

BERKELEY HEIGHTS PUBLIC SCHOOLS
BERKELEY HEIGHTS, NEW JERSEY

**GOVERNOR LIVINGSTON HIGH SCHOOL
MATHEMATICS DEPARTMENT**

Math Analysis/Math Analysis Honors
#0342/0343

Curriculum Guide

September 2005

Mrs. Judith A. Rattner, Superintendent
Mr. Matthew Jennings, Assistant Superintendent
Vincent Parisi, District Supervisor

Developed by: Catherine J. Birstler
Mary Tuller

This curriculum may be modified through varying techniques,
strategies, and materials, as per an individual student's
Individualized Educational Plan (IEP).

Approved by the Berkeley Heights Board of Education
at the regular meeting held on 10/20/2005.

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New Jersey Core Curriculum Content Standards – Mathematics	
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New Jersey Core Curriculum Content Standards – Career Education and Consumer, Family, and Life Skills	
*New Jersey Core Curriculum Content Standards can also be viewed at www.state.nj.us	

PHILOSOPHY/RATIONALE

Math Analysis and Math Analysis Honors are intended for college-bound students with above average to high mathematical ability. The courses expose students to traditional pre-calculus content with an emphasis on developing their ability to think in a logical and analytical manner. An emphasis is also given to developing the ability to communicate mathematical ideas effectively. Honors sections will delve, where appropriate, into additional explanation, synthesis and experimentation in order to prepare students for a more extensive study in Calculus.

Both courses encompass and extend the concepts mastered in Algebra 2, as well as the theory and applications of trigonometric functions. Attention is given to discrete mathematics and data analysis, realizing that these subjects provide the mathematical framework for many contemporary mathematical applications. The curriculum also includes vectors and parametric equations, combinatorics and probability, and matrices. In addition to further study in the above topics, the honors course will explore polar coordinates and complex numbers. Graphing calculators are used extensively in both courses to discover, apply, and reinforce numerous concepts.

The prerequisite for Math Analysis is the successful completion of Algebra 2, along with the teacher's recommendation. The prerequisite for Math Analysis Honors is a B+ average in Algebra 2 Honors, or an A average in Algebra 2, along with the teacher's recommendation. Five credits are given for passing each of these full year courses. The New Jersey Core Curriculum Content Standards (NJCCCS) for mathematics have been integrated throughout the curriculum and are referenced in each section.

COURSE PROFICIENCIES (continued)

18. Several models are considered when finding the best curve to model a set of data; the correlation coefficient is used to determine the best possible model for a particular situation. **(honors only)**

4.3/12C1	4.5/12F1	8.1/12A3
D2		8.2/12A3
4.4/12A1,4,5		

19. Conic sections are introduced and their equations are studied to identify the important characteristics of each; the characteristics are then used in graphing. **(regular only)**

4.2/12A1,3	4.5/12C6
C1	F3
4.3/12B2-4	

20. Limits are used to determine the continuity of functions **(and to graph rational functions in honors)**.

4.1/12C1	4.5/12F4	8.2/12A1
4.2/12E2		
4.3/12A2		
B2		

STUDENT PROFICIENCIES

The student will be able to:

1. Determine whether a given relation is a function, perform operations with functions and find composite functions. **(regular only)** (4.3/12B1,2)
2. Write the equation of a linear function, sketch its graph and recognize the relationship between the slopes of perpendicular and parallel lines. **(regular only)** (4.2/12C1; 4.3/12B1,2)
3. Graph rational functions. (4.3/12B2,3,4; 4.3/12C2; 4.5/12F3)
4. Determine whether a relation has symmetry about an axis or a point using either a graph or an equation. **(regular only)** (4.3/12B4; 4.5/12F3)
5. Identify transformations of simple graphs and sketch graphs of related functions. **(regular only)** (4.3/12B3,4; 4.3/12C2; 4.5/12F3)
6. Analyze and graph inverse functions and relations. **(regular only)** (4.3/12B1; 4.5/12F3)
7. Use a graphing calculator to determine critical points of a function. **(regular only)** (4.3/12B2; 4.5/12F3)
8. Define, understand and evaluate the six trigonometric functions. (4.2/12A3; 4.2/12E1)
9. Extend the understanding of trigonometric functions from acute angles to angles of any size. (4.1/12A2, B1; 4.2/12A3; 4.2/12E1)
10. Change from radian measure to degree measure and vice versa. (4.1/12A2; 4.3/12A3; 4.5/12E2)
11. Apply the appropriate formula for arc length and area of a sector to solve problems, given an angle in either degree or radian measure. (4.1/12B1; 4.2/12A1,3)
12. Graph trigonometric functions and use these graphs to evaluate the functions for different values in the domain. (4.2/12A1, B1; 4.3/12B2,3,4; 4.5/12C1, F3; 8.2/12A3; 9.2/12A3)
13. Evaluate and apply inverse trig functions, and develop an understanding of principal values. (4.1/12A2; 4.3/12B4; 4.5/12D4; 8.1/12B11)
14. Use trigonometric functions to model real-world phenomena. (4.2/12A-1; 4.2/12D-2; 4.3/12E-1; 4.3/12B-3; 4.3/12C-1; 4.5/12A-1-5; 4.5/12C-3,4; 8.1/12B-9,11; 8.2/12A-2)
15. Verify and apply trigonometric identities of varying complexity. (4.1/12B1; 4.2/12A4, D1,2; 4.5/12A1-5, D3, E2; 8.1/12B11)

STUDENT PROFICIENCIES (continued)

16. Solve trigonometric equations for one or multiple solutions. (4.1/12B1; 4.2/12D2; 4.3/12D2; 4.5/12D3, E2; 8.1/12B11)
17. Evaluate the angle of inclination of a line as an inverse trigonometric function of the slope. (4.3/12B2; 4.3/12C1; 4.5/12C1)
18. Graph polar equations. (**honors only**) (4.3/12B2; 4.5/12E1)
19. Write complex numbers in polar form. (**honors only**) (4.1/12B1; 4.5/12E2)
20. Perform operations on complex numbers written in polar form. (**honors only**) (4.1/12B1; 4.5/12C1,2)
21. Apply De Moivre's Theorem to find powers and roots of complex numbers. (**honors only**) (4.1/12B4; 4.5/12C1,2)
22. Perform simple operations with vectors algebraically and geometrically. (4.2/12A1,3; 4.2/12C2)
23. Extend the understanding of vectors to involve three dimensional space. (**honors only**) (4.2/12A1,3; 4.2/12C2)
24. Use inner products to determine whether two vectors are perpendicular. (4.2/12C1)
25. Find cross products of vectors. (**honors only**) (4.5/12E1)
26. Use vectors and parametric equations to solve problems. (4.3/12D2; 4.5/12A1-5, C3,4)
27. Identify an arithmetic or geometric sequence and find a formula for its n^{th} term. (4.3/12A1; 4.5/12C1)
28. Represent series using sigma notation. (4.5/12C1)
29. Solve problems using combinations and permutations. (4.4/12C1-4; 4.5/12A1-5, B1-4; 8.2/12A3)
30. Determine the probabilities of simple and compound events. (4.4/12B1-6; 4.5/12A1-5, B1-4)
31. Display sets of data using various tables and graphs. (4.1/12A1,2,3; 4.5/12B1-4, E1, F1,2; 8.1/12A3)
32. Find measures of central tendency and measures of variability presented as sets of data, or in a table or graph. (4.1/12A1-3,5; 4.3/12D2,3)

STUDENT PROFICIENCIES (continued)

33. Use the normal curve to study properties of normal distributions. (4.1/12A1-3,5; 4.3/12D3; 4.5/12A1-5; 9.2/12A1-4)
34. Assess different sampling procedures to identify their limitations and estimate population characteristics based on samples. **(honors only)** (4.1/12A1,2; 4.1/12C1; 9.2/12A4)
35. Use a sample proportion to find a confidence interval for a corresponding population proportion. **(honors only)** (4.1/12C1; 4.4/12A1,2; 9.2/12A4)
36. Use statistical analysis and technology to draw conclusions. (4.4/12A4,5; 4.4/12D2; 4.5/12A1-5, B1-4, F1,2; 8.1/12A3; 9.2/12A1-4)
37. Perform basic operations with matrices. (4.1/12B3)
38. Apply matrix operations to model and solve real-world problems. (4.3/12D2; 4.5/12A1-5, C-3,4; 9.2/12A3)
39. Solve systems of equations using inverse matrices. (4.3/12D2; 4.5/12A4, C3,4; 8.2/12A3)
40. Solve communication network problems using matrices. **(honors only)** (4.5/12A1-5, C-3,4; 8.2/12A3; 9.2/12A3)
41. Make predictions using powers of matrices. **(honors only)** (4.3/12D2; 4.5/12C3,4; 9.2/12E6)
42. To find images of points under different types of transformations using matrices. **(honors only)** (4.2/12B1; 4.3/12B3; 4.5/12C3,4; 8.2/12A3; 9.2/12A3)
43. Explore various models of curve fitting and use graphing calculator to find the regression line associated with such models. **(honors only)** (4.3/12C1; 4.3/12D2; 4.4/12A4,5; 4.5/12F1; 8.2/12A3)
44. Choose the model which best describes a set of data. **(honors only)** (4.3/12D2; 4.4/12A1,4,5; 8.1/12A3)
45. Identify and graph circles, ellipses, parabolas and hyperbolas. **(regular only)** (4.2/12A1,3; 4.2/12C1; 4.3/12B2-4; 4.5/12C6, F3)
46. Acquire an elementary appreciation of calculus concepts including limits and continuity. (4.3/12A2)
47. Use limits to sketch the graph of a rational function. **(honors only)** (4.3/12B2; 4.5/12F4)

STUDENT PROFICIENCIES (continued)

48. Understand how limits can be used to find areas and formulas for power series. (**honors only**) (4.1/12C1; 4.2/12E2; 4.5/12F4; 8.2/12A1)

METHODS OF EVALUATION

1. Homework and class work.
2. Class participation.
3. Tests and quizzes.
4. Projects.
5. Cooperative learning assignments.
6. Midterm and Final Exams

SCOPE AND SEQUENCE
COURSE OUTLINE/STUDENT OBJECTIVES

The student will be able to:

N. J. Core Curriculum Standards	Indicators	Course Outline/Student Objectives
4.2 4.3 4.5	C1 B1-4 C1,2 F3	I. Functions and Graphs (regular only) A. Relations and Functions 1. Determine domain and range of functions and relations 2. Determine whether a relation is a function 3. Evaluate and perform operations with functions 4. Find compositions of functions B. Graphs of Linear Equations 1. Graph linear equations using intercepts, slope and y-intercept or a table of values 2. Find zeros of linear functions 3. Write linear equations 4. Write equations of parallel and perpendicular lines C. Graphs of Rational Functions 1. Find vertical and horizontal asymptotes D. Analyze Families of Graphs 1. Understand symmetries, continuity and transformations of graphs 2. Graph functions a. by hand b. using graphing calculator c. locate critical points E. Find and Graph Inverses of Relations
4.1 4.2 4.3 4.5 8.1	A2 B1 A1,3 D1,2 E1 B3,4 E2 B11	II. Trigonometric Functions A. Measure Angles in Degrees and Radians 1. Find arc length and area of a sector B. Find The Values of the Six Trigonometric Functions for Acute Angles 1. Use trigonometry to find the sides and angles of right triangles 2. Use inverse trigonometric notation C. Find the Values of the Trigonometric Functions for an Angle of Any Size in Standard Position 1. Find reference and coterminal angles for any given angle 2. Find the values of the trigonometric functions where the reference angle is 30, 45, 60 or 90 degrees without a calculator

N. J. Core Curriculum Standards	Indicators	Course Outline/Student Objectives
4.2 4.5	A1,3 E1 A1-5 C3,4	III. Applications of Trigonometric Functions A. Use Techniques of Trigonometry to Measure Quantities Indirectly 1. Using the law of sines 2. Using the law of cosines 3. Using right triangle trigonometry B. Find the Area of a Triangle C. Modeling Real-World Phenomenon 1. Navigation 2. Surveying 3. Apparent size (honors only)
4.2 4.3 4.5 8.1 8.2 9.2	B1 B1-4 C1 A1-5 C3,4 D4 F3 B9 A3 A3	IV. Graphing Trigonometric Functions A. Sketch Graphs of Six Trigonometric Functions 1. By plotting points, recognize the periodic nature of the curves 2. Use period, amplitude and phase shift to translate the parent graphs of sine, cosine and tangent 3. Find appropriate viewing windows on graphing calculator and graph the functions B. Use Graphs to Solve Application Problems 1. Applications in oceanography 2. Applications in electricity C. Sketch Graphs for Inverses of Trigonometric Functions 1. Develop the idea of principal values
4.2 4.3 4.5 8.1	A1,4 B2 C1 D2 A2-5 C1 D3 E2 B11	V. Trigonometric Identities and Equations A. Identities 1. Distinguish between identities and equations 2. Derive and use basic identities a. reciprocal identities b. Pythagorean identities c. quotient identities d. co-function identities 3. Simplify expressions and verify identities 4. Derive and use sum, difference and double angle identities B. Solving Trigonometric Equations 1. Solve for principle values 2. Solve for all real solutions 3. Use various algebraic and trigonometric techniques to simplify and solve the equation

N. J. Core Curriculum Standards	Indicators	Course Outline/Student Objectives
		V. Trigonometric Identities and Equations (continued) C. Solving Applications using Trigonometric Equations (honors only) 1. Angle of inclination
4.1 4.3 4.5	B1,4 B2 C1,2 E1,2 F3	VI. Polar Coordinates and Complex Numbers (honors only) A. Graph Polar Equations 1. By plotting points 2. Using the graphing calculator B. Represent Complex Numbers in Trigonometric Form C. Find Powers and Roots of Complex Numbers
4.2 4.3 4.5	A1,3 C1,2 D2 A1-5 C3,4 E1	VII. Vectors and Parametric Equations A. Understand Vector Notation and Perform Operations Involving Vectors B. Find the Scalar and Vector Products of Vectors C. Apply Parametric Equations to Solve Problems D. Extend Vectors to Three Dimensions and Apply Them (honors only) 1. Sketch planes and find their equations 2. Define and evaluate determinants 3. Define and apply the cross product
4.3 4.5	A1 C1	VIII. Sequences and Series A. Identify a Sequence as Arithmetic or Geometric B. Find a Formula for the n^{th} Term in a Sequence C. Represent a Series Using Sigma Notation
4.4 4.5 8.2	C1-4 A1-5 B1-4 A3	IX. Combinatorics A. Solve Problems Related to the Basic Counting Principle B. Solve Problems Using Permutations 1. With or without repetition 2. Circular permutations C. Solve Problems Using Combinations
4.4 4.5	B1-6 A1-5 B1-4	X. Probability A. Find the Probability of Simple Events B. Find the Odds for the Success and Failure of an Event C. Find the Probability of Independent and Dependent Events D. Find the Probability of Mutually Exclusive and Inclusive Events E. Find Conditional Probability F. Use Binomial Theorem to Find the Probability of an Event G. Make Predictions Based on Probabilities H. Understand the Law of Large Numbers I. Find Geometric Probabilities (regular only)

N. J. Core Curriculum Standards	Indicators	Course Outline/Student Objectives
		X. Probability (continued) J. Find Expected Value and Determine if a Game is Fair (honors only)
4.1 4.3 4.4 4.5 8.1 9.2	C1 D2,3 A1-5 D2 A1-5 B1-4 E1 F1,2 A3 A1-4	XI. Statistics and Data Analysis A. Analyze and Display Mathematical Data 1. Bar graphs and histograms 2. Frequency distribution tables 3. Stem and leaf and box and whisker plots 4. Graphing calculator to displays B. Find Measures of Central Tendency C. Calculate Measures of Variability 1. Convert data to standard values (honors only) D. Use the Normal Distribution Curve E. Understand Sampling and Recognize its Role in Statistical Claims (honors only) F. Find a Confidence Interval for a Corresponding Population Proportion (honors only)
4.1 4.2 4.3 4.5 8.2 9.2	B3 B1 B3 D2 A1-5 C3,4 A3 A3, E6	XII. Matrices A. Operations With Matrices 1. Compare the techniques of pencil and paper with using technology B. Inverses 1. Evaluate determinants 2. Find inverses 3. Solve systems of equations using inverses C. Applications 1. Model real-world data with matrices 2. Apply matrix operations and equations to solve practical problems D. Apply Matrices in Solving Communication, Transition, and Transformation Problems (honors only)
4.2 4.3 4.5	A1,3 C1 B2-4 C6 F3	XIII. Conic Sections (regular only) A. Distance and Midpoint Formulas B. Use Analytic Methods to Prove Geometric Relationships C. Use and Determine the Standard and General Forms of the Equations of Conic Sections 1. Circles 2. Ellipses 3. Parabolas 4. Hyperbolas D. Graph Conic Sections

N. J. Core Curriculum Standards	Indicators	Course Outline/Student Objectives
		XIII. Conic Sections (regular only) (continued) <ol style="list-style-type: none"> 1. Using pencil and paper techniques 2. Verify using graphing calculator E. Applications Involving Construction and Navigation
4.3 4.4 4.5 8.1 8.2	C1 D2 A1,4,5 F1 A3 A3	XIV. Curve Fitting and Models (honors only) <ol style="list-style-type: none"> A. Find Line of Best Fit and Correlation Coefficient for a Set of Data B. Explore Exponential and Power Models to Fit Sets of Data C. Use Graphing Calculators to Find Equations of Regression Lines <ol style="list-style-type: none"> 1. Compare different models to make a judgment of the best model for a set 2. Use regression lines to make predictions 3. Understand how to linearize data
4.1 4.2 4.3 4.5	C1 E2 A2 B2 F4	XV. Introduction to Calculus <ol style="list-style-type: none"> A. Develop an Informal Notion of Limits B. Develop an Understanding of the Concept of Continuity C. Sketch Rational Functions (honors only) D. Approximate Area Under Curves (honors only) <ol style="list-style-type: none"> 1. Using pencil and paper techniques 2. Program graphing calculator to make calculations E. Develop and Use Models Using Series (honors only)

RESOURCES/ACTIVITES GUIDE

- I. Student and Teacher Editions of Text
 - A. Carter, John A., Gilbert J. Cuevas, Berchie Holliday, Daniel Marks, Melissa S. McClure. *Glencoe Advanced Mathematical Concepts, Precalculus with Applications*. Columbus, OH: McGraw Hill, 2006. **(regular level)**
 - B. Brown, Richard G. *Advanced Mathematics: Precalculus with Discrete Mathematics and Data Analysis*. Boston, MA: Houghton Mifflin Company, 1994 **(honors level)**
- II. Supplementary Materials
 - A. Glencoe Teaching Aids
 - 1. Answer Key Maker
 - 2. Answer Key Masters
 - 3. Answer Key Transparencies
 - 4. Five Minute Check and Teaching Transparencies
 - 5. Lesson Planning Guide
 - 6. Solutions Manual
 - B. Glencoe Applications
 - 1. Math and Science Activities Masters
 - 2. Problem Solving and Applications Masters
 - C. Glencoe Masters
 - 1. Study Guide and Practice Masters
 - 2. Prerequisite Skills Masters
 - 3. Enrichment Masters
 - D. Glencoe Assessment and Evaluation
 - 1. ExamView Pro CD-ROM
 - 2. Standardized Test Preparation CD-ROM
 - 3. Assessment and Evaluation Masters
 - E. Glencoe Technology and Multimedia
 - 1. Interactive Chalkboard CD-ROM
 - 2. Advanced Math PASS CD-ROM
 - 3. Multimedia Applications CD-ROM
 - F. Houghton Mifflin Masters
 - 1. Evaluation Masters
 - 2. Extra Practice Masters
 - 3. Study Guide Masters
 - G. Houghton Mifflin Solutions Manual

SUGGESTED AUDIO VISUAL/COMPUTER AIDS

1. Texas Instruments Graphing Calculator
2. Graphing Calculator View Screen for Overhead Projector
3. Overhead Projector
4. Laptop Computer and LCD Projector
5. Internet Access to:
 - www.amc.glencoe.com
 - <http://mathforum.org/dr.math>
 - www.sosmath.com
 - www.homeworkhelp.com/homeworkhelp/freemember/text/math/high/htopic00.htm
6. Computer Applications using Excel Spreadsheets

SUGGESTED MATERIALS

Resources for Students

I. Student Edition of Text

- A. Carter, John A., Gilbert J. Cuevas, Berchie Holliday, Daniel Marks, Melissa S. McClure. *Glencoe Advanced Mathematical Concepts, Precalculus with Applications*. Columbus, OH: McGraw Hill, 2006. **(regular level)**
- B. Brown, Richard G. *Advanced Mathematics: Precalculus with Discrete Mathematics and Data Analysis*. Boston, MA: Houghton Mifflin Company, 1994 **(honors level)**

II. Internet Access to:

www.amc.glencoe.com

<http://mathforum.org/dr.math>

www.sosmath.com

www.homeworkhelp.com/homeworkhelp/freemember/text/math/high/htopic00.htm

III. Classroom Set of Graphing Calculators

Resources for Teacher

I. Teacher Edition of Text and Supplementary Materials

- A. Carter, John A., Gilbert J. Cuevas, Berchie Holliday, Daniel Marks, Melissa S. McClure. *Glencoe Advanced Mathematical Concepts, Precalculus with Applications*. Columbus, OH: McGraw Hill, 2006. **(regular level)**
- B. Brown, Richard G. *Advanced Mathematics: Precalculus with Discrete Mathematics and Data Analysis*. Boston, MA: Houghton Mifflin Company, 1994 **(honors level)**

II. Transparencies

III. Manipulatives

Math Analysis Honors Sequence

Chapter 7	Trigonometric Functions
Chapter 8	Trigonometric Equations and Applications
Chapter 9	Triangle Trigonometry
Chapter 10	Trigonometric Addition Formulas
Chapter 11	Polar Coordinates and Complex Numbers
Chapter 12	Vectors and Determinants

MIDTERM EXAM

Chapter 13 sections 1, 2, 6	Sequences and Series
Chapter 15	Combinatorics
Chapter 16	Probability
Chapter 17	Statistics
Chapter 14	Matrices
Chapter 18	Curve Fitting and Models
Chapter 19	Introduction to Calculus

FINAL EXAM

Math Analysis Sequence

Chapter 1 Sections 1-5	Linear Relations and Functions
Chapter 3 Sections 7,1,2,4,6	The Nature of Graphs
Chapter 5	The Trigonometric Functions
Chapter 6	Graphs of Trigonometric Functions
Chapter 7	Trigonometric Identities and Equations
Chapter 8	Vectors and Parametric Equations

MIDTERM EXAM

Chapter 12	Sequences and Series
Chapter 13	Combinatorics and Probability
Chapter 14	Statistics and Data Analysis
Chapter 2	Systems of Linear Equations and Inequalities (Matrices)
Chapter 15	Introduction to Calculus

FINAL EXAM