

MATHEMATICS

Each year, the list of careers demanding familiarity with basic mathematical skills grows. Animation, urban planning, geography, environmental science, architecture, business management, nursing, dentistry, forestry management, psychology and photography represent only a small sample from this list. Many careers require more sophisticated mathematical skills, such as physics, engineering, and computer science.

The Mathematics Department at Santa Barbara City College offers a broad curriculum to meet the needs of students with a wide variety of goals. The department offers the following sequences and courses to help our students achieve their career goals:

1. A standard college-level sequence in single and multivariable calculus, linear algebra, and differential equations for students who plan to transfer to four-year colleges or universities in STEM fields.
2. Transfer-level courses in statistics, mathematics for liberal arts majors, and college algebra.
3. A two-course sequence in calculus for Business, Biological Sciences and Social Science majors.
4. A complete precalculus program, including elementary algebra, intermediate algebra, college algebra and trigonometry to review old or gain new mathematical skills.

Planning a Program of Study

The required first-year Calculus, and indeed all of our math courses, are offered each semester (except possibly in summer). The Physics courses are offered sequentially, beginning each spring with PHYS 121 Mechanics Of Solids And Fluids. Care should be taken, however, that one semester of calculus is completed before attempting the Physics sequence. It is recommended that students take courses in order. A programming language course should be taken as soon as possible because of its usefulness as a computational tool.

The mathematics major at Santa Barbara City College meets the accepted normal curriculum. However, transfer students are advised to review, in depth, the current catalogs of institutions to which they plan to transfer for additional course requirement information.

Because mathematics is such a precisely structured discipline, students who have not acquired adequate skills and understanding at one course level will find it most difficult to succeed in the next higher course. For this reason, an important part of the Mathematics Program at Santa Barbara City College is appropriate placement of students into classes to increase their chances of success in mastering course content.

Placement into a math class can occur one of three ways:

1. If students are beginning their college career and have not taken college level math classes at another accredited college or university, then they need to visit the assessment center. For assessment information and hours, call the Assessment Center at (805) 730-4149 or sbcc.edu/assessmentcenter (<http://www.sbcc.edu/assessmentcenter/>).
2. If students are transferring from another college or if have already taken college-level math classes, then they need to submit evidence of previous math courses to the Transcript Evaluation Office. For course evaluation information, go to sbcc.edu/teo (<http://sbcc.edu/teo/>).

3. If students are continuing at SBCC, they should follow the appropriate sequence posted in the Schedule of Classes. There are several branches of the sequence, and **each student should consult with a math instructor or counselor** to make sure he/she has chosen the correct path for his/her educational goals.

Students are urged to take placement examinations and enroll in math classes as soon as possible, preferably taking math their first semester. It is not wise to postpone taking required math courses. Doing so might significantly delay transfer.

Preparation for Transfer

Course requirements for transfer vary depending upon the college or university a student wishes to attend. Therefore, it is **most important for a student to consult with his/her counselor and departmental adviser before planning an academic program for transfer**. Information sheets for majors, outlining transfer requirements, are available in the Counseling Center and the Transfer Center.

Programs of Study

Associate Degree for Transfer

- Mathematics, Associate in Science for Transfer (AS-T) (<https://catalog.sbcc.edu/academic-departments/mathematics/mathematics-ast/>)

Associate Degree

- Data Science, Associate of Science (AS) (<https://catalog.sbcc.edu/academic-departments/computer-science/data-science-as/>)
- Mathematics, Associate of Science (AS) (<https://catalog.sbcc.edu/academic-departments/mathematics/mathematics-aa/>)

Certificates of Achievement

- Data Science, Certificate of Achievement (C) (<https://catalog.sbcc.edu/academic-departments/computer-science/data-science-certificate-achievement/>)

Credit Courses Mathematics (MATH)

MATH 074 Pre-algebra Refresher (1 Unit)

Hours: 18 (18 lecture)

Pre-algebra refresher for students who desire higher placement; students who've completed Math 004 but need review; or those who have attempted Math 95 and need pre-algebra review. Successful completion of this course may serve as a petition to challenge Math 4. Course does not replace a failing grade in Math 4.

MATH 077 Support for Intermediate Algebra (2 Units)

Prerequisites: Placement by SBCC assessment through multiple measures.

Corequisites: MATH 107.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies and concepts for intermediate algebra. Intended for students who are concurrently enrolled in Math 107 Intermediate Algebra. Review topics include skills developed in pre-algebra and elementary algebra, operations on integers and fractions, simplifying and manipulating algebraic expressions, solving simple linear equations, applying basic geometric formulas, translation from English to algebra, and using the vocabulary/language of arithmetic and pre-algebra.

Transfer Information: Extnl - Not Degree Applicable

MATH 087 Intermediate Algebra Refresher (1 Unit)

Hours: 18 (18 lecture)

Intermediate algebra refresher for students who desire higher placement; students who have completed Math 107 but need review; or those who have attempted Math 120 and need review. Successful completion of this course may serve as a petition to challenge Math 107. Course does not replace a failing grade in Math 107.

MATH 095 Elementary Algebra (5 Units)

Prerequisites: MATH 004 or MATH 041 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 90 (90 lecture)

Beginning algebra, similar to a standard first-year high school algebra course. Includes a review of signed numbers and their properties, equations and inequalities in one variable, graphing linear equations, systems in two variables, integer exponents, rational and polynomial expressions, quadratic equations, the quadratic formula and graphing parabolas.

MATH 107 Intermediate Algebra (5 Units)

Prerequisites: MATH 095 or MATH 007C or or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 90 (90 lecture)

Second course in algebra, including algebraic manipulation of polynomials, rational expressions, exponents, radicals, linear equations, ratio and proportion, inequalities, word problems, quadratic equations, systems of linear and quadratic equations. An introduction to functions and nonlinear equations. Exponential and logarithmic functions and their applications.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

MATH 108 Mathematical Concepts for Elementary School Teachers-Number Systems (4 Units)

Prerequisites: MATH 107 or equivalent, based on SBCC's Assessment Center placement via multiple measures.

Hours: 72 (72 lecture)

Recommended for prospective and in-service elementary school teachers. Mathematical investigations and problem solving involving sets, number sense, integers, and rational and real numbers.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, CSU Transferable, UC Transferable

MATH 110C Support for Statistics and Liberal Arts Math (2 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Corequisites: MATH 117 or MATH 114 or MATH 108.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies and concepts for elementary statistics and liberal arts mathematics. Intended for students who are concurrently enrolled in Math 117 Elementary Statistics, Math 114 Mathematics for Liberal Arts Majors, or Math 108 Mathematics for Elementary Teachers at Santa Barbara City College. Review topics include skills developed in elementary algebra and intermediate algebra, translation from English to algebra, evaluation of literal expressions, solving and graphing linear equations and calculator skills.

SBCC General Education: SBCCGE Area E1

MATH 114 Mathematics for Liberal Arts Majors (4 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 72 (72 lecture)

Intended to broaden students' understanding of methods, history and applications of mathematics. Logic, mathematical proofs, numeration systems, modular arithmetic, coordinate geometry and graphing, elementary probability and statistics, linear programming and financial math.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 117 Elementary Statistics (4 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 72 (72 lecture)

General education mathematics course. Introduction to design of experiments, descriptive statistics and sampling distributions. Central Limit Theorem, statistical inference, confidence interval estimation, tests of hypotheses, correlation and linear regression, categorical variables, Chi-square, one-way ANOVA, and multiple comparisons procedure.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 117A Elementary Statistics A (2 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 36 (36 lecture)

MATH 117A is the first part of a two course sequence of a general education mathematics course in statistics. Taken together, MATH 117A and MATH 117B are collectively equivalent to MATH 117, Elementary Statistics. Topics in this course include introduction to design of experiments, descriptive statistics, types of data, introductory probability and sampling distributions. Emphasis is placed on the application of statistical concepts to real world data, development of statistical literacy and reasoning, and the interpretation of results.

SBCC General Education: SBCCGE Area E1

Transfer Information: CSU Transferable, UC Transferable

MATH 117B Elementary Statistics B (2 Units)

Prerequisites: MATH 117A.

Hours: 36 (36 lecture)

MATH 117B is the second part of a two course sequence of a general education mathematics course in statistics. Taken together, MATH 117A and MATH 117B are collectively equivalent to MATH 117, Elementary Statistics. Topics include sampling distributions, Central Limit Theorem, statistical inference, confidence interval estimation, tests of hypotheses, correlation and linear regression, Chi-square, one-way ANOVA, and multiple comparisons procedure. Emphasis is placed on the application of statistical concepts to real world data, development of statistical literacy and reasoning, and the interpretation of results.

SBCC General Education: SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 118 Data Science for All (4 Units)

Same as: CS 118

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 108 (54 lecture, 54 lab)

Introduction to data science using real-world data sets from a variety of disciplines while also presenting inherent uncertainties and issues associated with exploring data. Exposes students to foundational statistical concepts and inferential thinking by learning computation methods in a commonly used programming language such as Python. Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 130 Calculus for Biological Sciences, Social Sciences and Business I (5 Units)

Prerequisites: MATH 137 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 90 (90 lecture)

Calculus of one variable, limits, continuity, differentiation, Riemann approximations, definite and indefinite integrals; introduction to integration techniques, exponential and logarithmic functions, curve-sketching, maxima/minima problems, and related rates and applications. SBCC General Education: SBCCGE Area D2, SBCCGE Area E1 Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 130C Support for Calculus for Biological Sciences, Social Sciences and Business I (2 Units)

Prerequisites: Placement by SBCC assessment through multiple measures or.

Corequisites: MATH 130.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies and advanced algebra concepts for calculus. Intended for students who are concurrently enrolled in Math 130 Calculus for Biological Sciences, Social Sciences and Business I at Santa Barbara City College. Review topics include skills developed in college algebra, with an emphasis on refining skills in algebraic manipulation, functions and geometry.

Transfer Information: CSU Transferable

MATH 131 Calculus For Biological Sciences, Social Sciences And Business II (3 Units)

Prerequisites: MATH 130.

Course Advisories: ENG 098 or ENG 103.

Hours: 54 (54 lecture)

Techniques of integration for single and multivariable calculus, functions of several variables, partial differentiation, maxima/minima problems, differential equations, and probability. Optional topics: infinite series, Taylor's Theorem and the calculus of trigonometric functions.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 137 College Algebra (5 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 90 (90 lecture)

Extensive treatment of functions and graphing techniques, including translations, symmetries, reflections, and graphs of inverse functions. Analysis and applications of polynomial, rational, absolute value, exponential and logarithmic functions. Systems of equations and inequalities, conics, and sequences and series.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 137C Support for College Algebra (2 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Corequisites: MATH 137.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies, and concepts for college algebra. Intended for students who are concurrently enrolled in Math 137 College Algebra at Santa Barbara City College.

Review topics include skills developed in elementary algebra and intermediate algebra, with an emphasis on refining skills in algebraic manipulation and simplification of linear, quadratic, polynomial, radical, and rational expressions, functions and graphing.

SBCC General Education: SBCCGE Area E1

MATH 138 Precalculus - College Algebra and Trigonometry (4 Units)

Prerequisites: MATH 137 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 72 (72 lecture)

Advanced algebra course emphasizing analysis, graphing and applications of trigonometric functions. Such functions are developed from circular functions. Trigonometric identities and conditional equations, applications to triangles, vectors, complex numbers, parametric equations and polar coordinates are covered. Additional topics include matrix algebra, logic and structure of proof, and the Binomial Theorem.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 138C Support for Precalculus (2 Units)

Prerequisites: Placement by SBCC assessment through multiple measures or MATH 120.

Corequisites: MATH 138.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies and advanced concepts for precalculus. Intended for students who are concurrently enrolled in Math 138 Precalculus II at Santa Barbara City College. Review topics include skills developed in college algebra, with an emphasis on refining skills in algebraic manipulation, functions and geometry.

Transfer Information: CSU Transferable

MATH 149 Precalculus for STEM Majors (6 Units)

Prerequisites: MATH 107 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 108 (108 lecture)

Preparation for SBCC's STEM Calculus sequence Math 150, followed by Math 160. Topics include the study of polynomial, absolute value, radical, rational, exponential, and logarithmic functions, analytic geometry, and polar coordinates. The study of trigonometric functions, their inverses and their graphs, identities, and proofs related to trigonometric expressions, solving trigonometric equations, solving right triangles, and solving triangles using the Law of Cosines and the Law of Sines will also be covered, as well as an introduction to conics.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSU Transferable

MATH 150 Calculus with Analytic Geometry I (5 Units)

Prerequisites: MATH 138 or equivalent based on SBCC's Assessment Center placement via multiple measures.

Hours: 90 (90 lecture)

Limits, derivatives and integrals of algebraic, trigonometric, exponential and logarithmic functions. Differentials and applications of the derivative.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 150C Support Course for Calculus with Analytic Geometry I (2 Units)

Prerequisites: placement by SBCC assessment through multiple measures or MATH 138.

Corequisites: MATH 150.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies and advanced algebra concepts for calculus. Intended for students who are concurrently enrolled in Math 150 Calculus with Analytic Geometry I at Santa Barbara City College. Review topics include skills developed in college algebra and precalculus, with an emphasis on refining skills in algebraic manipulation, functions, trigonometry and geometry.

Transfer Information: CSU Transferable

MATH 160 Calculus with Analytic Geometry II (5 Units)

Prerequisites: MATH 150.

Hours: 90 (90 lecture)

Techniques of integration; applications of definite integrals; polar and parametric equations; sequences and infinite series; introduction to differential equations and to vectors.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 160C Support Course for Calculus with Analytic Geometry II (2 Units)

Corequisites: MATH 160.

Hours: 36 (36 lecture)

Concurrent A review of core prerequisite skills, competencies, advanced algebra and beginning calculus concepts for second semester calculus. Intended for students who are concurrently enrolled in Math 160 Calculus with Analytic Geometry II at Santa Barbara City College. Review topics include skills developed in college algebra, precalculus, and first-semester calculus, with an emphasis on refining skills in algebraic manipulation, functions, trigonometry, proofs, limits and differentiation.

Transfer Information: CSU Transferable

MATH 180 Transition to Advanced Mathematics (4 Units)

Prerequisites: MATH 160.

Hours: 72 (72 lecture)

Designed to introduce students to the rigors of advanced mathematics courses, with an emphasis on reading and writing proofs. Topics include set theory and logic, relations, functions, induction, countable and uncountable sets, the Heine-Borel Theorem and the Bolzano-Weierstrass Theorem. Some elementary group theory and/or topology is covered.

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 188 Trigonometry Refresher (1 Unit)

Hours: 18 (18 lecture)

This short course is intended for students who wish to review trigonometry topics before or while taking Calculus or higher courses. A computer program is used to refresh concepts identified as needed for each student, plus weekly contact with the instructor. This course is not intended to replace Math 138.

MATH 200 Multivariable Calculus (4 Units)

Prerequisites: MATH 160.

Hours: 72 (72 lecture)

Functions of several variables, multiple integrals and applications, partial differentiation and applications, calculus of vector functions, Green's Theorem, Stokes' Theorem, and Divergence Theorem.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 210 Linear Algebra (4 Units)

Prerequisites: Math 160.

Hours: 72 (72 lecture)

Finite dimensional vector spaces, linear independence, basis, systems of linear equations, linear transformations, matrices, LU factorization, change of basis, similarity of matrices, eigenvalues and eigenvectors, applications, quadratic forms, symmetric and orthogonal matrices, canonical forms, and introduction to infinite dimensional vector spaces.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable

MATH 220 Differential Equations (4 Units)

Prerequisites: Math 200 and Math 210.

Hours: 72 (72 lecture)

Theory and applications of ordinary and partial differential equations.

Topics include constant coefficient equations, series techniques, introduction to Laplace Transforms, qualitative and quantitative solutions to linear and nonlinear systems of differential equations, and separable partial differential equations.

SBCC General Education: SBCCGE Area D2, SBCCGE Area E1

Transfer Information: CSUGE Area B4, IGETC Area 2A, CSU Transferable, UC Transferable