in the Introduction

A first course in vectors, matrices, vector spaces, and linear transformations. The ideas in this course serve not only as an introduction to more abstract mathematics courses at the junior-senior level, but also have many useful applications outside mathematics. The course is not intended to replace a more advanced linear algebra course at the junior-senior level. It should cover the following topics: vectors; operations on matrices; matrices; inverse of a matrix; solution of systems of linear equations; rank of a matrix; vector spaces and subspaces; linear dependence and independence; basis and dimension; linear transformations; sums, composites, inverses of linear transformations; range and kernel of a linear transformation; proof. Further topics could include: determinants; eigenvalues and eigenvectors; orthogonality and inner product spaces; and quadratic forms.

Course Content

1. Solutions of Linear Systems
2. Matrices
   a. Operations on matrices
   b. Inverse of a matrix
   c. Rank
   d. Determinants*
3. Vectors and Vector Spaces
   a. Subspaces
   b. Linear dependence and independence
   c. Dimension
   d. Spanning set and basis
4. Linear Transformations
   a. Matrices as linear transformations
   b. Sums, composites, and inverses of linear transformations
   c. Range, kernel, rank, nullity
5. Eigenvalues and Eigenvectors*
6. Inner Product Spaces and Orthogonality*
7. Quadratic Forms*
8. Proof

An asterisk (*) denotes an optional topic.

Course Objectives—The student will be able to:

1. Solve linear systems using a variety of techniques (e.g. Gaussian elimination, matrix inverse, Cramer's rule, matrix factorizations, etc.).
2. Perform operations on matrices (e.g. addition, scalar multiplication, multiplication, transpose, inverse, determinant*, etc.).
3. Determine whether vectors are linearly independent.
4. Determine whether a subset of a vector space is a subspace.
5. Find the dimension and a basis for a vector space/subspace.

9. Finite Mathematics (A and B) (for Business and Management)

3-4 semester hours

Prerequisite: College Algebra with a grade of "C" or better

Note: See Technology Statement in the Introduction

The course emphasizes concepts and applications, rather than mathematical structures. Form A (designed especially for students in business, economics, Social Sciences and Life Sciences, with applications drawn from these fields) includes such topics as: vectors, determinants, matrices and matrix algebra; systems of linear equations and matrices; systems of inequalities and linear programming; simplex method, set theory, logic and Boolean algebra; counting and probability theory; stochastic processes; game theory; Markov chain methods; mathematical modeling; and the mathematics of finance. Form B: matrix algebra; systems of linear equations and matrices; determinants; vectors in 2-space and 3-space; vector spaces; eigenvalues and eigenvectors.

Course Content

A. Usually Called Finite Mathematics
The topics listed are usually found in this course. Applications are drawn primarily from economics, business, and non-physical sciences. 1. Vectors, matrices, and matrix algebra
1. Solving systems of linear equations by matrix methods
2. Systems of inequalities and linear programming
3. Simplex method
4. Other applications of matrices
5. Set theory, logic, and Boolean Algebra
6. Counting and probability theory
7. Stochastic processes
8. Game theory
9. Markov Chain methods
10. Mathematical modeling
11. Mathematics of finance

B. Usually Called Applied Linear Algebra
This is a service course and not a course in abstract linear algebra for math majors and minors. Formal proofs should be avoided. The topics should be developed by appealing to intuition, geometry, and applications. The topics listed are usually found in this course.
1. Matrix Algebra
2. Systems of linear equations and matrices
3. Determinants
4. Vectors in 2-space and 3-space
5. Vector spaces
6. Eigenvalues and eigenvectors

Notes

This course (either A or B) is designed especially for students in areas such as business, economics, social science, and non-physical sciences. It does not count towards a major or minor in mathematics. The student who wishes to transfer this course should check the specific requirements at the senior institution. This course should emphasize the concepts and applications of mathematics rather than mathematical structures. Because of the duplication in the content in these two alternatives, full credit should not be given for both courses, and a student should not be required to take one if the other has been successfully completed.

10. Calculus for Business and Social Science

4-5 semester hours

Prerequisite: College Algebra with a grade of "C" or better

Note: See Technology Statement in the Introduction

This calculus course is designed specifically for students in business and the social sciences and does not count toward a major or minor in mathematics. It emphasizes applications of the basic concepts of calculus rather than proofs. Topics must include limits; techniques of differentiation applied to polynomial, rational, exponential, and logarithmic functions; partial derivatives and applications; maxima and minima of functions; and elementary techniques of integration including substitution and integration by parts. Business and social science applications are stressed throughout the course.

Course Content

1. Introductory Topics (note: these are preparatory to the core content of the course and should be a very minor portion of the course content.)
   A. Sets, functions, linear functions
   B. Applications of matrices and systems of equations
   C. More general functions and curve sketching
   D. Exponential and logarithmic functions
   E. Applications of functions and graphs
   F. Mathematical modeling

2. Differential Calculus
   A. Limits, definition of the derivative
   B. Formulas for finding derivatives
   C. Higher derivatives
   D. Maxima and minima of functions of one variable
   E. Functions of more than one variable
   F. Partial derivatives
   G. Maxima and minima of functions of two or more variables
   H. Applications in business and economics

3. Integral Calculus
   A. The definite integral and the indefinite integral
   B. The fundamental theorem of integral calculus
   C. The interpretation of the definite integral as a signed area
   D. Methods of integration: substitution, parts, basic formulas
   E. Approximate integration

Course Objectives—The student will be able to:

1. Find limits numerically, graphically, and algebraically.
2. Compute derivatives and partial derivatives of algebraic, exponential, and logarithmic functions.
3. Interpret the derivative as an instantaneous rate of change.
4. Use derivatives to solve problems involving business and social science applications.
5. Compute indefinite and definite integrals.
6. Use integrals to solve problems involving business and social science applications.
7. Determine mathematical models corresponding to problem situations.

Notes

This course may be taken before or after the course in finite mathematics. The student who wishes to transfer this course should check the specific requirements at the senior institution.

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11. Mathematics for Elementary Teaching I, II

3-4 semester hours each

Prerequisites: Geometry and Intermediate Algebra both with a grade of "C" or better

Note: See Technology Statement in the Introduction

This sequence focuses on mathematical reasoning and problem solving by using calculators and microcomputers in problem solving. Topics are selected from: sets, functions and logic, whole numbers, integers, rational numbers, irrational numbers and the real number system (e.g., number theory, probability, statistics, measurement and non-metric geometry).

Course Content

With consideration of the students being served, the topics will generally be selected from the following list:

1. Whole numbers
2. Sets, functions, and logic
3. Integers
4. Number theory
5. Rational numbers
6. Irrational numbers and the real number system
7. Probability
8. Statistics
9. Non-metric geometry
10. Measurement

Course Objectives—The student will be able to:

1. solve problems and analyze solutions of problems that require logic.
2. gain knowledge and understanding of the mathematical content that is taught in elementary schools.
3. develop an appreciation of and interest in the history, structure, and applications of mathematics, including the philosophical base upon which the discipline rests.
4. develop an in-depth understanding of the fundamental operations of the arithmetic of real numbers.
5. develop an understanding of the nature and structure of the real number system.
6. learn the basic concepts of elementary probability and statistics.
7. learn how to plan, perform, and interpret statistical experiments.
8. study and interpret graphs and prepare graphs to display information.
9. make measurement estimates and compute accurate measurements of area, volume, time, and other measurable quantities, with particular emphasis placed on the metric system of measurements. (Methods of introducing and integrating measurement activities into the curriculum are discussed.)
10. analyze articles from professional journals and publications in the field of elementary school mathematics.

Notes

This two-course sequence is designed to meet ***some*** of the requirements of the state certification of elementary teachers. Students should be **strongly** encouraged to successfully complete both classes at the same institution **and** to check the specific requirements at the senior institution.

These courses focus on mathematical reasoning and problem solving. Course pedagogy involves students as active participants in the learning process. The use of calculators and microcomputers is strongly recommended for problem solving.

12. Discrete Mathematics

3-4 semester hours

Prerequisite: College Algebra with a grade of “C” or better

Note: See Technology Statement in the Introduction

Introduction to analysis of finite collections and mathematical foundations of sequential machines, computer system design, data structures and algorithms. Includes: sets, counting, recursion, graph theory, trees, nets, Boolean algebra, automata, and formal grammars and languages.

Notes

The above description is for Discrete Mathematics, an Illinois Articulation Initiative course under the Mathematics General Education Panel. A closely related course, Discrete Structures, is found in the Computer Science portion of this guide and is approved by the Computer Science Majors Panel of the Illinois Articulation Initiative. While the descriptions are very similar, care must be taken if attempting to design a course that fulfills both needs.