

**Course:** 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

**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 Precalculus Schedule**    **Text: Precalculus: A Graphing Approach**  
**(Hungerford, Jovell & Mayberry, 2006)**

<u>Week</u>	<u>Chapters</u>	<u>Sections</u>	<u>Topics</u>
1	1	All	Number patterns
2	1 & 2	All	Number patterns; Equations and inequalities
3	2	All	Equations and inequalities
4	3	All	Functions and graphs
5	3	All	Functions and graphs
6	3	All	Functions and graphs
7	4	All	Polynomial and rational functions
8	4	All	Polynomial and rational functions
9	4	All	Polynomial and rational functions
10	6	All	Trigonometry
11	6	All	Trigonometry
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12	6	All	Trigonometry
13	7	All	Trigonometric graphs
14	7	All	Trigonometric graphs
15	7	All	Trigonometric graphs
16	8	All	Solving trigonometric equations
17	8	All	Solving trigonometric equations
18	8	All	Solving trigonometric equations
19	9	All	Trigonometric identities and proof
20			Review and mid-year exam
21	9	All	Trigonometric identities and proof
22	10	All except 10.4	Trigonometric applications
23	10	All except 10.4	Trigonometric applications
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24	10	All except 10.4	Trigonometric applications
25	11	All except 11.6,11.7	Analytic geometry
26	11	All except 11.6,11.7	Analytic geometry
27	11	All except 11.6,11.7	Analytic geometry
28	11	All except 11.6,11.7	Analytic geometry
29	12	All	Systems and matrices
30	12	All	Systems and matrices
31	12	All	Systems and matrices
32	13	All	Statistics and probability
33	13	All	Statistics and probability
34			Review
35			Final exam

# Precalculus Outline

## **I. Number patterns**

- A. Real numbers, relations, and functions
- B. Mathematical patterns
  - 1. Definition of a sequence
  - 2. Sequence notation
  - 3. Recursively defined sequence
- C. Arithmetic sequences
  - 1. Recursive form
  - 2. Explicit form
  - 3. Summation notation
  - 4. Partial sums
- D. Lines
- E. Linear models
- F. Geometric sequences
  - 1. Recursive form
  - 2. Explicit form
  - 3. Partial sums

## **II. Equations and inequalities**

- A. Solving equations graphically
  - 1. Complete graphs
  - 2. The intersection method
  - 3. Zeros,  $x$ -intercepts, and solutions
  - 4. The  $x$ -intercept method
  - 5. Technological quirks
- B. Solving quadratic equations algebraically
- C. Applications of equations
- D. Other types of equations
- E. Inequalities
  - 1. Interval notation
  - 2. Equivalent inequalities
  - 3. Solving linear inequalities
  - 4. Solving other inequalities
- 5. Quadratic and factorable inequalities

## **III. Functions and graphs**

- A. Functions
- B. Graphs of functions
  - 1. Increasing and decreasing
  - 2. Local maxima and minima
  - 3. Concavity and inflection points
  - 4. Graphs of piecewise defined and greatest integer functions
  - 5. Parametric graphing

- C. Quadratic functions
- D. Graphs and transformations
  - 1. Parent functions
  - 2. Vertical and horizontal shifts
  - 3. Reflections across the  $x$ - and  $y$ -axis
  - 4. Vertical and horizontal stretches and shrinks
  - 5. Combining transformations
- E. Symmetry
  - 1.  $x$ - and  $y$ -axis symmetry
  - 2. Origin symmetry
  - 3. Symmetry tests
  - 4. Even and odd functions
- F. Operations on functions
- G. Inverse functions
- H. Rates of change

#### **IV. Polynomial and rational functions**

- A. Polynomial functions
- B. Real zeros
- C. Graphs of polynomial functions
  - 1. Boundedness
  - 2. Continuity
  - 3. End behavior
  - 4. Intercepts
  - 5. Multiplicity
  - 6. Local extrema
  - 7. Points of inflection
- D. Rational functions
  - 1. Domain
  - 2. Intercepts
  - 3. Continuity
  - 4. Vertical asymptotes
  - 5. Big-little concept
  - 6. Holes
  - 7. End behavior
  - 8. Horizontal asymptotes
  - 9. Other asymptotes
- E. Complex numbers
- F. The Fundamental Theorem of Algebra

#### **V. Trigonometry**

- A. Right triangle trigonometry
  - 1. Angles and degree measure
  - 2. Similar triangles and trigonometric ratios
  - 3. Sine, cosine, and tangent
  - 4. Cosecant, secant, and cotangent

- B. Trigonometric applications
  - 1. Solving right triangles
  - 2. Angles of elevation and depression
- C. Angles and radian measure
  - 1. Initial and terminal sides
  - 2. Standard position and coterminal angles
  - 3. Arc length and radian measure
  - 4. Unit circle
  - 5. Converting between degrees and radians
- D. Trigonometric functions
  - 1. Trigonometric ratios in the coordinate plane
  - 2. Trigonometric functions of a real variable
  - 3. Unit circle descriptions of trigonometric functions
  - 4. Reference angles
  - 5. Trigonometric ratios of coterminal angles
- E. Basic trigonometric identities
  - 1. Quotient identities
  - 2. Reciprocal identities
  - 3. Pythagorean identities
  - 4. Period of a function
  - 5. Periodicity identities
  - 6. Negative angle identities

## **VI. Trigonometric graphs**

- A. Graphs of sine, cosine, and tangent
  - 1. Domain and range
  - 2. Basic transformations
  - 3. Even and odd functions
- B. Graphs of cosecant, secant, and cotangent
  - 1. Domain and range
  - 2. Basic transformations
- C. Periodic graphs and amplitude
- D. Periodic graphs and phase shifts

## **VII. Solving trigonometric equations**

- A. Graphical solutions
  - 1. Intersection method
  - 2.  $x$ -intercept method
- B. Inverse trigonometric functions
  - 1. Domain and range
  - 2. Graphs
  - 3. Evaluation
  - 4. Composition of inverse functions
- C. Algebraic solutions
- D. Simple harmonic motion and modeling

## VIII. Trigonometric identities and proof

- A. Identities and proofs
  - 1. Graphical testing
  - 2. Strategies for proving trigonometric identities
- B. Addition and subtraction identities
  - 1. For sine and cosine
  - 2. For tangent
  - 3. Cofunction identities
- C. Other identities
  - 1. Double-angle identities
  - 2. Power-reducing identities
  - 3. Half-angle identities
- D. Using trigonometric identities

## IX. Trigonometric applications

- A. Law of Cosines
- B. Law of Sines
  - 1. The ambiguous case
  - 2. Area of a triangle
  - 3. Heron's Formula
- C. Complex plane and polar form for complex numbers
  - 1. Real and imaginary axis
  - 2. Absolute value of a complex number
  - 3. Polar (trigonometric) form of a complex number
  - 4. Polar multiplication and division
- D. Vectors
  - 1. Magnitude
  - 2. Components
  - 3. Scalar multiplication
  - 4. Vector addition and subtraction
- E. Applications of vectors
  - 1. Unit vectors
  - 2. Linear combination of  $\mathbf{i}$  and  $\mathbf{j}$
  - 3. Direction angles
  - 4. Dot product
  - 5. Angles between vectors
  - 6. Orthogonal vectors

## X. Analytic geometry

- A. Ellipses
  - 1. Definition - foci, center, vertices, major and minor axes
  - 2. Equation of an ellipse centered at the origin
  - 3. Characteristics
  - 4. Graphing an ellipse
  - 5. Writing the equation of an ellipse

- 6. Applications
- B. Hyperbolas
  - 1. Definition - foci, center, vertices, asymptotes, focal axis
  - 2. Equation of a hyperbola centered at the origin
  - 3. Characteristics
  - 4. Graphing a hyperbola
  - 5. Writing the equation of a hyperbola
  - 6. Applications
- C. Parabolas
  - 1. Definition - focus, directrix, vertex, axis
  - 2. Equation of a parabola with vertex at the origin
  - 3. Characteristics
  - 4. Graphing a parabola
  - 5. Writing the equation of a parabola
  - 6. Applications
- D. Translations of conics
  - 1. Horizontal and vertical shifts
  - 2. Standard equations of conic sections
- E. Polar coordinates
  - 1. Locating points in a polar coordinate system
  - 2. Polar/rectangular coordinate conversion
- F. Eccentricity

## **XI. Systems and matrices**

- A. Solving systems of equations
- B. Graphs in 3D
  - 1. Three-dimensional coordinates
  - 2. Graphical representations of  $3 \times 3$  systems
- C. Matrices
  - 1. Augmented matrices
  - 2. Elementary row operations
  - 3. Reduced row-echelon form
  - 4. Gauss-Jordan elimination
- D. Matrix operations
  - 1. Matrix addition and subtraction
  - 2. Scalar multiplication
  - 3. Matrix multiplication
  - 4. Directed networks
- E. Matrix methods for square systems
  - 1. Matrix equations
  - 2. Identity matrices
  - 3. Inverse matrices
  - 4. Curve fitting
- F. Nonlinear systems
  - 1. Algebraic solutions
  - 2. Graphical solutions

## **XII. Statistics and probability**

- A. Basic statistics
  - 1. Categorical and quantitative data
  - 2. Data displays
    - a. Frequency tables
    - b. Bar graphs
    - c. Pie charts
    - d. Stem plots
    - e. Histograms
  - 3. Shapes of distributions
    - a. Uniform
    - b. Symmetric
    - c. Skewed
- B. Measures of center and spread
  - 1. Mean, median, mode
  - 2. Standard deviation, range, interquartile range
  - 3. Five-number summary and box plots
- C. Basic probability
  - 1. Definitions
  - 2. Probability distributions
  - 3. Mutually exclusive events
  - 4. Independent events
  - 5. Expected value of a random variable
- D. Determining probabilities
  - 1. Experimental estimates of probability
  - 2. Theoretical estimates of probability
  - 3. Equally likely outcomes
  - 4. Fundamental Counting Principle
  - 5. Permutations and combinations
  - 6. Binomial distributions
- E. Normal distributions
  - 1. Properties of the normal curve
  - 2. The 68-95-99.7 Rule
  - 3. Standard normal curve
  - 4. Finding  $z$ -values