

# MATHEMATICS

## Mission

The mission of the Math program is to produce graduates who have developed mathematical ability and knowledge of the depth and breadth of mathematics, who can communicate about and with mathematics, who use technology to support problem solving and promote understanding, and who apply the mathematical sciences, including statistics, in other academic disciplines.

## Student Learning Outcomes

Math students at Chadron State College will:

- Develop mathematical ability and knowledge of the depth and breadth of mathematics.
- Communicate about and with mathematics.
- Use technology to support problem solving and promote understanding.
- Apply the mathematical sciences, including statistics, in other academic disciplines.
- Bachelor of Science - Subject Major in Mathematics (<http://catalog.csc.edu/undergraduate/programs/mathematics/bs-subject-major-mathematics/>)
- Bachelor of Science in Education - Field Endorsement in Mathematics (Grades 6-12) (<http://catalog.csc.edu/undergraduate/programs/mathematics/bs-education-field-endorsement-mathematics-6-12/>)
- Bachelor of Science - Education - Middle Level Education Academic Area in Mathematics (Grades 5-9) (<http://catalog.csc.edu/undergraduate/programs/mathematics/bs-education-middle-level-education-academic-area-mathematics-5-9/>)
- Applied Statistics (<http://catalog.csc.edu/undergraduate/programs/mathematics/applied-statistics-minor/>)
- Mathematics (<http://catalog.csc.edu/undergraduate/programs/mathematics/mathematics-minor/>)
- Data Analytics (<http://catalog.csc.edu/undergraduate/programs/mathematics/data-analytics-minor/>)

### MATH 101 PRE-ALGEBRA3 Credits

A comprehensive review of arithmetic involving whole numbers, fractions, decimals, and signed numbers. Students will solve problems involving ratios, proportions, percent and geometry. Basic algebra concepts including working with variables, simplifying expressions, solving equations, and graphing will be introduced. Students will be introduced to the basic features of a graphing calculator.

**Add Consent:** Department Consent

**Drop Consent:** Department Consent

**Notes:** This course does not meet Essential Studies or specific program requirements.

**Requirements:** Math Placement Exam or Math Faculty Recommendation

### MATH 102 PRE-COLLEGE ALGEBRA3 Credits

Problem-solving skills, applied algebra and geometry, and basic data analysis. The goal is to develop readiness for a college algebra or statistics course.

**Add Consent:** Department Consent

**Drop Consent:** Department Consent

**Notes:** This course does not meet Essential Studies or specific program requirements.

**Requirements:** Math Placement Exam or Math Faculty Recommendation

### MATH 133 INTRODUCTION TO MATHEMATICS3 Credits

Everyday mathematics with practical applications. A study of various topics including estimation, consumer mathematics, finance, probability and statistics, with an emphasis on critical thinking and interpreting results as they relate to being an informed and productive citizen in our society.

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

### MATH 134 PLANE TRIGONOMETRY3 Credits

Angle measurement, circular functions, inverse trigonometric functions, trigonometric functions of an acute angle, solutions of right triangles, law of sines, law of cosines, additional theorems and related formulas, trigonometric identities, and applications.

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

### MATH 135 PRE-CALCULUS MATHEMATICS3 Credits

A mathematical modeling approach to diverse real-world applications in many fields. Algebraic analysis of polynomials, rational, exponential, and logarithmic functions. Trigonometry concepts such as circular functions, inverse functions, solving equations, Law of Sines and Cosines.

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

### MATH 137 MATHEMATICS TOPICS FOR ELEMENTARY TEACHERS3 Credits

This course broadens and deepens students' knowledge of the mathematical content of the elementary and middle school grades. Throughout the course, students use conceptual models to make sense of mathematics, perform activities to develop new perspectives, and examine a variety of materials for teaching. These guided, collaborative, learning experiences help prospective teachers to become reflective practitioners who can develop a pedagogical framework to teach mathematics. The covered contents include: 1. Numbers and the Base-Ten System 2. Fractions and Problem Solving 3. Addition and Subtraction 4. Multiplication 5. Multiplication of Fractions, Decimals, and Negative Numbers 6. Division

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation.

### MATH 138 APPLIED CALCULUS3 Credits

Differential and integral calculus with applications from business, economics, life sciences, physical sciences and social sciences.

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

**MATH 142 COLLEGE ALGEBRA4 Credits**

A mathematical modeling approach to diverse real-world applications in many fields. Algebraic, exponential, and logarithmic functions are developed graphically, numerically, symbolically, and verbally. Graphing calculators and other technologies are used extensively as descriptive and problem solving tools.

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

**MATH 151 CALCULUS I5 Credits**

Traditional approach to limits, continuity, differential calculus with applications, and an introduction to integral calculus.

**Essential Studies:** SLO #4

**Prerequisites:** Advanced high school mathematics including trigonometry or MATH 134, MATH 135, Math Placement Exam or Math Faculty Recommendation

**MATH 200 INTRO TO DATA ANALYTICS3 Credits**

Introduction to statistical programming in R and its applications. Students will become familiar with the process, techniques, and goals of exploratory data analysis. Students will be able to create, assess, debug code effectively, and interpret their findings in an effective manner.

**Prerequisites:** MATH 151

**MATH 201 INTRO TO PROGRAMMATIC DATA3 Credits**

Introduction to programming: a wholistic approach to learning how to code with a lens toward Big Data principles. Topics include but are not limited to Datatypes, Immutables, Functions, Packages, Loops, Recursion, and an introduction to object oriented programming (OOP)

**Prerequisites:** MATH 151

**MATH 202 INTRO TO DATABASE STRUCTURES3 Credits**

Principles of the RDBMS, DBMS, Structured Query Language (SQL), MySQL, NoSQL, JSON, Remote Database Access, and API Requests.

**Prerequisites:** MATH 201

**MATH 232 APPLIED STATISTICS3 Credits**

Descriptive statistics and statistical inference, with applications from business, economics, life and social sciences. Cannot be used by Mathematics majors in their minor.

**Essential Studies:** SLO #4

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

**MATH 235 MATHEMATICS FOR PROSPECTIVE ELEMENTARY AND MIDDLE SCHOOL TEACHERS I3 Credits**

This course broadens and deepens students' knowledge of the mathematical content of the elementary and middle school grades. Throughout the course, students use conceptual models to make sense of mathematics, perform activities to develop new perspectives, and examine a variety of materials for teaching. These guided, collaborative, learning experiences help prospective teachers to become reflective practitioners who can develop a pedagogical framework to teach mathematics. The covered contents include: 1. Ratio and Proportional Relationships 2. Number Theory 3. Algebra 4. Statistics 5. Probability

**Prerequisites:** MATH 133, MATH 137, MATH 142 or instructor consent

**Notes:** Does not apply toward Essential Studies mathematics requirement.

**MATH 236 HISTORY OF MATHEMATICS3 Credits**

Students will learn about the development of mathematics from the early Egyptian period to modern times, study prominent mathematicians and their major accomplishments, and know about many classical and modern mathematical problems.

**Essential Studies:** SLO #8

**MATH 237 HISTORY AND FOUNDATIONS OF MATHEMATICS3 Credits**

Logic, proof, relations, sets, functions, and history of mathematics.

**Prerequisites:** MATH 142 or MATH 151

**MATH 238 MATHEMATICS FOR THE ELEMENTARY TEACHER II3 Credits**

Geometry, probability, and statistics for elementary and middle grade levels. Does not apply toward Essential Studies mathematics requirement.

**Prerequisites:** MATH 235

**MATH 252 CALCULUS II5 Credits**

Integral calculus with applications of differentiation and integration. Sequences and series.

**Prerequisites:** MATH 151

**MATH 270 SPECIAL TOPICS1-3 Credits**

Special topics appropriate for lower division credit.

**Notes:** May be repeated with different emphases for up to six hours of credit.

**MATH 301 DATA LIFE CYCLE AND APPLICATION DEVELOPMENT3 Credits**

Principles of the Data Life Cycle and Management, Applying DLM principles to a real world scenario and data situations, Applying programming principles to learning additional languages

**Prerequisites:** MATH 202 and sophomore or above status

**MATH 302 APPLIED 'BIG DATA'3 Credits**

Machine learning, simple and linear regression, principal component analysis, neuro-linguistic programming, visualizations, and additional topics relevant to the field of "Big Data" analysis and applications

**Prerequisites:** MATH 301 and sophomore or above status

**MATH 303 DISCRETE MATHEMATICS3 Credits**

Graph theory, matrices, recurrence relations, linear programming, difference equations, combinatorics, Boolean algebra, and trees. Applications included.

**Essential Studies:** SLO #4

**Prerequisites:** Sophomore or above status

**Add Consent:** Department Consent

**Requirements:** Math Placement Exam or Math Faculty Recommendation

**MATH 330 DIFFERENTIAL EQUATIONS3 Credits**

Theory and solutions of ordinary differential equations and systems of differential equations. Modeling of science, engineering, and social science problem situations and phenomena, including power series methods.

**Prerequisites:** MATH 252 and Sophomore or above status

**MATH 331 PROBABILITY AND STATISTICS3 Credits**

Descriptive statistics, exploratory data analysis, probability, random variables and probability distributions, inferential statistics, point and interval estimation, hypothesis testing, correlation and regression. Applications from business, education, and science.

**Prerequisites:** MATH 151 or MATH 138 and Sophomore or above status

**MATH 334 COLLEGE GEOMETRY3 Credits**

Advanced plane geometry. Similar and congruent figures, logic, and constructions. Projective and other fields of geometry, both Euclidean and non-Euclidean.

**Prerequisites:** MATH 237 and Sophomore or above status

**MATH 336 CALCULUS III3 Credits**

Vector calculus and vector-valued functions, partial derivatives, multiple integrals, introduction to differential equations, and line and surface integrals.

**Prerequisites:** MATH 252 and Sophomore or above status

**MATH 337 LINEAR ALGEBRA3 Credits**

Two-dimensional vector spaces, linear transformations of the plane, orthogonality, and inner products. Vector space of  $n$ -tuples, subspaces, linear dependence, dimension and basis, matrices, and determinants.

**Prerequisites:** MATH 138 or MATH 151 and Sophomore or above status

**MATH 390 INTERNSHIP IN MATHEMATICS1-12 Credits**

Provides practical experience as a mathematician in government, business or industry. Open to upper division students major in the area of mathematics.

**Add Consent:** Department Consent

**Notes:** Interested students should contact the Internship and Career Services Office to secure application materials; application should be made prior to the semester the internship will be started; the amount of credit will be based on the availability of a suitable work position, the qualifications of the applicant, and the work hours.

**MATH 400 INDEPENDENT STUDY OR RESEARCH1-3 Credits**

Study or research in an area of special interest.

**Add Consent:** Instructor Consent

**Notes:** The number of credit hours is determined by the topic and the amount of work required.

**Requirements:** Permission of instructor, School Dean, and Academic Vice President is required.

**MATH 401 ADVANCED MATHEMATICS EDUCATION PERSPECTIVES3 Credits**

A capstone course for students in the Mathematics 7-12 Field Endorsement and the Middle Grades (5-9) Mathematics Endorsement. Advanced perspectives addressing the teaching of algebra, pre-calculus, discrete mathematics for teachers, and introductory number theory are discussed. Emphasis is on the clear and precise explanations of mathematical ideas and the mathematical connections that are explored at these levels.

**Prerequisites:** Junior or above status

**Add Consent:** Instructor Consent

**MATH 410 MATHEMATICS SEMINAR1 Credit**

Research, development, and presentation of a formal paper regarding some topic of interest in mathematics.

**Prerequisites:** Junior or above status and a minimum of 9 credit hours of upper division mathematics

**MATH 426 OPERATIONS RESEARCH3 Credits**

Game theory, linear programming, simplex method, duality, transportation and assignment problems, introduction to dynamic programming, and queuing theory. Applications of business and industrial perspectives.

**Prerequisites:** MATH 138 or MATH 151 and MATH 232 or MATH 331 and Sophomore or above status

**MATH 427 NUMBER THEORY3 Credits**

Introduction to the Ring of integers, Euclidean Rings, Chinese Remainder Theorem, divisibility, primes, primitive roots, indices, congruencies, Diophantine equations, quadratic reciprocity, number-theoretic functions, and cryptography, with an emphasis on applications.

**Prerequisites:** MATH 237 and Sophomore or above status

**Dual-listed:** MATH 527

**MATH 429 INTRODUCTION TO MODERN ALGEBRA3 Credits**

An axiomatic approach to the real number system and group theory. Homomorphism, isomorphisms, rings, introduction to integral domains, fields and selected topics in abstract algebra.

**Prerequisites:** MATH 237 with "C" and Junior or above status

**MATH 430 TOPICS IN MATHEMATICS1-3 Credits**

Topics to meet the needs of students who have completed the regular course of study.

**Prerequisites:** Junior or above status

**Notes:** Can be repeated with different emphasis for a maximum of 6 hours credit.

**MATH 433 STATISTICAL METHODS AND DATA ANALYSIS3 Credits**

Statistical research methods and modeling of statistical problems. Chi-square tests, analysis of variance, one-way and multi-factorial designs, multiple regression and correlation. Nonparametric methods. Use of calculators and personal computer software.

**Prerequisites:** MATH 232 or MATH 331 and Junior or above status

**MATH 434 INTRODUCTORY ANALYSIS3 Credits**

Structure and topology of the real number line. Completeness, compactness, connectedness. Rigorous treatment of limits, sequences, series, convergence, functions and continuity, derivatives, and selected topics on integration theory.

**Prerequisites:** MATH 237 with "C" and Junior or above status

**MATH 435 SAMPLING TECHNIQUES3 Credits**

Statistical survey methods, sampling techniques, point and interval estimation of population parameters, population size determination, and communication of sample survey results. Applications from business, the natural sciences, and the social sciences.

**Prerequisites:** MATH 232 or MATH 331 and Junior or above status

**MATH 437 MODERN ALGEBRA3 Credits**

Axiomatic approach to rings, integral domains, polynomials, fields, ideals and factor rings, selected topics in abstract algebra, and an introduction to vector spaces and algebraic coding theory.

**Prerequisites:** MATH 429 and Junior or above status

**MATH 438 NUMERICAL ANALYSIS3 Credits**

Numerical modeling of phenomena using interpolation and approximation, systems of linear equations, integration, and numerical solutions to differential equations.

**Prerequisites:** MATH 252, MATH 330 and Junior or above status

**MATH 439 THEORY OF STATISTICS3 Credits**

Joint distribution concepts, conditional expectations, method of distribution functions, transformation, method of moment-generating functions, order statistics, sampling distributions, central limit theorem, continuous and discrete random variables.

**Prerequisites:** MATH 151, MATH 232 or MATH 331 and Junior or above status

**MATH 440 MATH EDUCATION STANDARDS3 Credits**

An integrated content/pedagogy course on mathematics teaching, assessment, and curriculum standards, based on major content areas of the K-12 curriculum.

**Prerequisites:** 50% of endorsement completed and junior or above status

**MATH 441 COMBINATORICS3 Credits**

Basic Counting Rules, Graph Theory, Generating Functions, Recurrence Relations, Inclusion and Exclusion with prime numbers, Polya's Theory of Counting, the Pigeonhole Principle and Latin Squares

**Prerequisites:** MATH 151 or MATH 138 and Junior or above status

**Dual-listed:** MATH 541