

# New Rochelle High School

265 Clove Road, New Rochelle, New York 10801

## Mathematics Department Honors Pre-Calculus Syllabus

### Teachers

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### Course Description

The principal objectives of this course are to provide students with the best possible understanding of algebra and trigonometry, and to show how algebra and trigonometry can be

used to model real-life problems. Some of the major mathematical topics that we are going to explore are: Functions and their Graphs, Equations Solutions and Their Meaning, Polynomial Functions, Exponential and Logarithmic Functions, Rational Functions, Trigonometry, Analytic Trigonometry, Application of Trigonometry, Vectors and Dot Product, System of Equations and Inequalities, Matrices and Determinants, Sequences and Series, Analytic Geometry, Analytic Geometry in Three Dimensions, Limits, and Definition of Derivative, Rules of Derivatives, Derivatives of the six basic functions, Rolle's Theorem, The Mean Value Theorem, Extrema Points and Inflection Points, and Application of Differentiation.

### **Honors Pre-Calculus Class**

**Textbook:** Larson, Hostetler; Pre-Calculus with Limits  
2007 Houghton Mifflin Company.  
ISBN: 13:978-0-618-66090-2  
ISBN: 10:0-618-66090-9

### **Homework:**

Homework assignments will be announced by your instructor in class or online. Due dates will be strictly enforced. Depending on your instructor, there may be written and/or online homework (Webwork or WebAssign). **Only the online homework will count towards your homework grade.**

Textbook homework assignment is listed below the course outline. Every student should work on the assigned questions on the daily basis. You should do all the problems assigned before the scheduled quiz or test.

### **Exams and Quizzes:**

There will be three Exams and two Quizzes per marking period.

### **Quizzes Dates:**

1. **Quiz 1 September 21, 2018**
2. **Quiz 2 October 5, 2018**
3. **Quiz 3 October 30, 2018**
4. **Quiz 4 November 20, 2018**
5. **Quiz 5 December 13, 2018**
6. **Quiz 6 January 10, 2019**

### **Exam Dates:**

1. **Exam 1 September 28, 2018**
2. **Exam 2 October 19, 2018**
3. **Exam 3 November 9, 2018**

4. Exam 4 December 4, 2018
5. Exam 5 December 21, 2018
6. Exam 6 January 18 , 2019
7. Final Exam: Two hour final during the regents week in January  
Tentative Date: January 24, 2019

### Final Exam

Final exam covers all the topics discussed in the first and second marking period. It is a two-hour exam and will be given during the regents exams week in January. **The final exam will count as two test grade for the second marking period.** The exact time and location will be announced in class near the end of the second marking period. **Students must take the final examination during the scheduled time. The tentative date is January 24, 2019**  
**The final exam will not be given at any other time.**

### Grading policy for New Rochelle High School:

Course grades will be computed using the following percentages:

1. Tests 70%
2. Quizzes 15%
3. Homework Assignments 15%
4. The Final Exam for HPC will count for two test grades for the second marking period grade.

Student's Name \_\_\_\_\_

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_

Parent's Signature \_\_\_\_\_ Date \_\_\_\_\_

## Major Topics for Honor's Pre-Calculus

1. *Polynomial and Rational Functions: Chapter 2*

**a. Polynomial Functions of Higher Degree**

- i. Graph of Polynomial Functions
- ii. Leading Coefficient Test
- iii. Real Zeros of a Polynomial Function
- iv. Repeated Zeros
- v. Sketching Graphs of Polynomial Functions
- vi. Intermediate Value Theorem
- vii. *Applications (Do Word Problems)*

**b. Polynomial and Synthetic Division**

- i. Long Division of Polynomials
- ii. Synthetic Division
- iii. The Remainder Theorem
- iv. The Factor Theorem
- v. *Applications (Do Word Problems)*

**c. Zeros of Polynomial Functions**

- i. The Fundamental Theorem of Algebra
- ii. The Linear Factorization Theorem
- iii. *Rational Zero Test*
- iv. *Complex Solution to a Polynomial Function*
- v. *Factors of Polynomial Functions*
- vi. *Descartes' rule of Signs*
- vii. *Upper and Lower Bound Rules*
- viii. *Applications (Do Word Problems)*

**d. Rational Functions**

- i. Definition of Rational Functions
- ii. Horizontal, Vertical, and Slant Asymptotes
  - 1. Use the concept of Limit to discuss Asymptotes
  - 2. Use end behavior for Horizontal and Slant Asymptotes
- iii. Analyzing Graphs of Rational Functions
- iv. Sketching Graphs of Rational Functions
- v. *Applications (Do Word Problems)*

**e. *Project Using The TI Graphing Calculator or Excel (Optional)***

**2. Exponential and Logarithmic Functions: Chapter 3**

**a. Exponential functions and Their Graphs**

- i. Definition of Exponential Functions

- ii. One-to-One Property of Exponential Functions
- iii. Graph different type of exponential functions, not just  $f(x) = e^x$
- iv. *Applications (Do Word Problems)*

**b. Logarithmic Functions and Their Graphs**

- i. Definition of Logarithmic Function
- ii. Properties of Logarithmic Functions
- iii. Graph of Logarithmic Functions
- iv. Relationship of Logarithmic Functions and Exponential Functions
- v. The Natural Logarithmic Function
- vi. *Applications (Do Word Problems)*

**c. Properties of Logarithms**

- i. Discuss All the Base Properties/Formula of Logarithmic Functions
- ii. *Applications (Do Word Problems)*

**d. Exponential and Logarithmic Equations**

- i. Strategies for Solving Exponential and Logarithmic Equations
- ii. *Applications (Do Word Problems)*

**e. Exponential and Logarithmic Models**

- i. Exponential Growth Model
- ii. Exponential Decay Model
- iii. Gaussian Model
- iv. Logistic Growth Model
- v. Logarithmic Models

**f. *Project Using The TI Graphing Calculator or Excel (Optional)***

**3. Trigonometry: Chapter 4**

**a. Graphs of Sine and Cosine Functions**

- i. Discuss the Sine and Cosine Function Using the General Form\_
  - $y = A\sin(Bx + C) + D$
  - $y = A\cos(Bx + C) + D$
- ii. Finding the general solution to all the zeroes, all the maxima and minima for sine, cosine, secant and cosecant functions

**b. Graphs of Other Trigonometric Functions**

- i. Graph of Tangent Function
- ii. Graph of Cosecant Function
- iii. Graph of Secant Function
- iv. Graph of Cosecant Function
- v. Graph of Cotangent Function
- vi. Damped Trigonometric Functions
- vii. *Applications (Do Word Problems)*

**c. Inverse Trigonometric Functions**

- i. Discuss the six arc trigonometric Functions
- ii. Domain and Range of Arc Trigonometric Function
- iii. *Applications (Do Word Problems)*

**d. Applications and Models**

**e. *Project Using The TI Graphing Calculator or Excel (Optional)***

**4. Analytic Trigonometry: Chapter 5**

- a. Solving Trigonometric Equations
  - i. Linear Trigonometric Equations
  - ii. Equations of Quadratic Type
  - iii. Finding general solutions
  - iv. **Applications**
- b. Sum and Difference Formulas
  - i. Using Sum and Difference Formulas
  - ii. Solving Trigonometric Equations using Sum/Diff. Form.
  - iii. **Applications**
- c. Multiple Angle and Product-to-Sum Formulas
  - i. Solving Equations with double angle formulas
  - ii. Power Reducing Formulas
  - iii. Half-Angle Formulas
  - iv. **Applications**
- d. ***Project Using The TI Graphing Calculator or Excel (Optional)***

**5. Additional Topics in Trigonometry: Chapter 6**

**a. Vector in a Plane**

- i. Component Form of a Vector
- ii. Vector Operations (Graphically and Algebraically)
- iii. Direction Angle of a Vector
- iv. **Applications**

**b. Vectors and Dot Products**

- i. Vectors and Unit Vectors
- ii. Dot/Inner Product of two Vectors
- iii. Angle between two Vectors
- iv. Orthogonal/Normal Vectors
- v. Vector Components
- vi. **Application (Work)**

**c. Trigonometric Form of a Complex Number**

- i. Definition of a Complex number in Rectangular Coordinates
- ii. Algebraic and Geometric Operations with complex numbers
- iii. Complex number in Polar Coordinates
- iv. Complex Number as  $z = rcis\theta$  and  $z = re^{i\theta}$
- v. Product and Quotient of Two Complex Number
- vi. DeMoivre's Theorem
- vii. Definition of the nth Root of a Complex Number
- viii. Finding the nth root of a complex number

**d. Project Using The TI Graphing Calculator or Excel (Optional)**

**6. Systems of Equations and Inequalities: Chapter 7**

**a. Linear and Non-Linear System of Equations**

- i. The Method of Substitution
- ii. Nonlinear Systems of Equations
- iii. Graphical Approach to Finding Solutions
- iv. Applications

**b. Two Variable Linear Systems**

- i. Method of Elimination
- ii. Graphical Interpretation of Solutions
- iii. Applications

**c. Multivariable Linear Systems**

- i. Row-Echelon Form and Back-Substitution
- ii. Gaussian Elimination
- iii. Non-square Systems
- iv. Applications

**d. Partial Fractions**

- i. Partial Fraction Decomposition
- ii. Linear and Quadratic Factors
- iii. Repeated Factors

**e. System of Inequalities**

- i. The Graph of an Inequality

- ii. System of Inequalities
- iii. Applications
- f. **Linear Programming**
  - i. Linear Programming: A Graphical Approach
  - ii. Solving a Linear Programming Problem
  - iii. Applications
- g. *Project Using The TI Graphing Calculator or Excel (Optional)*

## 7. Matrices and Determinants: Chapter 8

- a. **Matrices and Systems of Equations**
  - i. Matrices
  - ii. Augmented Matrix
  - iii. Elementary Row Operations
  - iv. Row-Echelon Form and Reduced Row Echelon Form
  - v. Gaussian Elimination with Back-Substitution
  - vi. Gauss-Jordan Elimination
- b. **Operations with Matrices**
  - i. Equality of Matrices
  - ii. Matrix Addition and Scalar Multiplication
  - iii. Matrix Multiplication
  - iv. Application
- c. **The Inverse of a Square Matrix**
  - i. The Inverse of a Matrix
  - ii. Finding Inverse Matrices
  - iii. System of Linear Equations
  - iv. Applications
- d. **The Determinant of a Square Matrix**
  - i. Determinant of a 2 by 2 Matrix
  - ii. Determinant of a Square Matrix
- e. **Applications of Matrices and Determinant**
  - i. Cramer's Rule
  - ii. Area of a Triangle
  - iii. Test for Collinear Points
  - iv. Equation of a Line Using Determinants
  - v. Cryptography
- f. *Project Using The TI Graphing Calculator or Excel*

## 8. Sequence, Series and Probability (Optional for Reg. Pre-Calculus)

- a. Sequences and Series



- i. Sequences
- ii. Factorial Notation
- iii. Summation Notation
- iv. Series
- v. Applications
- b. Arithmetic Sequence and Partial Sums**
  - i. Arithmetic Sequences
  - ii.  $n$ th Term of an Arithmetic Sequence
  - iii. The Sum of a Finite Arithmetic Sequence
  - iv. The Sum of an Infinite Arithmetic Sequence
  - v. Application
- c. Geometric Sequence and Series**
  - i. Geometric Sequence
  - ii. The  $n$ th term of a Geometric Sequence
  - iii. The Sum of a Finite Geometric Sequence
  - iv. The Sum of a an Infinite Geometric Series
  - v. Applications
- d. Mathematical Induction**
  - i. The Principle of Mathematical Induction
  - ii. Using Mathematical Induction to Prove Summation Formulas
  - iii. Proving Inequalities using Mathematical Induction
  - iv. Finite Differences
- e. *Project Using The TI Graphing Calculator or Excel***

## **9. Topics and Analytic Geometry**

- a. Lines**
  - i. Inclination of a Line
  - ii. Angle Between two Lines
  - iii. Distance Between a Point and a Line
  - iv. Applications
- b. Parametric Equations**
  - i. Plane Curves
  - ii. Sketching Plane Curves
  - iii. Eliminating the Parameter
  - iv. Finding Parametric Equation for a Graph
- c. Polar Coordinates**
  - i. Coordinate Conversion
  - ii. Equation Conversion
- d. Graphs of Polar Equations**
  - i. Graphing a Polar Equation by Plotting Points
  - ii. Symmetry in Polar Coordinate
  - iii. Test for Symmetry in Polar Coordinates
  - iv. Zeros and Maximum  $r$ -Values
  - v. Sketching Polar Graphs
  - vi. Special Polar Graphs
    - 1. Limacons

- 2. Rose Curves
- 3. Circles and Lemniscates
- e. Polar Equations of Conics**
  - i. Alternative Definition of Conics
  - ii. Polar Equations of Conics
  - iii. Finding Polar Equation of a Conic
  - iv. Application (Kepler's Laws)
- f. *Project Using The TI Graphing Calculator or Excel (Optional)***

| Chapter 2               | Sections   | Exercises                    |
|-------------------------|------------|------------------------------|
| Polynomial and Rational | 2.1 Review | 1, 7, 11, 19, 33, 39, 47, 51 |

|  |                                       |   |
|--|---------------------------------------|---|
| Functions                                |                                       |   |
|  | 2.2 Review                            | 3, 7, 11, 19, 25, 33, 41, 53, 55, 61, 63, 89, 90, 92  |
|  | 2.3 Review                            | 1, 7, 15, 21, 27, 35, 37, 43, 47, 55, 63, 74, 79, 83  |
|  | 2.4 Review                            | 5, 13, 21, 25, 27, 35, 39, 47, 49, 53, 55, 57, 63   |
|  | 2.5                                   | 5, 11, 17, 23, 27, 31, 35, 41, 45, 47, 51, 53, 55, 61, 65, 71, 77, 81, 85, 93, 103, 105, 109, 111 |
|  | 2.6 Review                            | 3, 9, 11, 19, 25, 31, 39, 45, 49, 53, 61, 67, 75, 77  |
|  | 2.7                                   | 3, 7, 13, 19, 23, 29, 35, 39, 45, 49, 51, 53, 63, 67, 69, 71, 75                                  |
| Assessments                              | Quiz 1 Sept. 21, 2018<br>Sections TBA | Test # 1<br>Sept. 28, 2018<br>Sections: TBA   |
| Chapter 3                                | Sections                              |   |
| Exponential and<br>Logarithmic Functions | 3.1 Review                            | 3, 5, 9, 13, 21, 25, 45, 47, 49, 51, 55, 57, 61, 63, 65, 67, 70                                   |
|  | 3.2 Review                            | 3, 11, 17, 21, 27, 29, 41, 43, 65, 67, 69, 71, 79 – 85 odds, 89                                   |
|  | 3.3                                   | 1, 9, 13, 17, 21, 23, 29, 35, 37, 41, 47, 51, 57, 59, 63, 69 – 77 odds                            |
|  | 3.4                                   | 1, 5, 11, 15, 17, 25, 31, 57, 61, 63, 71, 75, 79, 85, 93, 99, 111, 115                            |
|  | 3.5                                   | 1, 5, 15, 21, 25, 29, 33, 37, 41, 43, 45, 47, 49, 51, 57, 63, 64                                  |
| Assessments                              |                                       | Test # 2<br>October 19, 2018<br>Sections: TBA   |
| Chapter 4                                | Sections                              |   |
| Trigonometry                             | 4.5                                   | 3, 11, 17, 25, 31, 45, 57, 65, 73, 75, 77, 79, 87   |
|  | 4.6                                   | 5, 13, 23, 41, 43, 47, 51, 63, 75, 76, 80   |
|  | 4.7                                   | 5, 7, 13, 15, 35, 37, 39, 41, 45, 49, 51, 55, 59-67 odds, 71, 73, 92, 95, 97, 105                 |

|                                      |  |  |
|--------------------------------------|--|--|
|                                      | 4.8  | 1, 5, 11, 15, 17, 21, 25, 29, 33, 37, 39, 41, 43, 47   |
| Assessments                          | Quiz # 2<br>October 5, 2018<br>Sections: TBA   |  |
| Chapter 5                            | Sections                                       |  |
| Analytic Trigonometry                | 5.3  | 1, 5, 11, 17, 21, 29, 33, 37, 49, 57, 6, 73, 75, 77  |
|                                      | 5.4  | 3, 5, 11, 21, 25, 29, 33, 35, 41, 57, 69, 91   |
|                                      | 5.5  | 1, 5, 9, 17, 21, 27, 31, 37, 45, 53, 57, 79, 97, 119, 120  |
| Assessments                          |  | Test # 3<br>November 9, 2018<br>Sections: TBA  |
| Chapter 6                            | Sections                                       |  |
| Additional Topics in Trigonometry    | 6.1 and 6.2 Review                             | 6.1: 3, 11, 21, 27, 31, 37, 41<br>6.2: 5, 11, 27, 31, 35, 41, 49   |
|                                      | 6.3  | 5, 11, 19, 25, 35, 41, 45, 53, 59, 74, 69, 73, 75, 82, 85  |
|                                      | 6.4  | 1, 7, 11, 17, 23, 27, 33, 37, 41, 43, 45, 51, 55, 65, 71   |
|                                      | 6.5  | 3, 9, 19, 29, 33, 45, 47, 57, 75, 81, 87, 91, 97, 103, 107, 111  |
| Assessments                          | Quiz # 3<br>October 30, 2018<br>Sections: TBA  |  |
| Chapter 7                            | Sections                                       |  |
| System of Equations and Inequalities | 7.1 to 7.3 Review                              | 7.1: 1, 5, 9, 27, 35, 43, 57, 63, 67<br>7.2: 1, 5, 11, 19, 27, 33, 39, 43, 51, 53<br>7.3: 1, 5, 11, 17, 25, 37, 43, 45, 53, 55, 59, 63, 65 |
|                                      | 7.4  | 1, 3, 7, 13, 17, 27, 29, 31, 37, 41, 43, 45, 51  |
|                                      | 7.5  | 1, 11, 21, 31, 35, 43, 51, 69, 71  |
|                                      | 7.6  | 1, 5, 9, 15, 19, 27, 33, 37, 39, 41, 45  |
| Assessments                          | Quiz # 4<br>November 20, 2018<br>Sections: TBA | Test # 4<br>December 4, 2018<br>Sections: TBA  |
| Chapter 8                            | Sections                                       |  |
| Matrices and Determinants            | 8.1 to 8.2 Review                              | 8.1: 5, 11, 15, 27, 33, 53,  |

|                                  |  |   |
|----------------------------------|--|---|
|                                  |  | 65, 67, 69, 73, 82, 83<br>8.2: 3, 7, 17, 21, 25, 33, 45, 55, 63   |
|                                  | 8.3  | 5, 9, 21, 31, 35, 47, 51, 65  |
|                                  | 8.4  | 3, 11, 21, 25, 33, 37, 45, 57, 63, 71, 81   |
|                                  | 8.5  | 1, 13, 15, 23, 27, 29, 33, 37, 51, 53   |
| Assessments                      | Quiz # 5<br>December 13, 2018<br>Sections: TBA |   |
| Chapter 9                        | Sections                                       |   |
| Sequence, Series and Probability | 9.1  | 1, 9, 15, 21, 25, 29, 35, 37, 47, 49, 53, 57, 61, 69, 77, 81, 87, 89, 97, 99, 105   |
|                                  | 9.2  | 1, 7, 9, 15, 23, 27, 31, 37, 39, 47, 53, 57, 59, 63, 67, 69, 75, 85, 87, 91   |
|                                  | 9.3  | 1, 7, 11, 19, 21, 31, 37, 49, 55, 71, 75, 81, 89, 101   |
|                                  | 9.4  | 3, 5, 9, 15, 17, 22, 41, 43, 45, 47, 49   |
|                                  | 9.5* (Optional)                                | 1, 5, 11, 13, 17, 23, 33, 35, 43, 47, 53, 59, 67  |
|                                  | 9.6* (Optional)                                | 3, 7, 9, 13, 17, 21, 29, 39, 43, 47, 51, 55, 57   |
|                                  | 9.7* (Optional)                                | 1, 5, 7, 9, 13, 17, 23, 27, 33, 35, 39, 43, 45, 49  |
| Assessments                      |  | Test # 5<br>December 21, 2018<br>Sections: TBA  |
| Chapter 10                       | Sections                                       |   |
| Topics in Analytic Geometry      | 10.1   | 1, 9, 13, 15, 21, 25, 29, 31, 39, 47, 49, 53  |
|                                  | 10.2 to 10.4 Review                            | 10.2: 1, 9, 17, 27, 31, 37, 45, 61<br>10.3: 5, 11, 23, 31, 39, 45, 51, 57<br>10.4: 3, 7, 11, 17, 23, 27, 33, 39, 45- 59 odds only |
|                                  | 10.6   | 3, 11, 15, 17, 23, 27, 29, 35, 41, 49, 61   |
|                                  | 10.7   | 1, 7, 11, 17, 25, 31, 39, 47, 49, 57, 63, 67, 73  |
|                                  | 10.8   | 1, 3, 5, 9, 11, 19, 25, 37, 45, 51, 61, 65  |

|  |   |  |
|--|---|--|
|  | <b>10.9* (Optional)</b>                       | 1, 3, 7, 9, 13, 17, 21, 27, 31, 33, 37, 43, 49, 53   |
| Assessments  | Quiz # 6<br>January 10, 2019<br>Sections: TBA | Test # 6<br>January 18, 2019<br>Sections: TBA        |
| <b>Final Exam for HPC<br/>During Regents Week in<br/>January</b> | <b>January 24, 2018<br/>Two hours Exam</b>    | <b>Sections: All the topics<br/>from MP1 and MP2</b> |

*Please remove sign and return to your teacher*

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2. Quizzes 15%
3. Homework Assignments 15%
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**Student's Name** \_\_\_\_\_

**Student's Signature** \_\_\_\_\_ **Date** \_\_\_\_\_

**Parent's Signature** \_\_\_\_\_ **Date** \_\_\_\_\_

