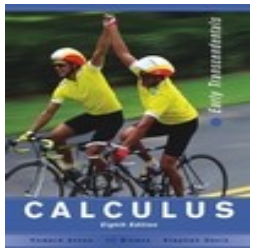

Advanced Placement Calculus

Performance Objectives and Time Table

Text: *Calculus,* 8th edition, by Howard Anton, Irl Bivens, Stephen Davis. John Wiley & Sons, Inc. 2005

First Nine Weeks

Unit 1:	Graphs, Functions & Limits	10 days
Unit 2:	Intro to Differentiation	9 days
Unit 3:	More Derivative Techniques	12 days
Unit 4:	Derivatives in Curve Sketching	9 days

Total - 40 days

Second Nine Weeks

Unit 5:	Applications of Derivatives	9 days
Unit 6:	Intro to Integrals	9 days
Unit 7:	Definite Integrals	10 days
Unit 8:	Applications of Definite Integrals	9 days

Total - 37 days

Third Nine Weeks

Unit 9:	Advanced Techniques of Integration	9 days

Fourth Nine Weeks

AP Exam Review

Unit 10: First Order Differential Equations 7 days
Unit 11: Infinite Series 12 days
Unit 12: Polar, Parametrics & Vectors 9 days

*Teacher Chosen Special Topics – list provided at the end of course objectives

Total - 37 days

Objectives	Sections Textbook Page Number(s)	Time (# block days)	Comments	Calculator Reference	Tests/SOL
Unit 1: Graphs, Functions & Limits	**Appendix A, 2.1 – 2.3, 2.5, 2.6**	**10 block days**		**√**	**APC 1, 2, 3**
1. Pre-Test: Express knowledge of algebraic and trigonometry topics	Supplement with Pre-test Worksheets	1	Two pre-tests are provided		
2. a) Determine the domain and range of a function. b) Find the zeros of a function. c) Determine if a function has x-axis, y-axis or origin symmetry. d) Determine whether a function is… even or odd, 1-1 and periodic d) Find the vertical and horizontal asymptotes of a function. f) Find the x-value of any points of discontinuity of a function.	Supplement with Worksheets	1	This is a review of the parent functions.	√	APC 1
3. Translate, stretch, compress and reflect functions	Supplement with Worksheets	1	This is review material.	√	APC 1
4. a) Review the basic properties of trig functions and their graphs.	Appendix A p. A12	1		√	APC 1

Objectives	Sections Textbook Page Number(s)	Time (# block days)	Comments	Calculator Reference	Tests/SOL
b) Solve inequalities and absolute value equations and inequalities.	Problems listed in Lesson 4 lesson plan				
5. a) Determine limits using tables and graphs. b) Determine limits by algebraic computations. c) Determine limits involving infinity	Sections 2.1 pp. 101-110 Section 2.2 pp. 113-120 Section 2.3 pp. 122-130	2		√	APC 2
6. Use the definition of continuity to determine when a function is continuous or discontinuous.	Section 2.5 pp. 144-152	1	Add in application of Intermediate Value Theorem.	√	APC 3
7. a) Determine where a trig function is discontinuous. b) Find limits with trig functions.	Section 2.6 pp. 155-159	1			APC 3
Unit 1 Review and Test		**2**			
<u>Unit 2</u>: Intro to Differentiation	**3.1 – 3.6**	**9 block days**		**√**	**APC 4, 5, 6, 8, 12**
1 a) State the definition of the derivative and use it to find the derivative of a function. b) Use the concepts of slope and derivations to find average and instantaneous velocity. c) Find the equation of a tangent line to the curve y = f(x).	Sections 3.1 pp. 165-175 Section 3.2 pp. 178-186	2		√	APC 4 APC 12
2. Use properties and theorems of differentiation to find derivatives of functions that involve polynomials,	Section 3.3 pp. 190-195 Section 3.4	2			APC 5 APC 6 APC 8

Objectives	Sections Textbook Page Number(s)	Time (# block days)	Comments	Calculator Reference	Tests/SOL
products and quotients.	pp. 198-202				
3. Differentiate absolute value and trig functions.	Section 3.5 pp. 204-207	1			APC 5
4. State and apply the Chain Rule to differentiate functions	Section 3.6 pp. 209-213	2			APC 6
Unit 2: Review and Test		**2**			

Unit 3: **More Derivative Techniques**	**1.5, 1.6, 1.8, 3.8, 4.1 – 4.3, 11.2**	**12 block days**		√	**APC 1, 5, 7, 8, 9, 11, 12, 17**
1. Evaluate expressions involving increments and differentials.	Section 3.8 pp. 224-239	1			APC 12
2. a) Determine whether a function has an inverse. b) Find the inverse of a function if it exists. b) Determine whether two functions are inverses.	Section 1.5 pp. 51-61	1			APC 1 APC 12

Objectives	Sections Textbook Page Number(s)	Time (# block days)	Comments	Calculator Reference	Tests/SOL
3. a) To simplify logarithmic and exponential functions. b) Sketch the graph of logarithmic and exponential	Section 1.6 pp. 65-73	1		√	APC 1

functions. c) Solve logarithmic and exponential equations.					
4. Find derivatives implicitly.	Section 4.1 pp. 235-241	2			APC 7
5. a) Find derivatives of logarithmic and exponential functions. b) Use logarithmic differentiation to find derivatives. c) Find derivatives of inverse functions	Section 4.2 pp. 243-247 Section 4.3 pp. 248-253	1	Logarithmic differentiation is no longer in the AP Curriculum.		APC 8 APC 9
6. a) Evaluate inverse trig functions b) Find derivatives of inverse trig functions.	Section 1.5 pp. 51-61 Section 4.3 pp. 248-253	2			APC 5
7. a) Sketch the graph of a parametric function. b) Find the first and second derivative of a parametric function.	Section 1.8 pp. 86-93 Section 11.2 pp. 731-736	1	Not in the AB curriculum.	√	APC 17
8. a) Use L'Hopital's Rule to evaluate limits involving indeterminate forms $\frac{0}{0}$ and $\frac{\infty}{\infty}$. b) Evaluate limits involving indeterminate forms $\infty \cdot 0$, $\infty - \infty$, 1^{∞}, 0^{0}, and ∞^{0}.	Section 4.4 pp. 256-262	1	Not in the AB curriculum		APC 11
UNIT 3: REVIEW AND TEST		**2**			

Objectives	Sections Textbook Page Number(s)	Time (# block days)	Comments	Calculator Reference	Tests/SOL
Unit 4: **Derivatives in Curve Sketching**	**5.1 – 5.4**	**9 block days**		**√**	**APC 1, 12**
1. a) Use derivatives to determine where a function is increasing or decreasing. b) Use the first and second derivative tests to locate local maximum and minimum points. c) Determine where the graph of a function is concave up or down. d) Determine the inflections points of the graph of a function.	Sections 5.1 pp. 267-275 Section 5.2 pp. 279-286	3		√	APC 1 APC 12
2. a) Sketch the graphs of polynomial and rational functions. b) Examine the graphs of functions that have corners and/or cusp.	Section 5.3 pp. 289-298	2		√	APC 12
3. Determine the absolute maximum and minimum values of a function.	Section 5.4 pp. 301-306	1		√	APC 12
4. Analyze the graph of a derivative.	Supplement with Worksheets	1	Old AP exam questions should be used.	√	
Unit 4 Review and Test		**2**			

Unit 5: **Applications of derivatives**	**3.7, 5.5, 5.7, 5.8**	**9 block days**		**√**	**APC 10, 12**
1. a) Solve applied maximum and minimum problems. b) State and apply Rolle's Theorem	Section 5.5 pp. 304-318	3			APC 10 APC 12

and the Mean Value Theorem for derivatives.	Section 5.7 pp. 329-333				
2. Solve problems involving related rates.	Sections 3.7 pp. 217-221	2			APC 12
3. Apply derivatives in solving rectilinear motion problems.	Section 5.8 pp. 336-341	1		√	APC 12
UNIT 5 REVIEW AND TEST		**3**			
OBJECTIVES	**SECTIONS TEXTBOOK PAGE NUMBER(S)**	**TIME (# BLOCK DAYS)**	**COMMENTS**	**CALCULATOR REFERENCE**	**TESTS/SOL**
UNIT 6: INTRO TO INTEGRALS	**6.3 – 6.5**	**9 block days**		**√**	**APC 14, 16**
1. Introduce the definite integral as an accumulator function.	Supplement with Worksheets	1			
2. a) Express a sum in sigma notation. b) Evaluate sums in sigma notation.	Section 6.4 pp. 373-383	1			
3. Approximate the area under a curve using left endpoint, right endpoint and midpoint approximations.	Section 6.4 pp. 373-383	1		√	APC 16
4. a) Use a Riemann sum to approximate area under a curve. b) Define the definite integral.	Section 6.5 pp. 386-393	1		√	APC 16
5. a) Recognize an integral as an antiderivative and evaluate indefinite integrals. b) Use the technique of substitution to solve indefinite integrals.	Section 6.2 pp. 355-362 Section 6.3 pp. 365-371	3			APC 14
UNIT 6 REVIEW AND TEST		**2**			
UNIT 7: DEFINITE INTEGRALS	**6.6 – 6.9, 7.7**	**10 block days**		**None**	**APC 13, 14, 15, 18**

1. a) State and apply the Fundamental Theorem of Calculus. b) State and apply the Mean Value Theorem for integrals.	Section 6.6 pp. 396-406	1			APC 14
2. a) Use integration to solve rectilinear motion. b) Find the average value of a function.	Section 7.7 pp. 481-488 Section 6.7 pp. 410-416	1			APC 15 APC 18
3. Evaluate definite integrals by substitution.	Section 6.8 pp. 419-422	1			APC 13
4. a) Investigate logarithmic functions from an integral point of view. b) Find the derivative of integrals with functions as limits of integration.	Section 6.9 pp. 425-434	1			APC 14
OBJECTIVES	**SECTIONS TEXTBOOK PAGE NUMBER(S)**	**TIME (# BLOCK DAYS)**	**COMMENTS**	**CALCULATOR REFERENCE**	**TESTS/SOL**
5. a) Evaluate integrals involving inverse trig functions. b) Evaluate integrals involving logarithms and exponents. c) Solve problems involving antidifferentiation.	Supplement with Worksheets	3			APC 15
UNIT 7 REVIEW AND TEST		**3**			

UNIT 8: APPLICATIONS OF THE DEFINITE INTEGRALS	**7.1, 7.2, 7.4, 7.5**	**9 block days**		**√**	**APC 14, 15**
1. Determine the area between two curves.	Section 7.1 pp. 442-449	2		√	APC 14
2. a) Use disk & washer methods to find volume of a solid that results	Section 7.2 pp. 450-456	3		√	APC 15

when a region is revolved about an axis or a parallel line. b) Determine the volume of a solid with a known cross section.					
3. a) Use integration to calculate lengths of plane curves. b) Use integration to calculate surface area of solids of revolution.	Section 7.4 pp. 465-468 Section 7.5 pp. 471-474	1	Not in AB curriculum	√	APC 15
UNIT 8 REVIEW AND TEST		**3**			

UNIT 9: **ADVANCED TECHNIQUES OF INTEGRATION**	**9.2, 9.3, 9.5, 9.7, 9.8**	**9 block days**		**None**	**APC 13, 16, 18**
1. Evaluate integrals using the technique of integration by parts.	Section 8.2 pp. 513-519	2	Not in AB curriculum		APC 13
2. Evaluate integrals that involve trigonometric functions.	Section 8.3 pp. 522-528	1	Not in AB curriculum		
3. a) Integrate rational functions that involve long division. b) Integrate rational functions using partial fractions.	Section 8.5 pp. 537-543	1	Not in AB curriculum		
OBJECTIVES	**SECTIONS** **TEXTBOOK PAGE NUMBER(S)**	**TIME** **(# BLOCK DAYS)**	**COMMENTS**	**CALCULATOR REFERENCE**	**TESTS/SOL**
2. Approximate definite integrals by use of the Trapezoidal Rule and Simpson's Rule.	Section 8.7 pp. 556-566	1	Simpson's Rule is no longer in the AP curriculum		APC 16
3. Evaluate improper integrals.	Section 8.8 pp. 569-575	2	Not in AB curriculum		APC 18
UNIT 9 REVIEW AND TEST		**2**			

UNIT 10: FIRST ORDER DIFFERENTIAL EQUATIONS	**9.1 – 9.3**	**7 block days**		**√**	**APC 15**
1. Solve differential equations and initial value problems.	Section 9.1 pp. 582-592	1		√	APC 15
2. Model and solve application problems involving differential equations.	Section 9.3 pp. 603-607	1		√	APC 15
3. a) Sketch direction fields and use them to find solutions satisfying initial conditions. b) Use direction fields to analyze limiting values in applications. c) Construct slope fields using technology and interpret fields as visualizations of differential equations. d) Given a slope field for a differential equation, graph an approximate particular solution by hand and if possible confirm the solution algebraically. e) Use Euler's method with specified steps to approximate specific y-values for solutions to initial value problems.	Section 9.2 pp. 596-600	3	Not in AB curriculum	√	
UNIT 10 REVIEW AND TEST		**2**			

OBJECTIVES	SECIONS TEXTBOOK PAGE NUMBER(S)	TIME (# BLOCK DAYS)	COMMENTS	CALCULATOR REFERENCE	TESTS/SOL

UNIT 11: **INFINITE SERIES**	**10.1, 10.3-10.8, 10.10**	**12** **block days**	**Unit 11 not in** **AB curriculum**	**None**	**APC** **19, 20**
1. a) State what it means for a sequence or series to converge. b) Determine whether or not a sequence converges, and if it does, find its limit. c) For a given series, write a specific number of partial sums to determine whether a series converges or diverges. c) Determine whether an infinite geometric series converges or diverges.	Section 10.3 pp. 643-649	1			APC 19
2. Determine whether a series converges or diverges using the divergence test, the integral test or the p-series test.	Section 10.4 pp. 652-657	1			APC 19
3. Use the comparison, limit comparison, ratio, and root tests to determine if a series converges or diverges.	Section 10.5 pp. 659-664	1			APC 19
4. a) Determine if an alternating series is convergent. b) Determine if a convergent alternating series is conditionally or absolutely convergent. d) Determine the bound for the amount of error when a converging alternating series is approximated by the nth partial	Section 10.6 pp. 666-672	1			APC 19

sum.					

Objectives	Sections Textbook page number(s)	Time (# block days)	Comments	Calculator Reference	Tests/SOL
5. a) Use Maclaurin and Taylor polynomials to approximate functions. b) Write a specified number of terms of the Maclaurin series or Taylor series for a given function. c) Write a series in sigma notation.	Section 10.7 pp. 675-683				APC 20
6. Determine the interval of convergence for a power series.	Section 10.8 pp. 685-692	2			APC 20
7. a) Differentiate and integrate power series b) Use series to approximate integrals.	Section 10.10 pp. 704-711	1			APC 20
8. a) Find the difference between $f(x)$ and its nth Taylor polynomial about $x = x_0$. b) Write LaGrange's form of the remainder for a specified Taylor or MacLaurin series.	Section 10.7 pp. 675-683 Supplement with Worksheets	2			APC 20
Unit 11 Review and Test		**2**			

Unit 12: **Polar, Parametics, and Vectors**	**11.1 – 11.3**	**9 block days**	**Unit 12 not in AB curriculum**	**√**	**APC 15, 17, 18**
1. a) Interchange coordinates and	Section 11.1	1		√	

equations between rectangular and polar form. b) Graph polar curves.	pp. 717-727				
2. a) Find first and second derivative of parametric equations. b) Find the arc length of the curve of parametric equations. c) Find tangent lines an arc length for polar curves	Section 11.2 pp. 731-736	2			APC 18
3. Determine the area bounded by polar curves.	Section 11.3 pp. 740-744	2		√	APC 15 APC 18
OBJECTIVES	**SECTIONS** **TEXTBOOK PAGE NUMBER(S)**	**TIME** **(# BLOCK DAYS)**	**COMMENTS**	**CALCULATOR REFERENCE**	**TESTS/SOL**
4. a) Find the components of a vector. b) Compute the norm of a vector. c) Find a unit vector in the same direction and in the opposite direction of a vector. d) Find the derivative of a vector function. e) Find the antiderivative of a vector function. f) Find the tangent vector to a given vector.	Supplement with Worksheets	1	Vector topics are not included in the brief addition.		APC 17
5. Given a position vector function, determine the velocity and acceleration vector functions, and velocity, speed, and acceleration at a specified time.	Supplement with Worksheets	2	Vector topics are not included in the brief addition.		APC 17
UNIT 12 REVIEW AND TEST		**2**			

THROUGHOUT THE YEAR, EXPOSE STUDENTS TO THE TYPES OF QUESTIONS FOUND ON BOTH THE MULTIPLE CHOICE AND FREE RESPONSE SECTIONS OF THE AP TEST.

EXAMPLES OF TEACHING STRATEGIES/ STUDENT ACTIVITIES:

Written and verbal communications are stressed throughout the course. Students are required to:

1. use various types of problem-solving; this allows the students to explore solutions numerically, algebraically, graphically, and verbally. For example,
    - Students are taught to explore limits using the graphing calculator by looking at the behavior of graphs. From this graphical representation they are expected to demonstrate verbally and in writing their understanding of the connection between the graph and the table of values for that graph with respect to limits at various points. Students then calculate limits at various points analytically.
    - Students experiment with area under the curve by first using Riemann sums to estimate the area, followed by usage of a graphing calculator program where they interpret results to draw the conclusion that as n increases the Riemann sum more closely approximates the actual area under the curve. Students then integrate with and without the graphing calculator to find the exact value of the area under the curve.

2. verbally present and support their solutions to homework and released AP problems to the class.
3. show mastery of the following graphing calculator techniques:
    - graph a function in an arbitrary viewing window,
    - find the zeros of functions,
    - numerically calculate the derivative of a function, and
    - evaluate a definite integral.
4. have a TI-83+ or TI-84 graphing calculator to be brought to class daily. The graphing calculator is used to help explore and investigate calculus concepts individually and in small group settings. Examples of programs available to each student are:
    - Riemann sums
    - Euler's Method
    - Trapezoid Rule
    - Slope fields
5. complete a written end of unit activity summarizing key concepts.
6. graph (with and without the calculator) and analyze the first and second derivatives to determine the behavior of the original function. Following classroom discussion on relative extrema, inflection points, etc. students break into groups to further explore these concepts.
7. provide justification and support of answers to free response questions in complete sentences in various class assessments.

After the AP exam, the teacher should pick appropriate units of study that will benefit the calculus student as he/she pursues mathematics. The choice of units is left up to the teacher, but it is recommended that they choose from this list of topics:

1. analytic geometry/ conic sections
2. second order differential equations
3. partial differentiation

4. further applications of the integral (work, pressure, force, etc.)
5. hyperbolic functions
6. integration using tables