Course: **Honors Precalculus**
Year: 2009 - 2010
Instructor: Mrs. Gillingham

Course philosophy: Welcome to my class! Mathematics is an extremely interesting and exciting pursuit. In this course, you have the opportunity to reinforce and extend your understanding of concepts learned in previous mathematics courses as well as to learn more sophisticated skills. Throughout the course, emphasis is placed on the processes used to find solutions, not on the solutions themselves. It is necessary to learn different problem-solving strategies and to be able to explain the methods used to find solutions to problems both in oral and written form. Mathematics is a skill that requires practice, practice, practice. Also, you have opportunities to apply your mathematical knowledge and skills to real-life situations via word problems. In addition, technology is used in a variety of ways to enhance learning.

Materials required: Text
Graphing calculator (TI-84 Plus)
Notebook for homework

Additional requirement:

All students are required to take the SAT 2 Math Level 2 Subject Test in May.

Classroom expectations:

1. Come to class on time.

2. Come to class prepared. Bring all the required materials and completed homework to class each day.

3. When you arrive in class, immediately get out your homework and begin work on the indicated warm-up exercise. Do not wait for me to start class.

4. You are responsible for any material covered or announcements made during your absence.

5. Respect yourself and others. Dishonest and inappropriate behaviors are not acceptable.

6. Finally, give each task your best effort and remain positive. You may find some of the concepts and problems quite challenging, but do not give up. There is great satisfaction found in persevering until a concept is mastered! Mathematics is an extremely interesting and exciting subject to explore!

Homework policies:

Mathematics is a skill, and, like all skills, it must be practiced. Homework is an important part of the learning process and is assigned almost every night. All homework should be done in pencil and kept in a notebook. It must be labeled with the page number and problem numbers. You must include the work for each problem, not just the answer. Most assignments are due at the beginning of the next class period. The maximum amount of focused, uninterrupted time spent on math homework should be 30 minutes/night for a regular course and 40 minutes/night for an honors course.

Grading procedure:

Grades are determined by points earned out of points possible. Major tests are cumulative and are always announced; quizzes may or may not be announced. Weighting factors are as follows:

tests and quizzes	90%
homework	10%

All grading procedures follow the policies written in the Student Handbook. To emphasize the importance of growth throughout the school year, the first trimester will count as 15% of your final grade, the second trimester as 25%, the third trimester as 35%, the mid-year exam as 10%, and the final exam as 15%.

Tentative Honors Precalculus Schedule **Text:** **Precalculus: Graphical, Numerical, Algebraic**
(Demana, Waits, Foley & Kennedy, 2007)

Week	Chapters	Sections	Topics
1	P	P.7	Solving inequalities
2	1	All	Functions and graphs
3	1	All	Functions and graphs
4	1	All	Functions and graphs
5	1	All	Functions and graphs
6	2	All	Polynomial, power, and rational functions
7	2	All	Polynomial, power, and rational functions
8	2	All	Polynomial, power, and rational functions
9	2	All	Polynomial, power, and rational functions
10	4	All except 4.6	Trigonometric functions
11	4	All except 4.6	Trigonometric functions
12	4	All except 4.6	Trigonometric functions
13	4	All except 4.6	Trigonometric functions
14	5	All	Analytic trigonometry
15	5	All	Analytic trigonometry
16	5	All	Analytic trigonometry
17	5	All	Analytic trigonometry
18	6	6.1 – 6.4	Applications of trigonometry
19	6	6.1 – 6.4	Applications of trigonometry
20			Review and mid-year exam
21	6	6.1 – 6.4	Applications of trigonometry
22	8	All except 8.4, 8.5	Analytic geometry in 2D and 3D
23	8	All except 8.4, 8.5	Analytic geometry in 2D and 3D
24	8	All except 8.4, 8.5	Analytic geometry in 2D and 3D
25	9	All except 9.6	Discrete mathematics
26	9	All except 9.6	Discrete mathematics
27	9	All except 9.6	Discrete mathematics
28	9	All except 9.6	Discrete mathematics
29	10	10.3	Limits
30			Review for SAT 2
31			Review for SAT 2
32	7	7.2 – 7.3	Matrix algebra
33	7	7.2 – 7.3	Matrix algebra
34	6	6.5	Graphs of polar equations
35			Final exam

Honors Precalculus Outline

I. Solving inequalities

A. Interval notation
   1. Bounded
   2. Unbounded
   3. Types
      a. Open
      b. Closed

B. Solving absolute value inequalities

C. Solving quadratic inequalities
   1. Algebraically
   2. Graphically

D. Approximating solutions to inequalities

E. Projectile motion

II. Functions and graphs

A. Modeling and equation solving
   1. Numerical models
   2. Algebraic models
   3. Graphical models
   4. Zero Factor Property
   5. Fundamental connections
      a. Root or solution of an equation
      b. Zero of a function
      c. *x*-intercept of a graph
   6. Problem solving
      a. Polya's four step process
      b. Applying the process
   7. Graphing calculator failure and hidden behavior

B. Functions and their properties
   1. Definition and notation
   2. Domain and range
   3. Continuity
      a. Removable discontinuity
      b. Jump discontinuity
      c. Infinite discontinuity
   4. Increasing and decreasing functions
   5. Boundedness
   6. Local and absolute extrema
   7. Symmetry
   8. Asymptotes
   9. End behavior

C. Twelve basic functions
   1. Identity function
   2. Squaring function

3. Cubing function
4. Reciprocal function
5. Square root function
6. Exponential function
7. Natural logarithm function
8. Sine function
9. Cosine function
10. Absolute value function
11. Greatest integer function
12. Logistic function

D. Defining a function piecewise

E. Building functions from functions
1. Combining functions algebraically
   a. Sum
   b. Difference
   c. Product
   d. Quotient
2. Composition
3. Relations and implicitly defined functions

F. Relations defined parametrically

G. Inverse relations and inverse functions
1. Horizontal line test
2. Inverse reflection principle
3. Inverse composition rule

H. Graphical transformations
1. Vertical and horizontal translations
2. Reflections across axes (including absolute value compositions)
3. Vertical and horizontal stretches and shrinks
4. Combining transformations

I. Modeling with functions
1. Functions from formulas
2. Functions from graphs
3. Functions from verbal descriptions
4. Functions from data

III. Polynomial, power, and rational functions

A. Linear and quadratic functions and modeling
1. Polynomial functions
   a. Names (zero, constant, linear, quadratic)
   b. Form
   c. Degree
2. Linear functions and their graphs
   a. Average rate of change
   b. Linear correlation and modeling
   c. Regression analysis
3. Quadratic functions and their graphs
   a. Forms
      i. Standard quadratic form

ii. Vertex form
b. Applications
i. Maximum value problem
ii. Vertical free-fall motion

B. Power functions with modeling
1. Power functions and variation
a. Direct
b. Inverse
2. Monomial functions and their graphs
3. Graphs of power functions
4. Modeling with power functions

C. Polynomial functions of higher degree with modeling
1. Graphs of polynomial functions
a. Local extrema
b. Zeros
2. End behavior of polynomial functions (leading term test)
3. Zeros of polynomial functions
a. Odd multiplicity
b. Even multiplicity
4. Intermediate Value Theorem
5. Modeling

D. Real zeros of polynomial functions
1. Long division and the division algorithm
2. Remainder Theorem
3. Factor Theorem
4. Synthetic division
5. Rational Zeros Theorem
6. Upper and lower bounds

E. Complex zeros
1. Fundamental Theorem of Algebra
2. Linear Factorization Theorem
3. Complex conjugate zeros
4. Factors of a polynomial with real coefficients

F. Graphs of rational functions
1. Definition of rational functions
2. Transformations of the reciprocal function
3. Limits and asymptotes
4. Analyzing graphs of rational functions

G. Solving equations in one variable
1. Solving rational equations by clearing fractions
2. Eliminating extraneous solutions
3. Applications

H. Solving inequalities in one variable
1. Polynomial inequalities
2. Rational inequalities
3. Solving an inequality involving a radical
4. Solving an inequality involving absolute value
5. Applications

IV. Trigonometric functions

A. Angles and their measures
   1. Degrees and radians
      a. Definitions
      b. Degree-radian conversion
   2. Circular arc length
   3. Angular and linear motion

B. Trigonometric functions of acute angles
   1. Right triangle trigonometry
      a. Sine
      b. Cosine
      c. Tangent
      d. Cotangent
      e. Secant
      f. Cosecant
   2. Evaluating trigonometric functions
      a. Without a calculator (degrees of 45 and 30)
      b. With a calculator (common calculator errors)
   3. Applications of right triangle trigonometry

C. The circular functions
   1. Trigonometric functions of any angle
      a. Coterminal angles
      b. Reference triangles
      c. Quadrantal angles
   2. Trigonometric functions of real numbers
   3. Periodic functions
   4. The 16-point unit circle

D. Graphs
   1. Sine and cosine: sinusoids
      a. Amplitude
      b. Period
      c. Frequency
      d. Modeling periodic behavior with sinusoids
   2. Tangent and cotangent
   3. Secant and cosecant

E. Inverse trigonometric functions
   1. Inverse sine or arcsine
      a. Evaluating without a calculator
      b. Evaluating with a calculator
   2. Inverse cosine or arccosine
   3. Inverse tangent or arctangent
   4. Composing trigonometric and inverse trigonometric functions

F. Solving problems with trigonometry
   1. Angle of elevation or angle of depression
   2. Navigation
   3. Simple harmonic motion

V. Analytic trigonometry

A. Fundamental identities
   1. Types of identities
      a. Basic identities that follow from definitions
         i. Reciprocal identities
         ii. Quotient identities
      b. Pythagorean identities
      c. Cofunction identities
      d. Odd-even identities
   2. Simplifying trigonometric expressions
   3. Solving trigonometric equations

B. Proving trigonometric identities
   1. Disproving non-identities
   2. Identities in calculus

C. Sum and difference identities
   1. Cosine of a sum or difference
   2. Sine of a sum or difference
   3. Using the sum/difference formulas
   4. Tangent of a sum or difference

D. Multiple-angle identities
   1. Double-angle identities
   2. Power-reducing identities
   3. Half-angle identities
   4. Solving trigonometric equations

E. The Law of Sines
   1. Derivation
   2. Solving triangles (AAS, ASA)
   3. Ambiguous case (SSA)
   4. Applications

F. The Law of Cosines
   1. Derivation
   2. Solving triangles (SAS, SSS)
   3. Triangle area and Heron's Formula
   4. Applications

VI. Applications of trigonometry

A. Vectors
   1. Definition of two-dimensional vector
      a. Head minus tail rule
      b. Magnitude
   2. Vector operations
      a. Vector addition
      b. Scalar multiplication
   3. Unit vectors
   4. Direction angles
   5. Applications

6. Dot product
    a. Definition
    b. Properties
7. Angle between two vectors
8. Orthogonal vectors

B. Parametric equations
1. Eliminating the parameter
2. Lines and line segments
3. Simulating motion

C. Polar coordinates
1. Plotting points in the polar coordinate system
2. Finding all polar coordinates of a point
3. Converting from polar to rectangular coordinates and vice versa
4. Equation conversion

D. Complex numbers
1. Plotting complex numbers in a complex plane
2. Absolute value (modulus) of a complex number
3. Trigonometric form of a complex number

E. Graphs of polar equations
1. Symmetry
2. Analyzing polar graphs
3. Types of polar curves

VII. Analytic geometry in two and three dimensions

A. Conic sections
1. Parabolas
    a. Definition
    b. Standard equation
    c. Focus, directrix, axis, focal length, and focal width
    d. Translations of parabolas
    e. Reflective property
2. Ellipses
    a. Definition
    b. Standard equation
    c. Focal axis, foci, vertices, semi-major axis, semi-minor axis, Pythagorean relation
    d. Translations of ellipses
    e. Orbits and eccentricity
    f. Reflective property
3. Hyperbolas
    a. Definition
    b. Standard equation
    c. Focal axis, foci, vertices, Pythagorean relation, asymptotes
    d. Translations of hyperbolas
    e. Orbits and eccentricity
    f. Reflective property

B. Three-dimensional Cartesian coordinate system
1. Three-dimensional Cartesian coordinates

2. Distance and midpoint formulas
3. Standard equation of a sphere
4. Equation of a plane in Cartesian space

VIII. Discrete mathematics

A. Basic combinatorics
   1. Discrete versus continuous
   2. Multiplication principle of counting
   3. Permutations
      a. Distinguishable permutations
      b. Permutation counting formula
      c. Applications
   4. Combinations
      a. Combination counting formula
      b. Distinguishing combinations from permutations
   5. Formula for counting subsets of a set with *n* objects

B. The Binomial Theorem
   1. Powers of binomials
   2. Binomial coefficients
   3. Pascal's Triangle

C. Probability
   1. Sample spaces
   2. Probability of an event
      a. Equally likely outcomes
      b. Outcomes not equally likely
   3. Probability function
   4. Strategy for determining probabilities
      a. Multiplication principle of probability
      b. Dependent and independent outcomes
   5. Venn diagrams and tree diagrams
   6. Conditional probability

D. Sequences
   1. Finite and infinite
   2. Defining a sequence
      a. Explicitly
      b. Recursively
   3. Limits of infinite sequences
      a. Convergence
      b. Divergence
   4. Arithmetic sequences
      a. Common difference
      b. Finding *n*th terms
   5. Geometric sequences
      a. Common ratio
      b. Finding *n*th terms
   6. Sequences and graphing calculators

E. Series
   1. Summation notation

2. Sums of finite arithmetic and geometric sequences
3. Infinite series
    a. Limits of partial sums
    b. Convergence of geometric series
    c. Sum of an infinite geometric series

F. Statistics and data
1. Graphical
    a. Displaying categorical data
    b. Stemplots
        i. Split-stem stemplots
        ii. Back-to-back stemplots
    c. Frequency tables
    d. Histograms
    e. Time plots
2. Algebraic
    a. Measures of central tendency
        i. Mean, median, and mode
        ii. Weighted mean
    b. Measures of dispersion
        i. Range
        ii. Five-number summary
        iii. Boxplots (including modified boxplots)
        iv. Variance and standard deviation
    c. Normal distributions

IX. Limits

A. Defining a limit informally
B. Properties of limits
C. Limits of continuous functions
D. One-sided and two-sided limits
E. Limits involving infinity

X. Matrix algebra

A. Definition
B. Determining the order of a matrix
C. Matrix addition and subtraction
D. Scalar multiplication
E. Matrix multiplication
F. Identity and inverse matrices
G. Determinants of square matrices
H. Finding inverse matrices
I. Properties of matrices
J. Augmented matrices