**Walter Payton College Prep**

# Honors Precalculus BC Course Outline 2017- 2018

*Textbook: Precalculus, 7th ed. (Cohen. Lee, Sklar)*

Honors Pre-Calculus BC extends and deepens the concepts of Honors Algebra II BC while allowing the students to explore newer ideas as well, providing them with a solid foundation for AP Calculus BC and beyond. Students should leave the course with the facility to perform algebraic manipulations, to see structure at various levels in mathematical expressions, to achieve desired geometric transformations of graphs, to encode given information in mathematical relations, to optimize relevant quantities, to determine and interpret rates of change, to work in the coordinate system that is natural to a given scenario, and to persevere in solving problems.

Effectively a double-honors course, Honors Pre-Calculus BC spends less time on review to allow more time on solving interesting problems. In nearly all activities, students collaborate in the problem-solving process, forming and testing conjectures while critiquing the ideas of others, thus engaging in the Standards for Mathematical Practice as defined by the Common Core. The mathematics is understood in terms of big ideas, and connections are made frequently with concepts from Honors Geometry and Honors Algebra II BC. Furthermore, topics specific to the AP Calculus BC curriculum are covered during the year, and students completing Honors Pre-Calculus BC will have seen what is essentially the first quarter of college-level introductory calculus course.

The mathematical content of the course includes Parametric Equations; Relations and Transformations; Rates of Change; Sequences and Series; Counting and Probability; Inductive Proof; Exponential, Logarithmic, Logistic, Radical, and Rational Functions; Triangle Trigonometry; Unit Circle Trigonometry; Trigonometric Identities and Equations; Polar Graphing; Vectors; Complex Numbers; Theory of Equations; Conic Sections; and Markov Chains.

## Quarter 1:

Topics:

- Parametric Graphing: students practice old skills in a new context by working with parametrically defined curves
- Review of function notation, domain, range, inverse functions, relations, from Algebra 2
- Review/introduction to increasing/decreasing and concave up/concave down
- Graph transformations and symmetry
- Modeling functions with real data via the Nspire and Geometer's Sketchpad.
- Average rate of change (ARC) and instantaneous rate of change (IRC), graphically and symbolically
- Arithmetic, geometric, and other sequences and series, defined recursively and explicitly
- Partial sums and sigma notation
- Binomial theorem and binomial probability
- Using inductive reasoning in problems and writing inductive proofs

## Quarter 2:

Topics:

- Review properties of exponents
- Solve radical equations with the aid of CAS

- Learning to manipulate and interpret exponential and logarithmic models
- Exploring interest rate problems and the number *e*
- Review polynomial functions and explore rational functions and their graphs in context of limits
- Solving triangles and polygons with trigonometry

**Quarter 3:**

Topics:

- Circle geometry involving radian measure, arc length, angular speed
- Constructing the unit circle in radians
- Solving basic trigonometric equations using unit circle identities
- Modeling periodic behavior (including simple harmonic motion) with transformed trig functions
    - This involves introduction of amplitude, period, and phase shift
- Derive inverse trig functions, especially noting domain and range
- Deriving/Proving more difficult trig identities
- Solving more complicated trig equations

**Quarter 4:**

Topics:

- Graph polar coordinates and simple polar graphs
- Learning complex numbers and their role in the Fundamental Theorem of Algebra
- Factor theorem and remainder theorem
- Theory of equations
- Understanding how to convert between rectangular and polar coordinates
- DeMoivre's Theorem
- Vector applications and cross and dot products
- More work with parametrics: graphing lines in 3-space, graphing conics, graphing other interesting curves.
- Locus definitions of conics
- Equations of conics in Cartesian coordinates
- Using matrices for Markov Chains
- Bonus lesson: bijections, cardinality, and orders of infinity.