

Lake Zurich High School Mathematics Department

H – Pre-Calculus

Course Description

Prerequisites:	H-Algebra II with a grade of B or better
Open To:	10, 11, 12
Credit:	1 unit
Level:	Honors

This course is designed as an Honors course that will give the student thorough preparation for college and/or high school AP Calculus. This course will include trigonometry, analytic geometry, limits, field properties of numbers, wrapping functions, transcendental functions, matrix theory, complex numbers, polar coordinates, rates of change, and the basics of derivatives and integrals. Students are required to bring a TI-83 or TI-84 graphing calculator to class on a daily basis.

Textbook

Title:	PreCalculus with Limits – A Graphing Approach
Publisher:	Houghton Mifflin
Author(s)	Larson, Hostetler, Edwards
Copyright date:	2005 – Fourth Edition
ISBN number:	(0-618-39480-X) (978-0-618-39480-7)

Course Objectives

At the end of the course, the student will be able to:

1. Simplify algebraic expressions and factor polynomials.
2. Solve polynomial equations, radical and rational exponent equations, compound and absolute value inequalities, and determine their domain.
3. Sketch and analyze graphs of polynomials and rational functions.
4. Apply properties of logarithmic and exponential functions.
5. Evaluate trigonometric functions at given angles and sketch graphs of trigonometric functions.
6. Use trigonometric identities to simplify, prove or solve trigonometric expressions and statements.
7. Apply trigonometry to solve triangles, represent vectors and perform operations with complex numbers.
8. Solve systems of equations by hand and with technology.
9. Analyze arithmetic and geometric sequences and series.
10. Sketch and analyze graphs from analytic geometry.
11. Analyze three dimensional space using vectors

Course Syllabus

1st Semester

Chapter	Topic
P1	Review of Algebraic Properties
P2	Solving Equations and Inequalities Algebraically and Graphically
1	Functions and Graphs
2	Polynomial and Rational Functions
3	Exponential and Logarithmic Functions
4	Trigonometric Functions
5	Analytic Trigonometry

2nd Semester

Chapter	Topic
6	Additional Topics in Trigonometry
7	Linear Systems and Matrices
8	Sequences, Series and Probability
9	Topics in Analytic Geometry
10	Analytic Geometry in Three Dimensions

Chapter and Unit Objectives

Chapter P1 Prerequisites - 1

Major Objectives: Simplify algebraic expressions and factor polynomials.

Detailed Unit Objectives:

1. Categorize real numbers into subsets.
2. Use absolute value to write distance inequalities.
3. Simplify expressions with radicals or rational exponents.
4. Use blueprints to expand binomials or factor polynomials.
5. Simplify rational expressions and find their domain.
6. Factor expressions with rational exponents.

Chapter P2 Prerequisites - 2

Major Objective: Solve various equations and inequalities from Algebra II.

Detailed Unit Objectives:

1. Solve equations with fractions by multiplying by the LCD.
2. Solve for zeroes, points of intersection, and x/y intercepts with a graphing calculator.
3. Solve quadratic equations by various methods.
4. Solve equations with radicals or rational exponents.
5. Solve equations and inequalities with absolute values.
6. Solve compound inequalities algebraically and graphically.

Chapter 1 Functions and Their Graphs

Major Objectives: Analyze functions, their graphs, and their inverses.

Detailed Unit Objectives:

1. Evaluate functions and find their domains.
2. Analyze graphs of functions.
3. Identify and graph shifts, reflections, and non-rigid transformations of functions.
4. Find arithmetic combinations and compositions of functions.
5. Find inverse functions graphically and algebraically.

Chapter 2 Polynomial and Rational Functions

Major Objectives: Sketch and analyze graphs of polynomials and rational functions.

Detailed Unit Objectives:

1. Sketch and analyze graphs of quadratic and polynomial functions.
2. Use quadratic models to find minimum and maximum values of real life applications.
3. Use long division and synthetic division to divide polynomials by other polynomials.
4. Determine the numbers of rational and real zeros of polynomial functions, and find the zeros.
5. Perform operations with complex numbers and plot complex numbers in the complex plane.
6. Determine the domains, find the asymptotes, and sketch the graphs of rational functions.

Chapter 3 Exponential and Logarithmic Functions

Major Objectives: Apply properties of logarithmic and exponential functions.

Detailed Unit Objectives:

1. Recognize, evaluate and graph exponential and logarithmic functions.
2. Rewrite logarithmic functions with different bases.
3. Use properties of logarithms to evaluate, rewrite, expand, or condense logarithmic expressions.
4. Solve exponential and logarithmic equations.
5. Use exponential growth models, exponential decay models, Gaussian models, logistic models, and logarithmic models to solve real-life problems.

Chapter 4 Trigonometric Functions

Major Objectives: Evaluate trigonometric functions at given angles and sketch graphs of trigonometric functions.

Detailed Unit Objectives:

1. Describe an angle and convert between degree and radian measure.
2. Identify a unit circle and describe its relationship to real numbers.
3. Evaluate trigonometric functions of any angle.
4. Use fundamental trigonometric identities.
5. Sketch graphs of trigonometric functions.
6. Evaluate inverse trigonometric functions.
7. Evaluate the compositions of trigonometric functions.
8. Use trigonometric functions to model and solve real-life problems.

Chapter 5

Analytic Trigonometry

Major Objectives: Use trigonometric identities to simplify, prove or solve trigonometric expressions and statements.

Detailed Unit Objectives:

1. Use fundamental trigonometric identities to evaluate trigonometric functions and simplify trigonometric expressions.
2. Verify trigonometric identities.
3. Use standard algebraic techniques and inverse trigonometric functions to solve trigonometric equations.
4. Use sum and difference formulas, double-angle formulas, half-angle formulas to rewrite and evaluate trigonometric functions.

Chapter 6

Additional Topics in Trigonometry

Major Objectives: Apply trigonometry to solve triangles, represent vectors and perform operations with complex numbers.

Detailed Unit Objectives:

1. Use the Law of Sines and the Law of Cosines to solve oblique triangles.
2. Find areas of oblique triangles.
3. Represent vectors as directed line segments and perform mathematical operations on vectors.
4. Find direction angles of vectors.
5. Find the dot product of two vectors and use properties of the dot product .
6. Multiply and divide complex numbers written in trigonometric form.
7. Find powers and n th roots of complex numbers.

Chapter 7

Linear Systems and Matrices

Major Objectives: Solve systems of equations by hand and with technology.

Detailed Unit Objectives:

1. Use systems of equations to model and solve real-life problems.
2. Solve word problem applications using systems in two or three variables.
3. Solve systems of equations using the Gaussian method.
4. Solve systems of equations using a graphing calculator.
5. Find partial fraction decompositions of a given fraction.
6. Understand the relationship between the graph of a system and its solution(s).

Chapter 8 Sequences, Series and Probability

Major Objectives: Analyze arithmetic and geometric sequences and series.

Detailed Unit Objectives:

1. Use sequence, factorial, and summation notation to write the terms and sums of sequences.
2. Recognize, write, and use arithmetic sequences and geometric sequences.
3. Use mathematical induction to prove statements involving a positive integer n .
4. Use the Binomial Theorem and Pascal's Triangle to calculate binomial coefficients and write binomial expansions.

Chapter 9 Topics in Analytic Geometry

Major Objectives: Sketch and analyze graphs from analytic geometry.

Detailed Unit Objectives:

1. Write equations for parabolas, circles, hyperbolas and ellipses in standard and general form.
2. Graph the conic sections and produce graphs on a graphing utility.
3. Evaluate sets of parametric equations for given values of the parameter and graph curves that are represented by sets of parametric equations.
4. Rewrite sets of parametric equations as singular rectangular equations and find sets of parametric equations for graphs.
5. Plot points in the polar coordinate system and convert points from rectangular to polar form and vice versa.
6. Convert equations from polar coordinate form to rectangular form and vice versa.
7. Graph polar equations.

Chapter 10 Analytic Geometry in Three Dimensions

Major Objectives: Analyze three dimensional space using vectors.

Detailed Unit Objectives:

1. Plot points, find distances between points, and find midpoints of line segments connecting points in space.
2. Write equations of spheres and graph traces of surfaces in space.
3. Represent vectors and find dot products of and angles between vectors in space.
4. Find cross products of vectors in space and use geometric properties of the cross product.
5. Use triple scalar products to find volumes of parallelepipeds.
6. Find parametric and symmetric equations of lines in spaces.
7. Find distances between points and planes in space.

Major Objectives: Analyze limits and use them to find derivatives and areas under curves.

Detailed Unit Objectives:

1. Determine if limits exist and, if so, evaluate limits.
2. Use direct substitution, dividing out and rationalizing technique to evaluate limits.
3. Approximate limits graphically and numerically with tables.
4. Evaluate one sided limits, limits of difference quotients from calculus, limits at infinity, limits of sequences, and limits of summations.
5. Use the tangent line to approximate the slope of a graph at a point.
6. Use the limit definition of slope to find exact slopes.
7. Find derivatives of function and use them to find slopes of graphs.
8. Use rectangles to approximate areas of plane regions.
9. Use limits of summations to find areas of plane regions.