

ST. JOHNSBURY ACADEMY | Course Bulletin

All courses at St. Johnsbury Academy are semester-long courses with credit being awarded at the end of each semester. Prerequisites are listed for all courses with such requirements.

MATHEMATICS

The sequence of courses will permit students to have the following experiences in math:

- View math as a blend of patterns instead of a set of isolated topics.
- Make connections; construct models and theories that order their understanding of their environment.
- Relate mathematical ideas to everyday experiences and real-world situations.
- Discover how to adjust procedures to solve new problems.
- Spend more time on each topic, enabling invention and practice.
- Create “real” connections and study those connections from concrete to abstraction.
- Develop communication, reasoning, and problem solving skills.

The mathematics program is divided into two sequences of course offerings designed to provide opportunities for all students to learn meaningful mathematics. At several points during their academic career, student placements are reviewed to ensure that they are working at a level consistent with their goals and abilities.

Permission to take an accelerated level course is normally predicated on maintaining a grade of at least 80 in the previous accelerated level course or at least 90 in the previous standard level course.

All courses use graphing calculators and/or computers to enhance the learning of mathematics.

All students are expected to write about their mathematical processes.

Standard

Upon leaving the Academy, standard level students are apt to pursue four-year college programs, two-year technical programs, on-the-job training, or armed forces experience. During this four-year curriculum, these students acquire sound preparation to follow any of these paths. Themes that are emphasized throughout include: problem solving, applications of the ideas presented, use of the graphing calculator, writing process, and collaboration.

Algebraic Foundations I (Standard)

1 CREDIT (3210)

This course is the first part of a two part standard level Algebra I course. The topics of the course will include the real number line and operations of those numbers. Exponents, powers, and order of operations will be explored through problem solving. Equations will be identified in the world around, including the workplace, and will be modeled through application. Students are taught the correct and appropriate use of a graphing calculator.

Algebraic Foundations II (Standard)

1 CREDIT (3212)

Prerequisite: Algebraic Foundations I

This course completes the two part standard level Algebra I course. The topics of the course include further investigation of equations and their application in the real world. Equations will be developed using technology. After investigating operations of exponents using manipulatives, the students will learn to apply the concept to scientific notation. Applications of systems of equations will be studied using both algebra and analytic geometry. Data analysis and linear regression will be explored using the graphing calculator. This course will also include the language of BASIC using the programming functions of the graphing calculator.

Integrated Math (Standard)

1 CREDIT (3251)

Prerequisites: Algebraic Foundations I and II (Standard) or Algebra I (Standard)

This course provides a bridge to Algebra II. It includes an intensive review of Algebra I skills and concepts. The geometry concepts of congruence, symmetry, translations, and reflections are explored. Modeling of area and volume is investigated through two and three dimensional objects. Topics of statistics and probability are examined using graphing calculator technology. Applications of ratios and proportions prepare students for the transition to Algebra II.

Algebra I (Standard)

1 CREDIT (3213)

Prerequisites: Satisfactory Placement Test, recommendation on prior achievement, with department recommendation

This course consists of the rules of algebra with an emphasis on linear functions. Students will learn to evaluate and simplify algebraic expressions and linear equations. In addition, students in this course will evaluate, analyze, and graph functions and relations. Applications of systems of equations will be studied using both algebra and analytic geometry. Data analysis and linear regression will be explored using the graphing calculator. This course will also include the language of BASIC using the programming functions of the graphing calculator.

Algebra II (Standard)

1 CREDIT (3233)

Prerequisites: Algebraic Foundations I and II (Standard) grade ≥ 80 or Algebra I (Standard) Grade ≥ 75 with department recommendation

This course consists of the rules of algebra with an emphasis on linear and quadratic functions. Students will continue to learn to evaluate and simplify algebraic expressions and solve equations and inequalities. In this course students will extend their knowledge of problem solving and mathematical modeling.

Geometry (Standard)

1 CREDIT (3253)

Prerequisites: Completion of Algebra II (Standard) with department recommendation

This course consists of the principles of Euclidean geometry supplemented by logic. Areas of study will include: basic geometric figures and relationships among them, properties of polygons with emphasis on triangles and quadrilaterals, properties of circles and related concepts, congruence and similarity, applications of measure, area, and volume, principles of proof and logic, symmetry, and transformations.

Trigonometry (Standard)

1 CREDIT (3273)

Prerequisites: Completion of Geometry (Standard) with department recommendation

Two primary goals of this course are to strengthen algebra skills in preparation for college-level math courses and to help students develop a better understanding of how algebra can be used to model real life problems. The student will learn right triangle trigonometry and have an introduction to trigonometric functions.

Precalculus (Standard)

1 CREDIT (3283)

Prerequisites: Successful completion of Trigonometry (Standard) with department recommendation

In this course students will explore broad applications of mathematical ideas as they pertain to the field of business, the social sciences, computer science, and number theory. The goal of this course is to prepare students to interpret data, to construct algorithms, and to build mathematical models to analyze and solve problems. Topics include probability, data analysis, sequences and series, and logic.

Applied Statistics (Standard)

1 CREDIT (3287)

Prerequisite: Satisfactory completion of Trigonometry; with department recommendation

This course will give students an opportunity to design and conduct surveys and experiments using statistical methods. Results of sampling and data collection will be displayed using statistical representations. Journal articles and published research will be analyzed and interpreted from a statistical perspective. The basic rules of simple probability, the fundamental counting theorem, conditional probability, and probability distributions will also be explored.

Accelerated

The students who enroll in accelerated math courses are likely to pursue competitive four-year college programs. These are highly motivated students with strong mathematical abilities. Themes emphasized through this sequence include problem solving, applications of the ideas presented, theory, and an appreciation of mathematics as a language. Graphing calculators are used to facilitate the teaching of these courses. One goal of the courses in this sequence is to prepare students for AP mathematics courses and beyond. Courses in this sequence differ from the equivalent Standard level course by the pace, the amount of required homework, and the level of abstraction and formal proof.

Algebra I (Accelerated)

1 CREDIT (3215)

Prerequisites: Above average Placement Test and recommendation based on prior achievement; with department recommendation

This course explores the rules of algebra with an emphasis on functions. Areas of study will include: manipulating number and operation concepts for rational and irrational numbers, evaluating and simplifying complex algebraic expressions, solving systems of equations both graphically and algebraically, using function and interval notations and factoring polynomials. Advanced topics include piecewise defined functions, complex algebraic fractions and function composition. Data analysis and regression will be explored using the graphing calculator. This course will also include the language of BASIC using the programming functions of the graphing calculator.

Algebra II (Accelerated)

1 CREDIT (3235)

Prerequisites: Algebra I (Accelerated); with department recommendation. Freshmen may start their math sequence with this course if a satisfactory score has been earned on the department placement test.

This course consists of the rules of algebra with an emphasis on linear and quadratic functions. Areas of study will include understanding and using number and operation concepts with emphasis on the number system. The students will be introduced to styles of proving, evaluating, and simplifying algebraic expressions. There will be emphasis on solving complex or unfamiliar problems using appropriate analysis techniques and reasonable estimation. The students will learn to generalize results from specific applications. Advanced topics of solving rational expressions, transformations, and exponential growth and decay are also included.

Geometry (Accelerated)

1 CREDIT (3255)

Prerequisites: Completion of Algebra II (Accelerated); with department recommendation

This course consists of the principles of Euclidean geometry. Areas of study will include: basic geometric figures and relationships among them, properties of polygons with emphasis on triangles and quadrilaterals, properties of circles and related concepts, congruence and similarity, applications of measure, area, and volume, principles of proof and logic, symmetry, and transformations. Algebra I and II concepts as well as higher degree polynomials will be modeled through geometry. Trigonometric ratios, algebraic treatments of trigonometric problems, special right triangles, Law of Sines, and Law of Cosines are also included.

Trigonometry (Accelerated)

1 CREDIT (3275)

Prerequisites: Algebra II (Accelerated) and Geometry (Accelerated); with department recommendation

This course allows the student to study many different areas within trigonometry. Topics will include angles and rotations, the unit circle and right triangle trigonometry, trigonometric functions, and circular functions and their graphs; trigonometric identities; and proofs of identities. Concepts will be applied in a variety of areas such as civil engineering and science. Students will make extensive use of graphing calculators. Arc length and polar coordinates are also included.

Precalculus (Accelerated)

1 CREDIT (3285)

Prerequisites: Completion of Trigonometry (Accelerated); with department recommendation

This course develops the analytic skills necessary to describe the behavior of mathematical functions. Topics include: algebraic expressions, u-substitution, higher degree polynomials, rational, logarithmic, and exponential functions, function composition, inverses of functions, transformations of functions, and polynomial and synthetic division. A review of trigonometric functions and the unit circle is also included.

Applied Calculus (Accelerated)

1 CREDIT (3286)

Prerequisites: Trigonometry and Precalculus (Accelerated or Standard); with department recommendation

This course will serve as an introduction or survey of the fundamentals of differential and integral calculus. Students will be encouraged to study these concepts in practical tangible applications through hands on projects, classic lectures, and direct research. While each student will learn the fundamentals of differentiation and integration, this course is not intended to be an alternate to the AP Calculus course.

Advanced Placement

AP Calculus AB

1 CREDIT (3298)

Prerequisites: Pre-Calculus (Accelerated) grade \geq 85; with department recommendation; AP Calculus AB Prep is required for students who will not continue to AP Calculus BC

This course is equivalent to the first semester of college calculus. The topics include limits, derivatives, integrals and the Fundamental Theorem of Calculus. Emphasis will be placed on conceptual understanding: reasoning with definitions and theorems, connecting concepts, implementing algebraic/computational processes, connecting multiple representations, building notational fluency, and communicating. This course follows the AP curriculum and leads directly to the Advanced Placement exam.

AP Calculus AB Prep

$\frac{1}{2}$ CREDIT (3297)

Prerequisites: AP Calculus AB; with department recommendation

This course is a continuation of AP Calculus AB and will strengthen skills and knowledge in preparation for the Advanced Placement Calculus AB exam in the spring. AP Calculus Prep meets every other day during second semester.

AP Calculus BC

1 CREDIT (3299)

Prerequisites: Calculus AB grade $>$ 85; with department recommendation

This course is a continuation of Calculus AB and is equivalent to second semester college calculus. In addition to further study of techniques of differentiation and integration, topics include sequences and series, vector and polar functions, and some basic differential equations. This course follows the AP curriculum and leads directly to the Advanced Placement exam.

AP Statistics

$1\frac{1}{2}$ CREDIT (3289/3290)

Prerequisites: Completion of Trigonometry; with department recommendation

This two-semester course leads directly to the taking of the Advanced Placement examination in Statistics in the spring. The topics discussed in this course include frequency, distributions and graphs, measures of central tendency, measures of variability, confidence intervals, and hypothesis tests. In the first semester, the course meets daily; in the second semester the course meets every other day.

Post Calculus

Multivariable Calculus

1 CREDIT (3300)

Prerequisites: Calculus BC; with department recommendation

This upper level calculus course is intended for students with a strong interest in mathematics and a solid foundation in single variable calculus. The topics of this course will include partial derivatives, gradients, constrained optimization using Lagrange multipliers, double and triple integrals with applications, as well as cylindrical and spherical coordinates, and using Jacobian matrices to change coordinate systems. Vector calculus will also be studied including line and surface integrals, divergence and curl, and the theorems of Green and Stokes. The use of computer algebra systems will be an essential part of the course.

Linear Algebra

1 CREDIT (3301)

Prerequisites: Multivariable Calculus; with department recommendation

This course builds on the concepts of three dimensional space developed in Multivariable Calculus and extends discussions of mathematical spaces to include arbitrary dimensions. Topics covered in the course will include systems of linear equations and how to solve them, the method of Gaussian elimination, matrices and linear mappings, determinants and their properties, eigenvectors and eigenvalues, and the diagonalization of matrices. The course will incorporate computer algebra systems and will seek to strike a balance between linear algebra's abstract structures and justifications and the rich collection of applications to science and engineering problems that the subject affords.

Computer Technologies

Introduction to Computer Science with Python (Standard)

1 CREDIT (3698)

Prerequisite: Satisfactory completion of Algebra II; with department recommendation.

This course is designed for students who have little to no experience in programming computers. Students will learn the basics of algorithmic thinking, and design programs to solve simple problems. A number of different programming environments will be used from highly structured programming environments such as Alice or Scratch then evolving to familiarity with at least one high level programming language such as Python. Students will learn the basics of variables, loops, conditional statements and standard data structures such as arrays and dictionaries. Students will gain familiarity with how computers work and their architecture. The students will use their computers to create and manipulate data sets and to automate tasks.

Programming JAVA (Accelerated)

1 CREDIT (3697)

Prerequisites: Geometry (Accelerated or Standard); with department recommendation

This course is a study of the structures and methods of higher level computer programming languages. Problem solving using modular design will be an integral part of the course. Students will become familiar with conditional logic, repetition, and program input and output. Commonly used algorithms will be studied including sorting and searching routines. Structured data types will include 2- and 3-dimensional arrays. Object-oriented programming will be introduced.

AP Computer Science Principles

1 CREDIT (3700)

Prerequisites: Introduction to Computer Science or AP Computer Science A; with department recommendation

This course builds on the skills and understanding from the Introduction to Computer Science course. Students follow the AP curriculum to explore the themes of creativity, abstraction, data and information, algorithms, programming, the Internet, and global impact through problem solving and real-world applications. The AP Computer Science Principles Assessment consists of two parts: a through-course assessment and the end-of-course AP Exam.

AP Computer Science A

1 CREDIT (3699)

Prerequisites: Intro to Programming in JAVA (Accelerated) grade ≥ 85 ; with department recommendation; AP Computer Science Principles

This course reinforces concepts in JAVA Programming and leads directly to the Advanced Placement Computer Science A examination. Students follow the AP curriculum to become familiar with application and applet design, classes and hierarchy, and complex algorithms. Additional topics include software history as well as current trends in software development. This course is appropriate for students with a strong interest in mathematics and engineering.

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