Mathematics

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The Department of Mathematics offers programs of study leading to the Bachelor of Science and Master of Science degrees in Mathematics. In addition, the Department of Mathematics offers a Bachelor of Science in Statistics. A Minor in Mathematics or Statistics is another option available to students.

B.S. in Mathematics

The Bachelor of Science in Mathematics provides a program of study that prepares students who are seeking employment in business & industry or who plan to pursue graduate study in mathematics.

The Minor in Mathematics requires a minimum of 18 hours of MATH credit, which must include MATH 2414 Calculus II and at least 6 advanced MATH hours.

On the graduate level, the Master of Science in Mathematics provides a program of study that prepares students beyond the undergraduate level for employment in business & industry or for a career in higher education. Students completing the M.S. in Mathematics also receive preparatory work for pursuing a doctoral degree in mathematics or mathematics education. For further information about the graduate program, see the graduate section of the catalog. For more information about the Mathematics program in general, visit the departmental web site at https://www.tarleton.edu/math (http://www.tarleton.edu/math/) or contact our Graduate Mathematics Coordinator at gradmath@tarleton.edu.

Below are the program requirements for the **B.S. in Mathematics**. Students complete the General Education Core Requirements along with a set list of courses that are required for the degree for 78 credit hours. In addition, each student chooses a specialized concentration with 42 credit hours to complete the 120-hour program.

Note: The Department of Mathematics delivers the MATH courses for those students pursuing the B.S. in Secondary Education (through the College of Education) with an emphasis in teacher certification for Grades 7-12 Mathematics. An option to receive a double major with the B.S. in Secondary Education and the B.S. in Mathematics is available through the concentration below called "Mathematics for Teaching." The Department of Mathematics also provides the mathematics content for students pursuing certification for Grades 4-8 Mathematics.

Students are encouraged to visit with faculty in the Department of Mathematics if they need assistance choosing a concentration. Faculty mentors can help students explore the types of career opportunities that are available to students for each concentration. Please reach out to the department office in the Mathematics Building, Room 142, if you need help connecting with a faculty mentor.

Academic advisors in the University College help students officially declare the major and concentration, along with helping students select courses each semester based on prerequisites and course rotations. For help in connecting with an academic advisor, please see the following website: https://www.tarleton.edu/advising/advisors/

The Department of Mathematics upholds a Mathematics Placement Policy to help ensure that students are placed into the appropriate mathematics courses.

For more information, please see your academic advisor.

The Bachelor of Science Degree in Mathematics

Required Courses

Placement for Calculus 1 (MATH 2413) is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
General Education Requirements (http://catalog.tarleton.edu/academicaffairs/)		43
MATH 2413 [shared]	Calculus I	
MATH 2414	Calculus II	4
MATH 3306	Differential Equations	3
MATH 3318	Linear Algebra	3
MATH 3311	Probability and Statistics I	3
MATH 3312	Probability & Statistics II	3
MATH 3320	Foundations of Mathematics	3
MATH 3433	Calculus III	4
MATH 4309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Advanced Analysis	3
MATH 4332 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Abstract Algebra	3
COSC 1310	Procedural Programming	3
COSC 3344	Computer Applications in Analysis	3
PHYS 2425 [shared]	University Physics I	
ENGL 1301 [shared] [WI (http://catalog.tarleton.edu/academicaffairs/)]	Composition I	
ENGL 1302 [shared] [WI (http://catalog.tarleton.edu/academicaffairs/)]	Composition II	
GOVT 2305 [shared]	Federal Government (Federal Constitution and Topics)	

GOVT 2306 [shared]	Texas Government (Texas Constitution and Topics)	
Total Hours		**78**

Additional Required Courses for Concentrations

General

Supporting Field (12 Hours Advanced) [1]		24
Electives		6
Select four of the following:		12
MATH 3301	Number Theory	
MATH 3360	Numerical Analysis	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Biomathematics

BIOL 1406 [shared]	Biology for Science Majors	
BIOL 1407	Biology for Science Majors II	4
BIOL 3303	Genetics	3
BIOL 3103	Genetic Techniques (Students will need to take BIOL 3103 after or concurrently with BIOL 3303)	1
BIOL 3407	Microbiology	4
BIOL 3353	Ecology and Evolution	3
CHEM 1311	College Chemistry I (Lecture)	3
CHEM 1111	College Chemistry I (Laboratory)	1
ENGL 3309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Professional Writing	3
MATH 3360	Numerical Analysis [2]	3
MATH 4320	Mathematical Modeling	3
Select two of the following:		8
BIOL 3413	Molecular Biology	
BIOL 3485	Immunology	
BIOL 4401	Ecology	
BIOL 4445	Parasitology	
Select two of the following:		6
MATH 3301	Number Theory	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Financial Analysis

ACCT 2301	Principles of Accounting I-Financial	3
ACCT 2302	Principles of Accounting II-Managerial	3
ACCT 3303	Intermediate Accounting I	3
COMM 2302 [shared]	Business and Professional Speaking	
ECON 2301 [shared]	Principles of Macroeconomics	
ECON 2302	Principles of Microeconomics	3
ECON 4311 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Econometrics and Forecasting	3
FINC 3301	Principles of Financial Management	3
ECON 3304	Environmental Economics	3
FINC 4304	Investments I	3
FINC 4307	Investments II	3
FINC 4300	Advanced Financial Management	3
Select four of the following:		12
MATH 3301	Number Theory	
MATH 3360	Numerical Analysis	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Environmental Mathematics

CHEM 1311 [shared]	College Chemistry I (Lecture)	
CHEM 1111 [shared]	College Chemistry I (Laboratory)	
CHEM 1312	College Chemistry II (Lecture)	3
CHEM 1112	College Chemistry II (Laboratory)	1
ENVE 2251	Fundamentals of GIS for Engineers	2
ENVE 2310	Introduction to Environmental Engineering	3
ENVE 3300	Fluid Mechanics	3
ENVE 3301	Environmental Systems Modeling	3
ENVE 3310 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Engineering Hydrology	3
ENVE 4310 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Water Resources Engineering	3
Select three from the following:		9
ENVE 2311	Soil Mechanics	
ENVE 3450	Environmental Biotechnology	
ENVE 3333	Groundwater Contamination and Remediation	
ENVE 4350	Solid and Hazardous Waste Management	
MATH 3360	Numerical Analysis	3
MATH 4320	Mathematical Modeling	3
Select two from the following:		6
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Pre-Actuarial

ACCT 2301	Principles of Accounting I-Financial	3
ACCT 2302	Principles of Accounting II-Managerial	3
COMM 2302 [shared]	Business and Professional Speaking	
ECON 2301 [shared]	Principles of Macroeconomics	
ECON 2302	Principles of Microeconomics	3
ECON 3301	Intermediate Macroeconomics	3
ECON 3302	Intermediate Microeconomics	3
ENGL 3309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Professional Writing	3
FINC 3301	Principles of Financial Management	3
FINC 4304	Investments I	3
ECON 4311 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Econometrics and Forecasting	3
FINC 4308	Principles of Insurance and Risk Management	3
Select four of the following: [3]		12
MATH 3301	Number Theory	
MATH 3360	Numerical Analysis	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Pre-Law

ACCT 2301	Principles of Accounting I-Financial	3
COMM 1311 [shared]	Introduction to Speech Communication	
COMM 1315	Public Speaking	3
COMM 2302	Business and Professional Speaking	3
COMM 3303	Debate	3
Sophomore ENGL literature [Shared]		
ENGL 3309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Professional Writing	3
ENGL 3310	Editing	3
PHIL 2303	Introduction to Logic	3
PHIL 3301	Ethics in the Professions	3
PSYC 2301 [shared]	General Psychology	
Electives		6
Select four of the following:		12
MATH 3301	Number Theory	

MATH 3360	Numerical Analysis	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Pre-Medical/Pre-Dental

BIOL 1406	Biology for Science Majors	4
BIOL 1407	Biology for Science Majors II	4
BIOL 3407	Microbiology	4
BIOL 4374	Biochemistry I	3
CHEM 1311	College Chemistry I (Lecture)	3
CHEM 1111	College Chemistry I (Laboratory)	1
CHEM 1312	College Chemistry II (Lecture)	3
CHEM 1112	College Chemistry II (Laboratory)	1
CHEM 2323	Organic Chemistry I	3
CHEM 2123	Organic Chemistry I Laboratory	1
CHEM 2325	Organic Chemistry II	3
CHEM 2125	Organic Chemistry II Laboratory	1
COMM 2302 [shared]	Business and Professional Speaking	
PHIL 3301 [shared]	Ethics in the Professions	
PHYS 2426 [shared]	University Physics II	
Select 11 hours from the following:		11
MATH 3301	Number Theory	
MATH 3360	Numerical Analysis	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Data Analysis

MATH 3310	Discrete Mathematics	3
MATH 3364	Data Analysis I	3
Select three of the following:		9
MATH 3301	Number Theory	
MATH 3360	Numerical Analysis	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
COSC 2341	Data Structures and Algorithms	3
COSC 3360	Python Programming for Data Science	3
COSC 4360	Machine Learning	3
Advised Electives (Data Science Support Field) Courses for the Data Science supporting field are to be chosen from an academic area in which data science is applicable. Supporting field must be developed in consultation with an academic advisor and have department head approval.		15
ENGR 2303 [shared]	Engineering Economy	
ENGL 3309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Professional Writing	3
COMM 2302 [shared]	Business and Professional Speaking	
Total Hours		**42**

Technical Writing

Sophomore Level English [shared]		
BIOL 1406 [shared]	Biology for Science Majors	
CHEM 1311	College Chemistry I (Lecture)	3
CHEM 1111	College Chemistry I (Laboratory)	1
COMM 2302 [shared]	Business and Professional Speaking	
ENGL 3309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Professional Writing	3
ENGL 3310	Editing	3
Advanced ENGL electives		6
ENGL 3312	Professional Writing and Visual Design	3
Lab Science elective		4
Electives		7

Select four of the following:		12
MATH 3301	Number Theory	
MATH 3360	Numerical Analysis	
MATH 3364	Data Analysis I	
MATH 4306	Partial Differential Equations	
MATH 4320	Mathematical Modeling	
MATH 4088	Undergraduate Research Project	
MATH 4390	Math Topics	
Total Hours		**42**

Mathematics for Teaching

This concentration is for students currently enrolled in a Secondary Mathematics Education program and wanting to pursue a second major.

Supporting Field in Education (12 hours adv)		24
Electives		6
MATH 3301	Number Theory	3
MATH 4302	College Geometry	3
MATH 4304	Survey of Mathematical Ideas I	3
MATH 4308	Survey of Mathematical Ideas II	3
Total Hours		**42**

[1] Courses for the supporting field are to be chosen from an academic area in which mathematics is applicable. Supporting field must be developed in consultation with an academic advisor and have department head approval.
[2] MATH 4390 Math Topics may be substituted for MATH 3360 Numerical Analysis with department head approval.
[3] With department head approval, MATH 4086: Statistical Models may substitute for one of the advanced MATH electives.

B.S. in Statistics

The Bachelor of Science in Statistics provides a program of study that prepares students who are seeking employment in business & industry or who plan to pursue graduate study.

The Minor in Statistics requires a minimum of 18 hours of STAT credit, with at last 6 advanced STAT hours.

Student completing the Bachelor of Science in Statistics may choose to continue their studies with the Master of Science in Mathematics, which provides a program of study that prepares students beyond the undergraduate level for employment in business & industry or for a career in higher education. For further information about the graduate program, see the graduate section of the catalog. For more information about the Mathematics program in general, visit the departmental web site at https://www.tarleton.edu/math (http://www.tarleton.edu/math/) or contact our Graduate Mathematics Coordinator at gradmath@tarleton.edu.

Below are the program requirements for the **B.S. in Statistics**. Students complete the General Education Core Requirements along with a set list of courses that are required for the degree for 84 credit hours. In addition, each student chooses a 24-hour support field within a 36-hour concentration to complete the 120-hour program.

Students are encouraged to visit with faculty in the Department of Mathematics if they need assistance choosing a support field. Faculty mentors can help students explore the types of career opportunities that are available to students. Please reach out to the department office in the Mathematics Building, Room 142, if you need help connecting with a faculty mentor.

The Bachelor of Science in Statistics

Required Courses		
Placement for Calculus 1 (MATH 2413) is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.		
General Education Requirements (http://catalog.tarleton.edu/academicaffairs/)		43
STAT 2300	Introduction to Applied Statistics Using Technology	3
STAT 2301	Intermediate Statistical Methods using Technology	3
STAT 3364	Data Analysis I	3
STAT 3311	Probability & Statistics I	3
STAT 3312	Probability & Statistics II	3
STAT 4300	Linear Models	3
STAT 4301 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Design of Experiments	3
MATH 2413 [shared]	Calculus I [1]	
MATH 2414	Calculus II	4
MATH 3318	Linear Algebra	3
MATH 3320	Foundations of Mathematics	3
MATH 3433	Calculus III	4
MATH 4309 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Advanced Analysis	3
COSC 1310	Procedural Programming	3
Total Hours		**84**

Additional Required Courses for Concentrations

General

Support Field (12 hours advanced) [2]		24
Select 12 hours from:		12

STAT 4302	Nonparametric Statistics	
STAT 4310	Bayesian Analysis	
STAT 4320	Time Series Analysis	
STAT 4364	Data Analysis II	
STAT 4086	Statistics Problems	
STAT 4384	Internship	
STAT 4098	Undergraduate Research Project	
STAT 4390	Statistics Topics	
Total Hours		**36**

Academic Advising Guides

Academic Advising Guides area available at the following website:

https://web.tarleton.edu/majorinfo/

Professors

- Brawner, B.
- Crawford, J.
- Emmert, K.
- Faulkenberry, E.
- Garza, J.
- Riggs, B.
- Smith, K.
- White, P.
- Winton, R.
- Wyatt, B.

Associate Professors

- Cook, S.

Assistant Professors

- Gresham, J.
- Mitchell, C.
- Warren, M.

Instructors

- Bendewald, B.
- Casey, D.
- Eubank, M.
- Groseclose, J.
- Hoffman, S.
- Holland, C.
- McCain, J.
- McMahan, J.
- Robinett, J.
- Salinas, I.
- Seaman, C.
- Summer, N.
- Thorpe, R.
- Wood, K.

Visiting Instructors

- Almon, S.

Mathematics Courses

MATH 0001. NCBO Math. 0 Credit Hours (Lecture: 0 Hours, Lab: 0 Hours).

MATH 0303. Basic Mathematics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course features an intensive study of basic arithmetic concepts and skills, and the introduction to basic algebra as a preparatory course for MATH 0304, Fundamentals of College Algebra. It does not count for degree credit. A student must earn a grade of at least C in order to progress to MATH 0304.

MATH 0304. Fundamentals of College Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Functions, algebraic expressions, polynomials, exponents, equations, and systems of linear equations. Primarily for non-science and non-mathematics majors; not for degree credit. A student cannot get credit for MATH 0304 if credit has previously been received for MATH 1314. A student must earn a grade of a least C in order to progress to MATH 1314. Prerequisites: Enrollment in this course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 0305. Foundations of Statistics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An intensive study of fundamental concepts and skills that support the processes in statistics and probability. Prerequisites: Enrollment in this course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 0306. Foundations of College Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An intensive study of fundamental concepts and skills that support the processes in College Algebra. Topics include the study of numeracy and the real number system; algebraic concepts, notation, and reasoning; quantitative relationships; mathematical models; and problem solving. Prerequisites: Enrollment in this course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 0324. Foundations of Math for Business & Social Sciences. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An intensive study of the fundamental concepts and skills that support the mathematical processes in Math for Business & Social Science.

MATH 0332. Foundations of Contemporary Mathematics 1. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An intensive study of the fundamental concepts and skills that support the mathematical processes in finance, probability, statistics, and geometry. Prerequisites: Enrollment in this course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 1100. Transitioning to University Studies in Mathematics. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).
This course seeks to transition new mathematics majors into university academic life. It will help new students utilize campus resources effectively, learn academic skills, and develop a support network with mathematics faculty and fellow mathematics majors. The course will introduce students to the culture of the mathematics department and mathematics community at large. Prerequisite: Must be a mathematics major.

MATH 1314. College Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
In-depth study and applications of polynomial, rational, radical, exponential and logarithmic functions, and systems of equations using matrices.

MATH 1316. Plane Trigonometry. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
In-depth study and applications of trigonometry including definitions, identities, inverse functions, solutions of equations, graphing, and solving triangles. Additional topics such as vectors, polar coordinates, and parametric equations may be included. Prerequisite: MATH 1314 or in accordance with the Department of Mathematics initial enrollment placement policy.

MATH 1324. Math for Business & Social Sciences I (Finite Mathematics). 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
The application of common algebraic functions, including polynomial, exponential, logarithmic, and rational, to problems in business, economics, and the social sciences. The applications include mathematics of finance, including simple and compound interest and annuities; systems of linear equations; matrices; linear programming; and probability, including expected value. Prerequisites: Enrollment in the course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 1325. Math for Business & Social Sciences II (Business Calculus). 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is the basic study of limits and continuity, differentiation, optimization and graphing, and integration of elementary functions, with emphasis on applications in business, economics, and social sciences. This course is not a substitute for MATH 2413 (Calculus I). This course cannot be counted on a degree program for a mathematics major. Prerequisite: MATH 1314 or MATH 1324.

MATH 1332. Contemporary Mathematics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Elementary mathematical applications to problems of finance, probability, statistics, and geometry, and the development of reasoning skills. This course cannot be counted on a degree program for a mathematics major. Prerequisites: Enrollment in this course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 1342. Elementary Statistical Methods. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Collection, analysis, presentation and interpretation of data, and probability. Analysis includes descriptive statistics, correlation and regression, confidence intervals and hypothesis testing. Technology will be incorporated where appropriate. Prerequisites: Enrollment in this course will be in accordance with the Mathematics Placement and Continuing Enrollment Rules.

MATH 2318. Linear Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduces and provides models for application of the concepts of vector algebra. Topics include finite dimensional vector spaces and their geometric significance; representing and solving systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion; matrices; determinants; linear transformations; quadratic forms; eigenvalues and eigenvectors; and applications in science and engineering. Prerequisite: MATH 2414.

MATH 2412. Precalculus Math. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Applications of algebra and trigonometry to the study of elementary functions and their graphs including polynomial, rational, exponential, logarithmic, and trigonometric functions. Additional topics will be chosen from analytical geometry, mathematical induction, sequences, and series. Prerequisites: MATH 1314 or in accordance with the Department of Mathematics initial enrollment placement policy. Lab fee: $2.

MATH 2413. Calculus I. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Algebraic and transcendental functions, limits, continuity, derivatives and related applications, an introduction to the definite integral, integration, and the Fundamental Theorem of Calculus. Use of computer technology and laboratory assignments will be required in this course. Prerequisite: MATH 1316 or MATH 2412. Lab fee: $2.

MATH 2414. Calculus II. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
Applications of integration, integration techniques, sequences and infinite series, power series, parametric and polar curves. Use of computer technology and laboratory assignments will be required in this course. Prerequisite: MATH 2413. Lab fee: $5.

MATH 3301. Number Theory. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
The study of congruence relations, rational integers, diophantine equations, quadratic reciprocity law, linear forms, integral domains, and related topics. Prerequisite: 6 hours of Mathematics including MATH 2413.

MATH 3302. Principles of Geometry. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Introduction to Euclidean geometry. Topics will include an introduction to logic, properties of parallel lines, triangles, quadrilaterals, and measurement. Similarity and proportionality will also be addressed. Credit for both MATH 3302 and MATH 4302 will not be awarded. Prerequisite: MATH 2413. Lab fee: $2.

MATH 3303. Concepts of Elementary Mathematics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
This course is designed to develop and extend the mathematical content knowledge of prospective elementary and middle school teachers. Topics will include problem solving, sets, functions, mathematical reasoning, numerical fluency, operations and properties of whole numbers, integers, rational numbers, and real numbers. Prerequisites: minimum of 45 hours complete and a C or better in MATH 1314 Lab fee: $2.

MATH 3305. Concepts of Elementary Mathematics II. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
This course is designed to develop and extend the mathematical content knowledge of prospective elementary and middle school teachers. Topics will include geometry, measurement, probability, data collection, and statistics. Prerequisite: C or better in MATH 3303 Lab fee: $2.

MATH 3306. Differential Equations. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Solutions and applications of homogeneous and nonhomogeneous ordinary differential equations, including first-order equations and higher-order linear equations. Qualitative properties of solutions are investigated, as well as exact methods for solving differential equations and initial value problems including series, Laplace transform, separation of variables, variation of parameters, and undetermined coefficients. Prerequisite: MATH 2414.

MATH 3310. Discrete Mathematics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduces students to the techniques and tools of reasoning, decision making and combinational problem solving. Topics include sets and logic, combinations, probability, relations, functions and graphs, symbolic logic, finite state and Turing machines. Prerequisite: MATH 2413 or concurent enrollment.

MATH 3311. Probability and Statistics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will include probability axioms and properties; conditional probability and independence; counting techniques; and discrete, continuous, univariate, and multivariate random variables. Prerequisite: MATH 2414.

MATH 3312. Probability & Statistics II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will include normal distributions; sampling distributions; the central limit theorem; descriptive statistics; and the theory of statistical estimation and testing, with applications to proportions, means, contingency tables, univariate linear regression, and analysis of variance. Prerequisite: MATH 3311.

MATH 3318. Linear Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduces and provides models for application of the concepts of vector algebra. Topics include finite dimensional vector spaces and their geometric significance; representing and solving systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion; matrices; determinants; linear transformations; eigenvalues and eigenvectors; inner products; orthogonality; and applications in science and engineering. Prerequisite: MATH 2414.

MATH 3320. Foundations of Mathematics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course introduces students to concepts and forms of proof found in advanced mathematics courses. Topics include logic, set theory, mathematical induction, relations, functions, and cardinality. Prerequisite: MATH 2413.

MATH 3360. Numerical Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An introduction to numerical analysis. Topics will be selected from error analysis, solving algebraic equations, interpolation, numerical differentiation and integration, methods for solving systems of equations, approximation theory, and initial value problems of ordinary differential equations. Prerequisites: MATH 2414 and 3 hours of COSC.

MATH 3364. Data Analysis I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Mathematical foundations of data analysis techniques. Applications of Lagrangians to support vector machines, gradient descent methods for artificial neural networks, and conditional probabilities for Bayesian classifiers. Additional topics will be selected from: the class imbalance problem, cost sensitive learning, bootstrapping, kernel methods, impurity measures, distance metrics, topological data analysis, anomaly detection and convergence theorems for various methods. Prerequisites: MATH 2318, MATH 3433, COSC 1310 and one course from MATH 1342, STAT 2301, STAT 3312, or MATH 3450.

MATH 3433. Calculus III. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).
The calculus of two dimensional vectors, parametric equations, cylindrical and spherical coordinates, multivariable differential calculus, directional derivatives and their applications, multiple integration, vector analysis, line and surface integrals, Green's Theorem, Stokes's Theorem. Use of computer technology and laboratory assignments will be required in this course. Prerequisite: MATH 2414. Lab fee: $5.

MATH 3450. Principles of Bio-Statistics. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
An introduction to statistical methods that are applied in biology and agriculture. Use of technology and hands-on laboratory assignments will be required in this course. This course cannot be counted on a degree program for a mathematics major. Credit cannot be awarded for both MATH 1342 and 3450. Prerequisite: MATH 1314 or MATH 1316 or MATH 2412 or MATH 2413. Lab fee: $2.

MATH 4086. Mathematics Problems. 1-4 Credit Hours (Lecture: 0 Hours, Lab: 1-4 Hours).
Special problems in mathematics. Not covered by any course in the curriculum. Work may be either theory or laboratory. May be repeated with approval of the department head for additional credit. Prerequisite: Approval of department head.

MATH 4088. Undergraduate Research Project. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 0 Hours).
Methods of research in the mathematical sciences or in mathematics education through a research project directed by a departmental faculty member. The student is required to prepare a final report and presentation. No credit is earned until the student has enrolled in at least 3 credit hours and the final report and presentation are certified as completed by the faculty member directing the project, at which time the student will receive 3 credit hours. Prerequisites: Mathematics major, junior standing, 24 semester hours MATH and department head approval.

MATH 4302. College Geometry. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).
Topics will include logic, properties of circles and transformations, projective and non-Euclidean geometry. Technology will be included when appropriate. Credit for both MATH 3302 and MATH 4302 will not be awarded. Prerequisite: MATH 2413 Lab fee: $2.

MATH 4304. Survey of Mathematical Ideas I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is designed to bring together and supplement the technical material of other mathematics courses to communicate mathematics effectively. Topics in number & operations, number theory, algebra, statistics, and probability will be explored. Technology will be used where appropriate. Prerequisites: MATH 2413 and (MATH 3302 or MATH 4302).

MATH 4305. Concepts of Elementary Mathematics III. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is designed to develop and extend the mathematical content knowledge of prospective elementary and middle school teachers. Topics will include ratios, proportionality, number theory, and the development of algebraic reasoning through the use of patterns, relations, and functions, with an emphasis on multiple representations (numerical, graphical, verbal, and/or symbolic). Technology will be integrated into the curriculum where appropriate. Prerequisites: Junior Standing and a C or better in MATH 3305.

MATH 4306. Partial Differential Equations. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An introduction to theory and applications of partial differential equations. Topics for study may include separation of variables, heat equation, Laplace's equation, wave equation, Fourier series, and Sturm-Liouville eigenvalue problems. Prerequisite: MATH 3306.

MATH 4308. Survey of Mathematical Ideas II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
This course is designed to bring together and supplement the technical material of other mathematics courses to communicate mathematics effectively. Topics in statistics, probability, trigonometry, precalculus, and calculus will be explored. Technology will be used where appropriate. Prerequisites: MATH 4304 and (MATH 1342 OR MATH 3311).

MATH 4309. Advanced Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (http://catalog.tarleton.edu/academicaffairs/)]
A study of the theory of the calculus of functions of a single variable. Topics include the topology of the real line, functions, sequences and their limits, continuity, differentiation, and analysis of variance. Prerequisites: MATH 2414 and MATH 3320.

MATH 4311. Probability and Statistics II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will include normal distributions; sampling distributions; the central limit theorem; descriptive statistics; and the theory of statistical estimation and testing, with applications to proportions, means, contingency tables, univariate linear regression, and analysis of variance. Prerequisite: MATH 3311.

MATH 4320. Mathematical Modeling. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An advanced course in mathematical modeling requiring students to build and validate deterministic models of complex phenomena. The course will emphasize both qualitative and quantitative computational techniques of applied mathematics. Prerequisites: MATH 2414 and 6 hours of advanced MATH.

MATH 4332. Abstract Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (http://catalog.tarleton.edu/academicaffairs/)]
The study of preliminary notions, group theory, the theory of rings and ideals, and polynomial rings. Prerequisites: MATH 2414 and MATH 3318.

MATH 4370. Introduction to the History of Mathematics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
An introduction to the historical and philosophical development of the various branches of mathematics. The evolution of mathematical ideas will be studied from their developmental stages to the modern concepts used today. Prerequisite: 6 advanced hours in MATH.

MATH 4384. Internship. 3 Credit Hours (Lecture: 0 Hours, Lab: 4 Hours).
The student will complete a supervised and comprehensive work experience in a mathematics-related position with a public or private business organization for career preparation in a mathematics-related enterprise. The work experience must be formally approved and arranged with a cooperating sponsor prior to semester of enrollment in the course, and should be completed within the semester of course enrollment. Oral and written reports of the internship experience will be required. Prerequisites: At least 24 hours of degree-applicable MATH coursework with no grade lower than a 'C' in a MATH course, minimum 2.6 MATH GPA, minimum 2.6 overall GPA, junior or senior classification, and approval of department head.

MATH 4390. Math Topics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will be selected from areas of mathematics suitable for upper level study. This course may be repeated once, with department head approval, as topics change. Prerequisites: MATH 2414 and 6 hours of upper level mathematics.

MATH 4486. Mathematics Problems. 1-4 Credit Hours (Lecture: 0 Hours, Lab: 1-4 Hours).
Special problems in mathematics. Not covered by any course in the curriculum. Work may be either theory or laboratory. May be repeated with approval of the department head for additional credit. Prerequisite: Approval of department head.

Statistics Courses

STAT 2300. Introduction to Applied Statistics Using Technology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to data types, sampling and bias, graphs, descriptive statistics, linear regression, correlation, probability, random variables of discrete type, binomial Poisson and geometric distributions, continuous random variables and the normal distribution, sampling distributions and the central limit theorem. Statistical software such as R, Python, or SAS are integrated throughout the course. Prerequisite: corequisite: MATH 2413.

STAT 2301. Intermediate Statistical Methods using Technology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Descriptive statistics, estimation using confidence intervals, hypothesis tests of one population parameter, two population comparisons, ANOVA completely randomized design, ANOVA completely randomized block design. Statistical software such as R, Python, or SAS are integrated throughout the course. Prerequisite: STAT 2300.

STAT 3311. Probability & Statistics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will include probability axioms and properties; conditional probability and independence; counting techniques; and discrete, continuous, univariate, and multivariate random variables. Prerequisite: MATH 2414.

STAT 3312. Probability & Statistics II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will include normal distributions; sampling distributions; the central limit theorem; descriptive statistics; and the theory of statistical estimation and testing, with applications to proportions, means, contingency tables, univariate linear regression, and analysis of variance. Prerequisite: MATH 3311 or STAT 3311.

STAT 3364. Data Analysis I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Mathematical foundations of data analysis techniques. Applications of Lagrangians to support vector machines, gradient descent methods for artificial neural networks, and conditional probabilities for Bayesian classifiers. Additional topics will be selected from: the class imbalance problem, cost sensitive learning, bootstrapping, kernel methods, impurity measures, distance metrics, topological data analysis, anomaly detection and convergence theorems for various methods. Prerequisites: MATH 3318, MATH 3433, COSC 1310, and one course from MATH 1342, STAT 2301, STAT 3312, or MATH 3450.

STAT 4086. Statistics Problems. 1-4 Credit Hours (Lecture: 0 Hours, Lab: 1-4 Hours).
Special problems in statistics. Not covered by any course in the curriculum. Work may be either theory or laboratory. May be repeated with approval of the department head for additional credit. Prerequisite: Approval of department head.

STAT 4098. Undergraduate Research Project. 1-3 Credit Hours (Lecture: 0 Hours, Lab: 1-3 Hours).
Methods of research in statistics through a research project directed by a departmental faculty member. The student is required to prepare a final report and presentation. No credit is earned until the student has enrolled in at least 3 credit hours and the final report and presentation are certified as completed by the faculty member directing the project, at which time the student will receive 3 credit hours. Prerequisite: Approval of department head.

STAT 4300. Linear Models. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Development of the matrix theory needed to formulate, analyze, and verify model assumptions of linear models. Parameter estimation and hypothesis testing for linear models utilizing least squares. Applying linear models to real world problems. Prerequisites: MATH 3318, STAT 3312, and STAT 2301.

STAT 4301. Design of Experiments. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (http://catalog.tarleton.edu/academicaffairs/)]
Introduction to model design. Topics can be chosen from, but are not limited to, ANOVA completely randomized design, ANOVA completely randomized block design, fixed and random effects, factorial designs, analysis of covariance, or categorical data analysis. Prerequisite: STAT 4300.

STAT 4302. Nonparametric Statistics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to nonparametric statistics. Topics will include hypothesis testing, contingency tables, rank tests, and goodness-of-fit tests Prerequisite: STAT 2301, STAT 3312.

STAT 4310. Bayesian Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Introduction to Bayesian analysis, including comparisons of Bayesian and frequentist techniques. Topics will include prior and posterior distributions, Bayesian updating, and implementation of Markov Chain Monte Carlo and Gibbs sampling. Prerequisite: STAT 2301, STAT 3312.

STAT 4320. Time Series Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Statistical analysis of time series data in the time and frequency domains. Topics will include auto-regressive, moving average, and ARIMA models, the autocovariance and partial autocovariance functions, and spectral analysis. Prerequisite: STAT 2301, STAT 3312.

STAT 4364. Data Analysis II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Advanced statistical analysis using supervised and unsupervised machine learning and appropriate software packages such as R, Python, SAS, or SQL. Large data sets are utilized extensively. Prerequisite: MATH 3364 or STAT 3364.

STAT 4384. Internship. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
The student will complete a supervised and comprehensive work experience in a statistics-related position with a public or private business organization for career preparation in a statistics-related enterprise. The work experience must be formally approved and arranged with a cooperating sponsor prior to semester of enrollment in the course, and should be completed within the semester of course enrollment. Oral and written reports of the internship experience will be required. Prerequisite: Approval of department head.

STAT 4390. Statistics Topics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).
Topics will be selected from areas of statistics suitable for upper level study. This course may be repeated once, with department head approval, as topics change. Prerequisite: Approval of department head.