AP Calculus AB

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Introduction and Purpose

Welcome to Advanced Placement Calculus AB at Valley Park High School. You are one of a select group of students who has chosen to challenge yourself academically by enrolling in an advanced mathematics course with the opportunity to earn a semester of college credit. It is our hope that you will find the rigor challenging, your knowledge level heightened, and your capacity to learn expanded as a result.

This course will generally cover the AB Calculus curriculum as stated by The College Board (see below). There are two AP Calculus exams: AB and BC. Calculus AB will cover one semester of college calculus. On the morning of Wednesday, **MAY 5, 2009**, you will have the opportunity to show what you know on the AP exam. Depending on your score and the college or university you choose, you may earn college credit. THIS IS A COLLEGE COURSE. You SHOULD strongly consider taking the AP exam in order to gain credit for the work and learning that will be done this year.

Topic Outline for Calculus AB

I. Functions, Graphs, and Limits
Analysis of graphs
Limits of functions (including one-sided limits)
Asymptotic and unbounded behavior
Continuity as a property of functions
(Chapters 1, 2)

II. Derivatives
Concept of the derivative
Derivative at a point
Derivative of a function
Second derivatives
Applications of derivatives
Computation of derivatives
(Chapters 3, 4)

III. Integrals
Interpretations and properties of definite integrals
Applications of integrals
Fundamental Theorem of Calculus
Techniques of antidifferentiation
Applications of antidifferentiation
Numerical approximations to definite integrals
(Chapters 5, 6, 7)

Students will be able to:

- work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. They will understand the connections among these representations.
- understand the meaning of the derivative in terms of a rate of change and local linear approximation and they will be able to use derivatives to solve a variety of problems.
- understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and will be able to use integrals to solve a variety of problems.
- understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
- communicate mathematics both orally and in well-written sentences and will be able to explain solutions to problems.
- model a written description of a physical situation with a function, a differential equation, or an integral.
- use technology to help solve problems, experiment, interpret results, and verify conclusions.
- determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.
- develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.

Pace, Workload, and Types of Activities

We will cover Chapters 1-7 well before the AP exam. We do this by moving swiftly along and completing a speedy review of Chapter 1. The fast pace is essential in order to learn all the material. It is important that you keep up with your assignments! I often do not collect homework from the textbook in this course. I may sometimes check or collect it, or I may give a homework quiz. You are expected to complete the work regardless, and your success is highly dependent on that work.

We will also do supplementary work in addition to textbook problems, including many AP-style questions. I will collect and grade those much more frequently. In class, students will spend much of the block working collaboratively in groups to make sense of new ideas and to solve problems. Groups will frequently present their ideas to the class. Both during and outside of class, we will work with graphing calculators extensively to solve problems and to experiment and make conjectures.

One emphasis of this course is learning to communicate your mathematical ideas in writing. On the AP test, you will need to write mathematical justifications. To prepare for this work, we will practice justifications, grade our work using AP scoring guides, discuss how to write mathematics clearly, and complete activities reflecting on your progress and how you can improve your mathematical writing.

Your workload won't be much worse than what you had as a Trigonometry student, yet the concepts will be new, and it may prove more difficult.

Grading

I will assign grades based on the Valley Park grading scale (see below).

94-100%	A	73-76%	C
90-93%	A-	70-72%	C-
87-89%	B+	67-69%	D+
83-86%	B	63-66%	D
80-82%	B-	60-62%	D-
77-79%	C+	Below 60%	F

This class will utilize weighted grades. The grade distribution will be as follows:

Final Exam	20%
Homework	10%
Daily Quizzes	10%
Quizzes	20%
Tests/Projects	40%

There will be four exams and three or more quizzes first semester and three exams and three or more quizzes second semester. There will not be chapter tests as you may be used to; instead, we will have exams just before each mid-quarter and near the end of each quarter (benchmarks). In addition to these assessments, daily quizzes, worksheets, homework quizzes, occasional projects, and other assignments will contribute to your grade.

The purpose of school, and this course, is STUDENT LEARNING. Learning, not the attainment of letter grades, is our aim.

This statement does not mean that I, as your teacher, do not believe in grades. However, grade motivation is a dangerous kind, and I will not let that get in the way of your learning – whether that is your learning of calculus, or your learning of other important lessons. Bottom line: strive to LEARN and your grades will take care of themselves.

Assistance

I am available most mornings (starting at 7:30 a.m.) and afternoons.

In addition, it is possible to get some help online. There are many great math sites out there; I have links to some from my webpage. You may invest in private tutoring, but I don't anticipate most of you will need such assistance as we will become somewhat a family and will be able to support from within. I highly recommend exhausting resources at school before paying for a tutor.

Advanced Placement

Advanced Placement courses offer college credit at an affordable level while maintaining high standards. Over 90% of U.S. colleges accept AP credit. This year will help prepare you for the rigor of college, and the statistics show that students who take AP courses consistently outperform those students that did not take AP. You can feel confident that AP courses stand out on a college application.

Supplies

Each of you should have been issued our textbook:
Finney, Ross L., Franklin D. Demana, Bert K. Waits, and Daniel Kennedy. Calculus: Graphical, Numerical, Algebraic Needham, Massachusetts: Pearson Prentice Hall, 2003.

In addition, I HIGHLY recommended that each student have a graphing calculator. We will be using the TI-83 Plus in class. Any calculator in the TI-83/84 family will be fine, and many others are allowed on the AP exam. If you do not own a graphing calculator, you may check one out for the year from me.

Academic Honesty

I do not anticipate any problems with academic integrity, however, if it becomes compromised, it WILL NOT BE TOLERATED. Consequences for academic dishonesty are your parent being notified and an office referral. Other consequences may be enforced.

Exam Dates

Below are the dates for exams in each quarter. I will let you know what each exam will cover in advance so that you know how much to study; they will NOT necessarily land at the ends of chapters. If these dates need to be changed for an important reason (e.g., snow days or other unforeseen events), I will let you know as soon as possible.

1st Semester
- Exam 1: Sept. 17 (No advisory on the 16th)
- Exam 2: Oct. 16
- Exam 3: Nov. 19
- Exam 4: Dec. 22 (Final Exam)

2nd Semester
- Exam 1: Feb. 9
- Exam 2: March 4
- Exam 3: April 15*

* We will have one exam in April (before our final exam and the AP exam). This date could change, depending on when we finish material.

Advanced Placement Calculus AB Schedule

Chapter (entire chapter covered unless otherwise noted)	Topics	Approximate Time (number of 70-minute blocks)
1 (cover sections 1.1-1.5)	Lines Functions and Graphs Exponential Functions Parametric Equations Functions and Logarithms	5 days
2	Rates of Change and Limits Limits Involving Infinity Continuity Rates of Change and Tangent Lines	7 days
3	Derivative of a Function Differentiability Rules for Differentiation Velocity and Other Rates of Change Derivatives of Trigonometric Functions Chain Rule Implicit Differentiation Derivatives of Inverse Trigonometric Functions Derivatives of Exponential and Logarithmic Functions	13 days
4	Extreme Values of Functions Mean Value Theorem Connecting f' and f'' with the graph of f Modeling and Optimization Linearization and Newton's Method Related Rates	11 days
5	Estimating with Finite Sums Definite Integrals Definite Integrals and Antiderivatives Fundamental Theorem of Calculus Trapezoidal Rule	9.5 days
6 (cover sections 6.1-6.5)	Antiderivatives and Slope Fields Integration by Substitution Integration by Parts Exponential Growth and Decay Population Growth	11 days
7	Integral as Net Change Areas in the Plane Volumes Lengths of Curves Applications from Science and Statistics	11 days
8.1 only	L'Hopital's Rule	1 day

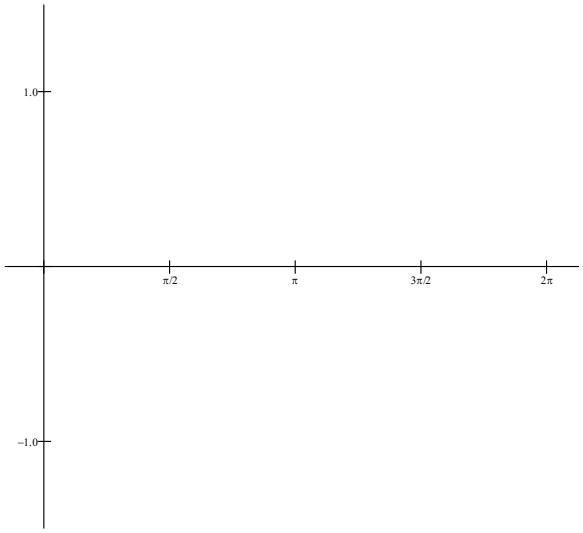
Sample In-Class Activity

Below is a sample in-class exploration. It illustrates students' working with functions graphically, numerically, analytically, and verbally (students work collaboratively in groups on the activity and then share findings in whole-class discussions). We also frequently use explorations from Paul Foerster's Calculus Explorations (Emeryville, CA: Key Curriculum Press, 1998) for in-class investigations and as homework. Our class textbook also provides "Concepts Worksheets" designed to help prepare for AP testing, and we do many of those too.

Worksheet 3.5A: Derivative of Trig Functions

1. Let $f(x) = \sin x$

   a. Carefully graph *f* on the interval $[0, 2\pi]$. Use the axes below.



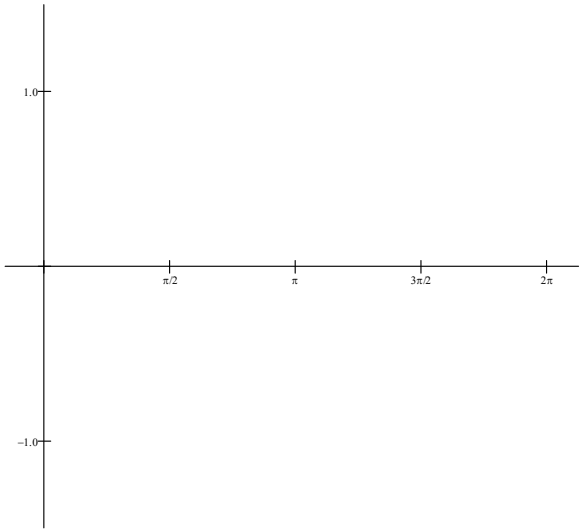
   b. Estimate $f'(\pi)$ numerically with average rates of change over a small intervals. (Do NOT use nDeriv in calculator) Show your work.

Set your calculator aside. Do not use it for the next few parts (until you are told to use it again).

c. Examine your graph of *f* above to find the x-values in the interval $[0, 2\pi]$ with $f'(x) = 0$. How can you tell by looking at the graph of *f* ?

d. Sketch a graph of f' using your answers to parts (b) and (c) as starting points. Estimate other derivatives by visual inspection. Use the table included below to keep track of your estimates.

x	$f'(x)$
0	
$\frac{\pi}{2}$	
π	
$\frac{3\pi}{2}$	
2π	



e. Look at your graph of $f'(x)$ and make a conjecture about the formula for $f'(x)$.

You may start using your calculator again starting with part (f).

f. Check your conjecture by comparing your formula to the graph and table of $f'(x)$ given by nDeriv in your calculator. If your conjecture didn't work, examine the table and graph of nDeriv and make a new guess.

Conclusion: $\frac{d}{dx}(\sin x) =$

2. Let $g(x) = \cos x$. Graph its derivative in your calculator (using nDeriv). Make a conjecture about the formula for $g'(x)$. Compare the graph and/or table of your formula to the graphed derivative, and adjust as necessary.

Conclusion: $\frac{d}{dx}(\cos x) =$

3. Use your conclusions above and rules about derivatives to find $\frac{d}{dx}(\tan x)$. Simplify your answer as much as possible.

4. You can find the derivative of other trig functions with methods similar to #3 above. For now, just look up the following derivatives on p. 138 of your textbook. Be sure to compare your answer to #3 with the book's formula for $\frac{d}{dx}(\tan x)$; if they don't agree, try to simplify your answer more or look for an error.

$\frac{d}{dx}(\tan x) =$

$\frac{d}{dx}(\sec x) =$

$\frac{d}{dx}(\cot x) =$

$\frac{d}{dx}(\csc x) =$

5. Find the second derivative of $f(x) = \sin x$. Take the derivative again and again to find the third and the fourth derivatives.