Advanced Topics in Mathematics II

Open to Any Grade Level Student (after successful completion of or is currently enrolled in Calculus AB or BC) (10 Credits)

- *Meets high school graduation requirement for Math Credits*
- *Optional College Credits through San Diego State University*

General Information

Description

In **Advanced Topics in Mathematics II**, students will learn concepts such as:

- Differential equations, dynamical systems, complex analysis, and discrete math topics.
- Real-world applications of math in science, business, social sciences, and the arts.
- Selecting and using technology for doing and presenting mathematical work.
- Review and study in more depth mathematics concepts covered in prior courses.
- Additional topics and research in modern mathematics.

Expectations and Goals

Students take this course after successful completion of or currently enrolled in Calculus AB or BC

- Successful completion of Calculus AB or BC means a "C" or better in the course and a score of at least 3 or higher on the Advanced Placement Calculus AB or BC Exam.
- Students should not take this course instead of Calculus
- Students may take this course without taking Advanced Topics in Mathematics I

Student Background

Students entering **Advanced Topics in Mathematics II** should *already* have a good understanding of the following concepts:

- Functions (including composite functions, inverse functions, domain, range, etc.)
- Graphing all types of functions in two dimensions. Basic graphing in three dimensions.
- Trigonometry (functions, inverse functions, identities, graphing, unit circle values, etc.)
- Parametric Equations (graphing, converting to and from familiar algebraic forms)
- Basic Calculus (at least an introduction to limits, derivatives, and integrals)
- Vectors (notation, arithmetic, graphing, applications)

Students entering **Advanced Topics in Math II** should also be able to solve problems such as

Example Function Problem: What is the domain of $f(x(t), y(t))$ given $f(x,y) = \dfrac{x^2}{y}, x(t) = \ln t, \text{ and } y(t) = \tan x$	Calculus Problem: Find the derivative of $f(x) = (x-1)^2(x+2)^2$ and use your result to find the equation of the line tangent to $f(x)$ at $x = -1$. Graph the curve and line together.
Graphing Problem: Sketch the graph for each set of parametric equations. Indicate the orientation and state an appropriate domain. $\begin{aligned} x(t) &= 3t-4 \\ y(t) &= -2t+5 \end{aligned} \qquad \begin{aligned} x(t) &= 3\cos t \\ y(t) &= 4\sin t \end{aligned}$	Vector Problem: Draw a sketch of an object being pulled by the forces $\mathbf{F}_1 = <1, 5>$ and $\mathbf{F}_2 = <-4, 1>$. Draw the single vector that represents the total force acting on the object? What is the magnitude of this force?

Students entering **Advanced Topics in Mathematics II** are expected to do the following things:

- Keep up with assignments without a daily check from the teacher.
- Work independently and with classmates to solve problems and understand concepts.
- Read mathematical arguments, proofs, and examples.
- Prepare projects inside and outside of class and give presentations in front of peers.
- Solve complex and open-ended problems.
- Develop proofs and write out mathematical arguments for solving problems.
- Connect mathematics to other disciplines (such as physics, economics, or music).
- Think creatively from the perspective of a student and a teacher.
- Participate in community service through project design, testing, and implementation.

Estimated Homework

Students will be expected to spend an average of approximately 1 to 2 hours outside of class on homework, reading, and preparation for each class period. Students will complete approximately six to eight projects each semester. (This is a general guideline for planning and scheduling purposes. A student's individual ability level and competency may affect the actual preparation times needed.)

This Class Is Best For...

Advanced Topics in Mathematics II is a projects- based math course where students explore new areas of mathematics as well as reviewing concepts studied in previous courses. Students will also design, research, create and present interdisciplinary projects using mathematics as it is applied to other fields. Community service will be a significant portion of the course wince students will develop projects and activities to be used by other students and teachers in lower-level math classes. Students in Advanced Topics in Mathematics II will learn material specific to their own interests and will be exposed to the concepts their classmates are studying through ongoing class presentations. This course provides students the opportunity to experience mathematics from the perspective of a student, teacher, researcher, scientist and artist

Course Materials

Required Materials

Students will use a variety of materials including books, journals, computer programs, professional connections, and Internet resources.

Internet resources

- AbbyMath.com