

**Walter Payton College Prep**  
**Honors Precalculus Course Outline 2017- 2018**

*Textbook: Precalculus with Limits, 3rd Ed. by Larson, Hostetler, Edwards*

All of the functions that are necessary to take a full Calculus course are studied here. Polynomial, rational, exponential and logarithmic functions are studied in greater depth than in Algebra 2. Unit circle trigonometry is revisited, this time with the introduction of radian angle measures, along with graphing in the coordinate plane and manipulations using identities. Transformation of functions is a recurring theme of this course and receives strong emphasis. Finally, the concept of the derivative is developed in anticipation of Calculus. As in all math courses at Walter Payton, students learn to move fluidly between graphic, numeric and symbolic representations of functions.

1<sup>st</sup> Semester: Transformations of Functions, Exponentials, Logarithms, Trigonometry

2<sup>nd</sup> Semester: Further Trigonometry, Polynomials, Rational Functions, Conic Sections, Limits, Derivatives

### Quarter 1

1. Graphs and Transformations (Chapter 1)
  - Transformations of elementary functions (linear, quadratic, square root, absolute value, and piecewise): translation, reflection, scaling.
  - Increasing, decreasing, and constant intervals and relative/absolute minima and maxima. Even/Odd functions
  - Composition of functions and inverse functions.
  
2. Polynomials (Chapter 2.1 to 2.5)
  - Quadratic Functions, optimization
  - Polynomial end behavior
  - Factor and remainder theorem,
  - Zeros, complex numbers, Fundamental theorem of Algebra
  - Difference Quotient

### Quarter 2

3. Rational Functions (Ch. 2.6 & 2.7) & Limits (Ch. 12.1 - 12.4)
  - Rational Functions
  - Graphs of rationals, asymptotes
  - Limits: notation, methods of evaluation
  - ARC to IRC - Tangent line problem
  - Derivatives
  
4. Conics (Chapter 10.1-10.3)
  - Conics: Parabolas, Ellipses, Hyperbolas
  - Parametrics
  
5. Law of Sines and Cosines: (Chapter 6.1-6)
  - Law of Sines
  - Law of Cosines
  - Applications

### Quarter 3

6. Trigonometric Functions (Chapter 4)
  - Angles: Radians and Degrees, terminal side
  - Right Triangle Trig.
  - Trig. of any angle; reference angles, estimation
  - Unit circle & it's properties
  - Graphs of trig. functions (domain/range, amplitude, period) and transformations
  - Inverse trig functions
7. Analytic Trigonometry (Chapter 5)
  - Fundamental Identities and their uses
  - Verifying/proving identities
  - Solving trig. equations
  - Formulas: Sum. Difference, Multiple-angle, Product-Sum

### Quarter 4

8. Exponential and Logarithmic Functions (Chapter 3)
  - The exponential function and its transformations: components, properties.
  - The logarithmic function and its transformations: components, properties.
  - Solving exponential and logarithmic equations.
9. Introduction to Calculus
  - Review of Difference Quotient and Limits
  - ARC to IRC
  - Increasing, Decreasing, Concavity, Points of Inflection Review
  - Derivatives of Polynomial Functions

### **Quarter 3: Trig Extensions, Polynomials and Rational Functions**

Topics:

- Further trig extensions: simplifying expressions, verifying identities, solving equations on a closed interval, utilizing sum and difference identities.
- Law of sines: solve oblique triangles given AAS, ASA, or SSA information.
- Law of cosines: solve oblique triangles given SSS or SAS information.
- Polynomial behavior: roots, zeros, end behavior, graphing and sign graphs.
- Long Division of Polynomials.
- Complex roots and conjugates.
- Rational functions: roots, asymptotes, holes.

Major projects/assessments:

- Derivation of cofunction identities, oblique triangle area formula, and  $\sin(u + v)$  identity.
- Solving trig equations on specified intervals as well as over the reals.
- Nine Squares trig identity extra credit assignment.
- Rice Krispies Lab—area maximization

### **Quarter 4: Conic Sections, Limits, and the Derivative**

Topics:

- Geometric definitions of parabolas, ellipses, and circles. (Hyperbolas can be considered if time permits).
- Limits: estimation of limits graphically and numerically, evaluation of limits to infinity and rationalizing techniques, evaluation of limits via substitution.
- Introduction to the derivative: approximating slopes of tangent lines using the definition of the derivative

Major projects/assessments:

- Paper Folding Activity: create parabolas and ellipses using patty paper
- Analysis of the Mirascope via Geometer's Sketchpad (teacher led)
- Avery Rocket Video and Discussion
- Nspire Secant to Tangent Line Activity (guided worksheet)