CALCULUS AP

Course Outline
(Revised 2008)

Number/Level: 331 Advanced Placement

Textbook:

Calculus of a Single Variable Early Transcendental Functions 4th Edition, Larson, Hostetler, Edwards, Houghton Mifflin Publishing Co. 2007.

Additional Resources*:*

How to Prepare for the AP Calculus Exam 8th Edition, Horkett, Bock, Barron's Pub., Co. 2005.

Multiple Choice and Free Response Questions in Preparation for the AP Calculus (AB) Examination 8th Edition, *Lederman, Mc Mullen, D & S marketing systems, 2003*

Calculus AB/BC: Preparing for the Advanced Placement Examinations, Maxine Lifshitz, AMSCO Publishing, 2004.

Calculus: Graphical, Numerical, Algebraic 3rd Edition, Finney, Demana, Waits, and Kennedy, Prentice Hall.

Course Length: Full Year

Credit: 6 Credits

I. Prerequisite:

Students enrolling in the course must have attained at least a "B" in Pre-Calculus Honors or with a teacher recommendation. Students who have completed Pre-Calculus Academic and wish to enroll in AP Calculus must take the Pre Calculus Honors exam and score at least 70% or meet other criteria designated by the math supervisor and instructor.

II. Course Description:

This is a college level Calculus course, which prepares students for the Advanced Placement Calculus AB Exam, administered by the Educational Testing Service. Acceptable scores on the AP exam (the specific score required depends on the college) can earn the student college credits. Taking the appropriate AP exam is a course requirement.

The course meets six periods per week. The proficiencies coincide with those recommended by the College Board, the administrators of the Advanced Placement Program.

III. Description of Instruction*:*

Students are expected to be active participants in the learning process. The teacher will involve them in the introduction and development of the material through questioning and class discussions. The Smart Board and the computer will be used to help students visualize concepts. Understanding of concepts is stressed rather than rote memorization of skills. When appropriate, students are guided in discovering the concepts themselves through a study of patterns and by relating the new work to their prior knowledge.

Graphing calculators will be used to help students explore functions, find patterns, make generalizations and visualize concepts. In order to cover all the objectives tested on the AP Exam, it is necessary to proceed quickly and usually a new topic will be introduced every other day.

Homework must be done conscientiously, with a serious effort made to use the textbook and class notes as resources. When obtaining incorrect answers, students must take time to go over their work and try to find their mistake.

IV. Student Evaluation:

Short quizzes will be given once or twice a week. A major unit test will be given at the end of each chapter. An exam will be given at the end of each semester, covering all the work of that semester.

Tests and Quizzes	75-80%
Homework	20-25%

V. Supplementary Materials:

Teacher prepared worksheets
TI Graphing Calculator (TI 84+ recommended)

VI. District Policy: ACADEMIC INTEGRITY

Pupils are expected to be honest in all of their academic work. This means that they will not engage in any of the following acts:

• Cheating on examinations or other school assignments, including but not limited to, the non-authorized use of books or notes, the use of crib sheets, copying from other students' papers, exchanging information with other students orally, in writing, or by signals, obtaining copies of the examination illegally and other similar activities. Cheating through the use of technology to exchange information on any school assignment, examination, etc. is prohibited. Technology is defined as, but not limited to, computers, telephones, text messaging, palm pilots, calculators, cameras or any other hand held device.

• Plagiarism is not permitted in term papers, themes, essays, reports, images, take-home examinations, and other academic work. Plagiarism is defined as stealing or use without acknowledgment of the ideas, words, formulas, textual materials, on-line services, computer programs, etc. of another person, or in any way presenting the work of another person as one's own.

• Falsifications, including forging signatures, altering answers after they have been graded, inserting answers after the fact, erasing of grader's markings, and other acts that allow for falsely taking credit.

A pupil found guilty of academic dishonesty may be subjected to a full range of penalties including, but not limited to reprimand and loss of credit for all of the work that is plagiarized.

Disciplinary action may also be a consequence of such behavior. Additional consequences may apply as defined in specific department policies and guidelines.

A teacher who believes that a pupil has been academically dishonest in his/her class should resolve the matter in the following manner:

• Reprimand the student orally and/or in writing. The teacher is also authorized to withhold credit in the work due to academic dishonesty.

• If warranted, the teacher shall file a written complaint against the student with the Administration, requesting a more stringent form of discipline. The complaint must describe in detail the academic dishonesty that is alleged to have taken place, and must request that the matter be reviewed by the Administration.

• The Administration will determine if further discipline of the pupil is appropriate, and will determine the nature of the discipline on a case-by-case basis.

• If the pupil is not in agreement with the disciplinary action of the Administration, he/she may appeal the action first to the Principal and secondly to the Superintendent. If the pupil is dissatisfied with the Superintendent's disposition of the case, he/she may grieve the action in accordance with Policy No. 5710, Pupil Grievance.

VII. District Policy: Discrimination

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

VIII. Proficiencies:

Unit 1: Limits and Their Properties ***Time: 2 weeks***

At the conclusion of this unit the students will be able to:

1. Understand what calculus is and how it compares with pre-calculus.
2. Understand that the tangent line problem is basic to calculus.
3. Understand that the area problem is also basic to calculus.
4. Estimate a limit using a numerical or graphical approach.
5. Learn different way that a limit can fail to exist.
6. Evaluate a limit using properties of limits.
7. Develop and use a strategy for finding limits.
8. Evaluate a limit using dividing out and rationalizing techniques.
9. Evaluate a limit using the Squeeze Theorem.
10. Determine continuity at a point and continuity on an open interval.
11. Determine one-sided limits and continuity on a closed interval.

12. Use properties of continuity.
13. Understand and use the Intermediate Value Theorem.
14. Determine infinite limits from the left and from the right.
15. Find and sketch the vertical asymptotes of the graph of a function.

Unit 2: Differentiation ***Time: 3 weeks***

At the conclusion of this unit the students will be able to:

1. Find the slope of the tangent line to a curve at a point.
2. Use the limit definition to find the derivative of a function.
3. Understand the relationship between differentiability and continuity.
4. Find the derivative of a function using the Constant Rule.
5. Find the derivative of a function using the Power Rule.
6. Find the derivative of a function using the Constant Multiple Rule.
7. Find the derivative of a function using the Sum and Difference Rules.
8. Find the derivative of the sine function and of the cosine function.
9. Use derivatives to find rates of change.
10. Find the derivative of a function using the Product Rule.
11. Find the derivative of a function using the Quotient Rule.
12. Find the derivative of a trigonometric function.
13. Find higher order derivatives of a function.
14. Find the derivative of a composite function using the Chain Rule.
15. Find the derivative of a function using the General Power Rule.
16. Simplify the derivative of a function using algebra.
17. Find the derivative of a transcendental function using the Chain Rule.
18. Find the derivative of a function involving the natural logarithmic function.
19. Define and differentiate exponential functions that have bases other than *e*.
20. Distinguish between functions written in implicit form and explicit form.
21. Use implicit differentiation to find the derivative of a function.
22. Find derivatives of functions using logarithmic differentiation.
23. Find the derivative of an inverse function.
24. Differentiate an inverse trigonometric function.
25. Find a related rate.
26. Use related rates to solve real-life problems.

Unit 3: Applications of Differentiation ***Time: 3 weeks***

At the conclusion of this unit the students will be able to:

1. Understand the definition of extrema of a function on an interval.
2. Understand the definition of relative extrema of a function on an open interval.
3. Find extrema on a closed interval.
4. Understand and use Rolle's Theorem.
5. Understand and use the Mean Value Theorem.
6. Determine intervals on which a function is increasing or decreasing.
7. Apply the First Derivative Test to find the relative extrema of a function.
8. Determine intervals on which a function is concave upward or concave downward.
9. Find any points of inflection of the graph of a function.
10. Apply the Second Derivative Test to find relative extrema of a function.

11. Determine (finite) limits at infinity.
12. Determine the horizontal asymptotes, if any, of the graph of a function.
13. Determine infinite limits at infinity.
14. Analyze and sketch the graph of a function.
15. Solve applied minimum and maximum problems.
16. Understand the concept of a tangent line approximation.
17. Compare the value of the differential, dy, with the actual change in y, Δy.
18. Estimate a propagated error using a differential.
19. Find the differential of a function using differential formulas.

Unit 4: Integration Time: 3 weeks

At the conclusion of this unit the students will be able to:

1. Write the general solution of a differential equation.
2. Use indefinite integral notation for antiderivatives.
3. Use basic integration rules to find antiderivatives.
4. Find a particular solution of a differential equation.
5. Understand the concept of area.
6. Approximate the area of a plane region.
7. Find the area of a plane region using limits.
8. Understand the definition of a Riemann sum.
9. Evaluate a definite limit using limits.
10. Evaluate a definite integral using properties of definite integrals.
11. Evaluate a definite integral using the Fundamental theorem of Calculus.
12. Understand and use the Mean Value Theorem for Integrals.
13. Find the average value of a function over a closed interval.
14. Understand and use the Second Fundamental Theorem of Calculus.
15. Use pattern recognition to find an indefinite integral.
16. Use a change of variables to find an indefinite integral.
17. Use the General Power Rule for Integration to find an indefinite integral.
18. Use a change of variables to evaluate a definite integral.
19. Evaluate a definite integral involving even or odd functions.
20. Approximate a definite integral using the Trapezoid Rule.
21. Use the Log Rule for Integration to integrate a rational function.
22. Integrate trigonometric functions.
23. Integrate functions whose antiderivatives involve inverse trigonometric functions.
24. Use the method of completing the square to integrate a function.
25. Review the basic integration rules involving elementary functions.

Unit 5 Differential Equations Time: 2 weeks

At the conclusion of this unit the students will be able to:

1. Use initial conditions to find particular solutions of differential equations.
2. Use Slope Fields to approximate solutions of differential equations.
3. Use separation of variables to solve a simple differential equation.

4. Use exponential functions to model growth and decay in applied problems.
5. Recognize and solve differential equations that can be solved by separation of variables.
6. Use differential equations to model and solve applied problems.

Unit 6: Applications of Integration ***Time: 4 weeks***

At the conclusion of this unit the students will be able to:

1. Find the area of a region between two curves using integration.
2. Find the area of a region between intersecting curves using integration.
3. Describe integration as an accumulation process.
4. Find the volume of a solid of revolution using the disk method.
5. Find the volume of a solid of revolution using the washer method.
6. Find the volume of a solid with known cross sections.
7. Find the volume of a solid of revolution using the shell method.
8. Compare the uses of the disk method and the shell method.
9. Find the arc length of a smooth curve.
10. Find the area of a surface of revolution.
11. Find the work done by a constant force.
12. Find the work done by a varying force.
13. Find the center of mass of a one-dimensional system.
14. Find the center of mass of a two-dimensional system.
15. Find fluid pressure and fluid force.

Unit 7: Techniques of Integration ***Time: 3 weeks***

At the conclusion of this unit the students will be able to:

1. Review procedures for fitting an integration problem to one of the basic integration rules.
2. Find an antiderivative using integration by parts.
3. Solve trigonometric integrals involving powers of sine and cosine.
4. Solve trigonometric integrals involving powers of secant and tangent.
5. Use trigonometric substitution to solve an integral.
6. Use integrals to model and solve real-life applications.
7. Understand the concept of partial fraction decomposition.
8. Use partial fraction decomposition with linear factors to integrate rational functions.
9. Use partial fraction decomposition with quadratic factors to integrate rational functions.
10. Recognize limits that produce indeterminate forms.
11. Apply L'Hopital's Rule to evaluate a limit.
12. Evaluate an improper integral that has an infinite limit of integration.
13. Evaluate an improper integral that has an infinite discontinuity.

Unit 8: Review for the AP Calculus AB Exam ***Time: 6 weeks***

At the conclusion of this unit the students will be able to score a 5 on the AP Calculus AB Exam.

Unit 9: Infinite Series ***Time: 4 weeks***

At the conclusion of this section the students will be able to:

1. List the terms of a sequence.
2. Determine whether a sequence converges or diverges.
3. Write a formula for the nth term of a sequence.
4. Use properties of monotonic sequences and bounded sequences.
5. Understand the definition of a convergent infinite series.
6. Use properties of infinite geometric series.
7. Use the nth-Term test for Divergence of an infinite series.
8. Use the Integral Test to determine whether an infinite series converges or diverges.
9. Use properties of p-series and harmonic series.
10. Use the Direct Comparison Test to determine whether a series converges or diverges.
11. Use the Limit Comparison Test to determine whether a series converges or diverges.
12. Use the Alternating Series Test to determine whether an infinite series converges.
13. Classify a convergent series as absolutely or conditionally convergent.
14. Rearrange an infinite series to obtain a different sum.
15. Use the Ratio Test to determine whether a series converges or diverges.
16. Use the Root Test to determine whether a series converges or diverges.
17. Find polynomial approximations of elementary functions and compare them with elementary functions.
18. Find Taylor and Maclaurin polynomial approximations of elementary functions.
19. Understand the definition of a power series.
20. Find the radius and interval of convergence of a power series.
21. Determine the endpoint convergence of a power series.
22. Differentiate and integrate a power series.
23. Find a geometric power series that represents a function.
24. Construct a power series using series operations.
25. Find a Taylor or Maclaurin series for a function.