

# AOS Course Descriptions



## AOS Mathematics Courses

### **AOS Mathematical Analysis and Computational Modeling I, *weighted 0.5* 563001**

Grade 9

Credit: 1

SOL Test. This course provides the foundation for investigation of mathematical systems and their interrelationships from a transformational approach. Elementary and transcendental functions, parametric equations, polar coordinates, matrices, and linear algebra are studied in context-rich, data-driven application problems. A scientific, inquiry-based methodology is utilized to clearly connect mathematical concepts to topics in the integrated physical sciences course. An introduction to statistics through normal distributions and elementary probability theory with an emphasis on applications to scientific research provides a foundation for further study in the second course. Mathematical and computational modeling using various technologies is a major feature of the course. The course places heavy emphasis on mathematical communication, reasoning, authentic problem solving, critical thinking, and multiple representations of mathematical concepts.

### **Mathematical Analysis and Computational Modeling II with Statistics, *weighted 0.5* 563002**

Grade 10

Credit: 1

This course provides a continuation and expansion of the study of elementary, transcendental, and logistic functions, as well as parametric, polar, matrix, and linear algebra systems. Infinite sequences and series, limits, continuity, and rates of change as an introduction to the derivative are major topics introduced in this second course. Emphasis on mathematical modeling to study rates of change introduces the concept of a derivative. Differential calculus concepts are thoroughly explored, and integration is introduced to prepare students for the AP Calculus BC course the following year. The inquiry-based methodology and transformation approach utilized in the previous course are continued as unifying themes in this second course. Inferential statistics topics, including both parametric and non-parametric tests, are major components of the course and are introduced in project-based activities that complement the integrated science course and provide a foundation for independent science research in the 11th and 12th grade. Mathematical and computational modeling using various technologies is an integral part of the course. Heavy emphasis is placed on mathematical communication, reasoning, authentic problem solving, critical thinking, and multiple representations of mathematical concepts.

### **AOS AP Calculus AB, *weighted 1.0***

**561100**

Grades 11-12

Credit: 1

This course covers all the topics in the College Board's description of an AB level AP Calculus course. In addition, the students experience use of one or more differential equations to create models for a variety of dynamic processes of the types studied in the physical and biological sciences. After the AP exam in May, the students are introduced to classical methods of statistical inference. Students have the opportunity to take the AP AB Calculus Exam in May with the possibility of earning college credit.

### **AOS AP Calculus BC, *weighted 1.0***

**571100**

Grades 11-12

Credit: 1

This course covers all of the topics in the College Board's description of a BC level AP Calculus course. In addition, the students experience use of one or more differential equations to create models for a variety of dynamic processes of the types studied in the physical and biological sciences. After the AP exam in May, the students are introduced to classical methods of statistical inference. Students have the opportunity to take the AP BC Calculus Exam in May with the possibility of earning college credit.

### **AOS Multivariable Calculus DE, *weighted 1.0***

Grade 12

**583007**

Credit: 1

This is a course in vector calculus. There is a special emphasis on using vector fields to model motion of particles and fluids in two and three dimensions. The software tool *Mathematica* is used throughout the course to create interactive graphics to enhance the meaning of calculations. In this context students discover methods for computing or approximating double and triple integrals. The work includes the use of the theorems of Gauss, Green, and Stokes to measure flow and turbulence.

Upon successful completion of this full-year course, students will receive college credits. The transferability of a college course to another college or university for credit is determined by the receiving institution.

Normally, academic courses intended for transfer with a grade of "C" or above will transfer to four-year institutions of higher education. However, no guarantee can be made to students regarding transferability to all colleges or universities. This information may be found on most college and university websites or by contacting the admissions office.

**AOS Multivariable Calculus with Topics from Differential Equations, weighted 1.0** **583301**

Grade 12

Credit: 1

This course includes all the topics in the AOS Multivariable Mathematics. In addition, the students write differential equations for a variety of oscillating motions including those with damping and exterior forcing. As they explore techniques for getting exact or appropriate solutions of these equations they will work with several techniques included in a first college level course in differential equations.

## AOS Science Courses

**AOS Integrated Science I, weighted 0.5**

**664900**

Grade 9

Credit: 1

**SOL TEST** This course is the first in a series of integrated science courses (two-year sequence of courses) designed for AOS students. Students study the physical sciences, physics, chemistry, and earth science as an integrated progression of science topics and learn content typically taught in these courses. The course is inquiry-based with much of the content learned through laboratory exercises, many of which are student-designed. Students take the Earth Science and Chemistry SOL tests during the AOS Integrated Science course progression. AOS Integrated Science I, II, and III prepare students for the advanced study of physical sciences in the junior and senior years. This course is required for all AOS 9<sup>th</sup> graders.

**AOS Integrated Science II, weighted 0.5**

**645900**

Grade 9

Credit: 1

Co-requisite: AOS Integrated Science I

**SOL TEST** This course is the second in a series of integrated science courses (two-year sequence of courses) designed for AOS students. Students study the physical sciences, physics, chemistry, and earth science as an integrated progression of science topics and learn content typically taught in these courses. The course is inquiry-based with much of the content learned through laboratory exercises, many of which are student-designed. Students take the Earth Science and Chemistry SOL tests during the AOS Integrated Science course progression. AOS Integrated Science I, II, and III prepare students for the advanced study of physical sciences in the junior and senior years. This course is required for all AOS 9<sup>th</sup> graders.

**AOS Integrated Science III, weighted 0.5**

**654900**

Grade 10

Credit: 1

Prerequisite: AOS Integrated Science I and II

**SOL TEST** This course is the third in a series of integrated science courses (two-year sequence of courses) designed for AOS students. Students study the physical sciences, physics, chemistry, and earth science as an integrated progression of science topics and learn content typically taught in these courses. The course is inquiry-based with much of the content learned through laboratory exercises, many of which are student-designed. Students take the Earth Science and Chemistry SOL tests during the AOS Integrated Science course progression. AOS Integrated Science I, II, and III prepare students for the advanced study of physical sciences in the junior and senior years. This course is required for all AOS 10<sup>th</sup> graders.

**AOS Biology, weighted 0.5**

**652900**

Grade 11

Credit: 1

The AOS Biology course is the next progression for students who have completed the first two years in the integrated, inquiry-based science program. AOS Biology is a rigorous course preparing students for college level work. The approach of this course is a project/problem-based program where a scientific dilemma is posed to students; the students identify what they need to know in order to answer the question; the teacher leads them through the content they need in order to answer the question; and lab activities are relevant to the topic covered. Biology is a required class for AOS students in Grade 11.

**AOS Sophomore Science Research, weighted 0.5**  
Grade 10

**651900**  
Credit: 1

Prerequisite: AOS Integrated Science I and II

In this course students conduct a series of interdisciplinary science research activities designed to involve students in the application and use of inquiry-based methodology and to learn the use of techniques, equipment, and protocols typically used in scientific research laboratories. This course also enhances the ability of students to read and write scientific papers at the publication level. During the second semester, students begin work on a science research project of their own design that can be continued throughout their years as an AOS student. Sophomore Science Research is offered in conjunction with AOS Integrated Science III. This course is required for all AOS 10<sup>th</sup> graders.

**AOS Junior Science Research, weighted 0.5**  
Grade 11

**661900**  
Credit: 1

Prerequisite: AOS Sophomore Science Research

Students continue to conduct interdisciplinary science research activities using inquiry-based methodology and increase their skill level with laboratory techniques and protocols in this course. This course also enhances the ability of students to read and write scientific papers at the publication level. Based on their interests, students begin to develop a research plan for an independent science research project that they complete in the Senior Science Research course. With a faculty mentor, they conduct a literature search, develop laboratory protocols, develop a materials list, create a budget, and work as a bench scientist. Regular presentation of results is an expectation for all research students. While it is intended that most of the bench-work can be conducted at AOS, some students interact with local scientists who act as mentors during both the school year and summer.

**AOS Senior Science Research, weighted 0.5**  
Grade 12

**671900**  
Credit: 1

Prerequisite: AOS Junior Science Research

In this course students continue to conduct interdisciplinary science research activities using inquiry-based methodology and increase their skill level with laboratory techniques and protocols. This course also enhances the ability of students to read and write scientific papers at the publication level. Students in senior research continue their work on the plan created during the junior research course. They conduct their bench-work with the guidance of a faculty mentor. Regular presentation of results is an expectation for all research students. While it is intended that most of the bench-work can be carried out at AOS, some students interact with local scientists who act as mentors during both the school year and summer.

**AOS AP Biology, weighted 1.0**  
Grade 12

**664100**

Credit: 1

This advanced course is a college-level, fast-paced course that follows the course outline of the College Board's AP Biology program. The course emphasizes cellular biology, biochemical processes of cellular respiration and photosynthesis, vertebrate anatomy and physiology, advanced genetics, evolution, plant anatomy and physiology, and ecology.

Students have the opportunity to take the AP Biology Exam in May with the possibility of earning college credit.

**AOS AP Environmental Science, weighted 1.0**      **674100**  
Grade 12

Credit: 1

This advanced course is a college-level, fast-paced course in Environmental Science that follows the course outline of the College Board's AP Environmental Science program. The course includes field work and many extended lab procedures. The course emphasizes population biology; ecosystems; geologic and earth science

concepts; atmospheric science; land and water use topics including energy and energy use, consumption, and conservation, and pollution; and global change.

Students have the opportunity to take the AP Environmental Science Exam in May with the possibility of earning college credit.

**AOS AP Chemistry, weighted 1.0**

**669100**

Grade 12

Credit: 1

This advanced course is a college-level, fast-paced course in Chemistry that follows the course outline of the College Board's AP Chemistry program. The course includes many extended lab procedures. In addition, such fields as organic chemistry, biochemistry, nuclear chemistry, coordination complexes, and semi-micro qualitative analysis are introduced.

Students have the opportunity to take the AP Chemistry Exam in May with the possibility of earning college credit.

**AOS AP Physics, weighted 1.0**

**662100**

Grade 12

Credit: 1

This course is a college-level, fast-paced course in that follows the course outline of the College Board's AP Physics program. Emphasis is placed on mechanics, and the student has the option to study additional topics. Pre-calculus and calculus skills are used to develop concepts and solve problems.

Students have the opportunity to take the AP Physics Exam in May with the possibility of earning college credit.