

AP Calculus (BC)

Primary textbook:

Calculus (8th Edition)

Larson, Hostetler, Edwards

Houghton Mifflin Company

2006

Supplementary textbook:

Single Variable Calculus with Vector Functions

James Stewart

Thomson, Brooks, Cole

2007

Supplementary materials:

800 Questions in Calculus

Skylight Publishing

2005

Be Prepared for the AP Calculus Exam

Howell, Montgomery

Skylight Publishing

2005

Preparing for the AP Calculus (BC) Exam

Best, Lux

Venture Publishing

2001

TI 89 Titanium calculators are provided for all students. We try to have a balance between calculator active problems and non-calculator problems. Solutions will be found algebraically or analytically when possible and supported graphically and numerically using calculators. Students will have to justify solutions using one or more of these methods. Written sentences will often be required as part of a complete solution. Homework problems are often presented to the class by students. It requires them to write solutions on the front board as well as to verbally convey the justification for their solutions. They are often questioned about steps done with a calculator and they have to explain “how they did it as well as why they did it.”

The first semester will cover chapters one through six, followed by a review and semester exam. The second semester will cover chapters seven through eleven, followed by a comprehensive review of the entire course. During the review, we will work through released exams giving attention to acceptable methods of justifying solutions. We will consider when written sentences are appropriate as part of a complete solution. We will explore situations where calculators can be used to find solutions and to justify conclusions.

All objectives from the College Board’s topic outline for BC Calculus are incorporated into the course outline. Frequent use of technology will be implemented throughout the course.

Chapter 1 Limits and Their Properties (2 weeks)

Section 1.1

Understand the tangent line problem and the need for calculus

Understand the area problem and the need for calculus

Section 1.2

Develop an intuitive understanding of the limiting process

Find limits graphically and numerically (tables)

Use a formal definition of limit

Section 1.3

Evaluate limits analytically (algebraically)

Evaluate limits using the Squeeze Theorem

Section 1.4

Develop an intuitive understanding of continuity

Understand continuity in terms of limits

Determine continuity at a point and on an open interval

Evaluate one-sided limits

Develop a geometric understanding of the graphs of continuous functions

Apply the Intermediate Value Theorem

Section 1.5

Evaluate infinite limits

Find asymptotes of the graphs of functions

Test 1

Sections 1.1-1.5

Chapter 2 Differentiation (2 weeks)

Section 2.1

Find the slope of a curve at given points

Find the equation of the tangent line at a given point

Find the derivative at a point using the limit definition

Understand the relationship between differentiability and continuity

Section 2.2

Use the power rule to find the derivative of a function

Use derivatives to find rate of change

Section 2.3

Use the product rule to find the derivative of a function
Use the Quotient Rule to find the derivative of a function
Find higher order derivatives

Section 2.4

Use the Chain Rule to find the derivative of a function
Find derivatives analytically and numerically

Section 2.5

Find the derivative of a function using implicit differentiation

Section 2.6

Solve related rate problems

Test 2

Sections 2.1-2.6

Chapter 3 Applications of Differentiation (4 weeks)

Section 3.1

Find relative extrema on open intervals
Find extrema on closed intervals

Section 3.2

Apply Rolle's theorem
Apply the Mean Value Theorem

Section 3.3

Find intervals on which a function is increasing or decreasing
Use the first derivative to find relative extrema

Section 3.4

Determine intervals on which a function is concave up or concave down
Use the second derivative to find points of inflection

Section 3.5

Determine limits at infinity
Find horizontal asymptotes of a function

Section 3.6

Sketch the graphs of functions

Compare functions and their respective rates of change

The instantaneous rate of change will be found by taking the limit of the average rate of change

The approximate rate of change will be found from tables

Analyze graphs of derivatives

The sketches of a function f , the first derivative of f , and the second derivative of f will be placed on the same graph and analyzed

The derivative will be used to find the rate of change in many applications

Particle motion, including velocity and acceleration will be analyzed

Section 3.7

Solve optimization problems

Section 3.8

Use Newton's method to find zeros of a function

Section 3.9

Find the differential of a function

Estimate propagated error

Test 3

Sections 3.1-3.7, 3.9

Chapter 4 Integration (3 weeks)

Section 4.1

Find solutions to differential equations

Section 4.2

Approximate the area of a plane region

Find the area of a plane region using limits

Create a computer program to approximate areas of plane regions (left, right, midpoint evaluation points)

Section 4.3

Evaluate a definite integral using limits

Understand that the integral is a limit of Riemann sums

Understand the basic properties of definite integrals

Section 4.4

Use the Fundamental Theorem of Calculus to evaluate a definite integral

Find the average value of a function over a closed interval

Apply the Second Fundamental Theorem of Calculus

Section 4.5

Use the General Power Rule to evaluate an indefinite integral

Use a change of variables to evaluate a definite integral

Section 4.6

Use the Trapezoidal Rule to approximate a definite integral

Use Simpson's Rule to approximate a definite integral

Create a computer program for the Trapezoidal Rule

Create a computer program for Simpson's Rule

Test 4

Sections 4.1-4.6

Chapter 5 Logarithmic, Exponential, and Other Transcendental Functions (3 weeks)

Section 5.1

Find derivatives of functions involving the natural logarithmic function

Section 5.2

Apply the Log Rule for integration

Integrate trigonometric functions

Section 5.3

Find the derivative of an inverse function

Section 5.4

Differentiate natural exponential functions

Integrate natural exponential functions

Section 5.5

Differentiate and integrate exponential functions that have bases other than e

Section 5.6

Differentiate an inverse trigonometric function

Section 5.7

Integrate functions that involve inverse trigonometric functions

Section 5.8

Differentiate and integrate hyperbolic functions (Optional topic)

Test 5

Sections 5.1-5.7

Chapter 6 Differential Equations (2 weeks)

Section 6.1

Solve differential equations with initial conditions

Use slope fields to approximate solutions to differential equations

Use Euler's method to approximate solutions to differential equations

Section 6.2

Use separation of variables to solve differential equations

Solve growth and decay problems

Section 6.3

Use separation of variables to solve differential equations

Solve logistic differential equations

Section 6.4

Solve a first order linear differential equation (optional topic)

Solve a Bernoulli differential equation (optional topic)

Test 6

Sections 6.1-6.3

Review Chapters 1-6 (2 weeks)

Semester Exam

Chapters 1-6

Chapter 7 Applications of Integration (3 weeks)

Section 7.1

Find the area between two curves using integration
Understand that integration is an accumulation process

Section 7.2

Find the volume of a solid of revolution using the disk method
Find the volume of a solid of revolution using the washer method
Find the volume of a solid with known cross sections

Section 7.3

Find the volume of a solid of revolution using the shell method

Section 7.4

Find the arc length of a curve
Find the area of a surface of revolution
Find the total distance traveled by a particle

Section 7.5

Find the work done by a variable force

Section 7.6

Find the center of mass of a system of point masses (optional topic)
Find the centroid of a plane region (optional topic)
Find the volume of a torus (optional topic)

Section 7.7

Find fluid force

Test 7

Sections 7.1-7.5

Chapter 8 Integration Techniques, L'Hopital's Rule and Improper Integrals (3 weeks)

Section 8.1

Review basic integration techniques

Section 8.2

Evaluate an integral using integration by parts
Apply the tabular method

Section 8.3

Evaluate trigonometric integrals

Section 8.4

Use trigonometric substitution to evaluate an integral

Section 8.5

Use partial fractions to evaluate integrals

Section 8.6

Use a table of integrals to evaluate an integral

Section 8.7

Use L'Hopital's Rule to evaluate limits

Section 8.8

Evaluate improper integrals

Test 8

Sections 8.1, 8.2, 8.5, 8.7, 8.8

Chapter 9 Infinite Series (4 weeks)

Section 9.1

Determine whether a sequence converges or diverges

Section 9.2

Define a series as a sequence of partial sums

Use a series to convert a repeating decimal to a fraction

Consider the harmonic series and its properties

Apply the nth Term Test

Section 9.3

Apply the Integral Test and the p-series convergence theorem

Section 9.4

Apply the Direct Comparison Test

Apply the Limit Comparison Test

Section 9.5

Apply the Alternating Series Test

Find the error bound of an alternating series

Section 9.6

Apply the Ratio Test

Apply the Root Test

Section 9.7

Find Taylor and MacLaurin polynomial approximations of functions

Find the Lagrange error of a Taylor polynomial

Analyze Taylor series term by term graphically

Section 9.8

Find the radius and interval of convergence of a power series

Differentiate and integrate a power series

Section 9.9

Find a geometric power series to represent a function

Section 9.10

Find a Taylor or MacLaurin series for a function

Use known Taylor series to compute other Taylor series using substitution, differentiation and antidifferentiation

Test 9

Sections 9.1-9.10

Chapter 10 Conics, Parametric Equations and Polar Coordinates (2 weeks)

Section 10.1

Describe conic sections presented in rectangular form

Section 10.2

Convert parametric equations to rectangular equations

Describe curves presented in parametric form

Section 10.3

Find derivatives of parametric functions

Find the slope of a tangent line to a parametrically defined curve

Find arc length of a parametrically defined curve

Find area of a surface of revolution

Section 10.4

Find derivatives of polar functions

Convert polar equations to rectangular equations and the reverse

Find the slope of a tangent line to a polar graph

Section 10.5

Find the area of a region bounded by a polar graph

Find the arc length of a polar graph

Find the area of a surface of revolution

Section 10.6

Describe conics sections presented in polar form

Test 10

Sections 10.3-10.5

Chapter 11 Vectors and the Geometry of Space (1 week)

Section 11.1

Write a vector as a linear combination of unit vectors

Section 11.2

Understand the three dimensional coordinate system

Use three dimensional vectors

Section 11.3

Find the dot product of two vectors

Determine if two vectors are orthogonal

Find the angle between two vectors

Section 11.4

Find the cross product of two vectors

Review Chapters 1-11 (3-4 weeks)

Released AP exams, 800 Questions in Calculus and Be Prepared for the AP Calculus Exam by Skylight Publishing, Preparing for the AP Calculus (BC) Exam by Venture Publishing will all be used.

Post Exam (1-2 weeks)

Solve differential equations with initial conditions