



Eleanor Roosevelt High School

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Dimitri Saliani, Principal www.erhsnyc.org

Course Outline, Mathematics - Pre-calculus -

Course Description:

Pre-calculus does provide the necessary foundation for students intending to continue on to calculus. The course will emphasize mathematical thinking, the use of mathematical models, and the understanding of mathematical functions and graphs. Specified topics include equalities and inequalities, polynomial functions, rational functions, exponential functions, logarithmic functions, and trigonometric functions.

Course Objectives:

This course is intended to:

- Help students understand and appreciate the major concepts of functions
- Prepare students for calculus
- Make students aware of the applications of pre-calculus mathematics in client disciplines
- Engage students in mathematical reasoning
- Develop students' abilities to approach pre-calculus topics from graphical, numerical, and symbolic points of view
- Help students learn to read mathematics and to become independent learners of mathematics
- Develop students' abilities to create mathematical models and use these models to solve problems
- Engage students in the solution of problems, especially open-ended problems, that apply pre-calculus topics
- Develop students' ability to write about mathematical ideas and problem solutions

Essential questions:

1. How do you determine the differences and similarities between the families of functions, (Exponential, Logarithmic, Quadratic, Polynomial, Rational, Trigonometric)?
2. Which problem-solving strategy is most appropriate in this situation?
3. How do I use my mathematical tools to create models for real-world situations and then solve them efficiently for a given set of conditions?
4. How does the unit circle relate to the trigonometric functions?

Instructor: Mr. Goncalves

Classroom: Room 401

Schedule: Refer to your program

Extra help hours:

- Tuesday 5th period
- Thursday 1st period

Contact Information:

- **Phone:** Office (212) 772-1220
- **E-Mail:** ggoncalves@erhsnyc.net

Materials:

1. Primary textbook: *PRECALCULUS graphical, numerical, algebraic* by Demana, Waits, Foley, and Kennedy. Pearson Education, Inc. 2004.
2. Secondary textbook: AMSCO's Math B
3. Graphing Calculator: TI-83 is recommended
4. Pencils, an eraser, a ruler (preferably a protractor), and a compass
5. Graph Paper
6. Notebook – Composition book recommended
7. Folder or binder to keep quizzes, exams, and hand-outs.

Teaching Strategies:

1. Lecture on concepts and techniques
2. Presentation of examples and strategies
3. Large and small group discussions and explorations
4. Reading and writing assignments
5. Practice and learning through homework assignments
6. Applications to demonstrate relevance and extend learning
7. Active student engagement in group work and discussions
8. Quizzes, and tests to encourage and monitor learning

Course Requirements:

1. Regular attendance in class
2. Homework primarily self-assessed, completion expected. Students will be assigned daily homework and encouraged to use the composition book. Homework assignments submitted past due date will not be accepted unless under extreme circumstances. Homework quizzes will be given weekly to ensure learning and homework completion
3. Active participation and engagement in full-class, small-group, and individual activities
4. Quizzes, tests, and final examination. At least one-week notice will be given for tests and quizzes. There will be no make up quizzes or tests unless the instructor is informed in advance and an acceptable written note is provided with a justification for the absence. There will be no test revisions.
5. Notebook: Students strongly encouraged to take notes during class. Extra credit will be awarded to students who capture complete notes in an orderly manner.
6. Pencil and eraser: Ink is not allowed on any assignment or test.

Homework: Students are encouraged to complete all homework problems soon after the section is discussed in class. Questions for the quiz every other week will for the most part be based on these problems. The instructor may also collect particular homework assignments in order to provide constructive feedback to the students and to verify that students are making reasonable progress on

these assignments. Students are encouraged to discuss homework questions with the instructor and other students. The work submitted should be your own though. A limited amount of time at the beginning of each class will be allocated for discussion of homework problems.

Quizzes: Quizzes will be given every week (except on a test day), and will be equivalent to a 30% of your final grade. No make-up quizzes will be allowed.

Exams: There will be two to three exams per marking period. The exams are composed of multiple choice and free-response questions. Each exam is worth 40 points and they are cumulative. There are NO test revisions.

Classroom Policies:

1. Active participation requires attendance and arrival to class in time to be prepared for work when the class period begins. Students arriving late on the day of a quiz or test will not be given extra time.
2. Respect your classmates as well as your instructor. Discussion in class will pertain to the topic of the course. All students have a right and responsibility to ask questions and give insight related to the understanding of course content. Students having a large number of questions should consult the instructor outside of class.
3. Participation in large and small group discussions is required and assessed for active engagement and contribution.
4. All work turned in on tests, quizzes, and individual papers must be entirely your own. Behavior contrary to this will result in a grade of F on the assignment. On homework, acknowledge any ideas you received from others. Students should be aware of and adhere to the college's policy on plagiarism.
5. You are encouraged to study together outside of class. The work you turn in should be entirely your own, though. If you receive help in completing the homework, make sure you put away any notes, write the answer in your own words, and give credit to your collaborators.

Guidelines for group work:

1. Every group member has the right and responsibility to contribute to the group's work. All members of the group are to be respected and listened to. If you find that you tend to dominate the group discussion, make an extra effort to enable and encourage other group members to participate. If the work is to be submitted, make sure there is a copy (preferably more than one) in class on the day it is due.
2. Share your ideas with others. You'll be surprised to find out how often your ideas will help lead to a right answer! No idea or question is stupid.
3. Arrive prepared and ready to start. When discussing homework in a group, be sure to try all problems in advance and identify where you have questions.
4. During an in-class activity, do not ask the instructor for assistance until everyone in the group has the same question.
5. Take responsibility for your own learning. Share your strategies/questions with the aim of having others understand what you are getting at and where/why you are stuck. This is different from "I couldn't get ..." and expecting another student to show you their answer.
6. Avoid taking responsibility for someone else's learning (since they will not learn). Listen to others with the aim of understanding their strategies and questions. This is more beneficial (and harder) than just showing them how to do it your way.
7. Even when there are no questions, spend some group time comparing resolutions. It feels great to show something amazing you've come up with or to share in someone else's solution. Take

- some time to enjoy these moments.
8. Have fun, but stick to task.

Grading Policy:

Criteria for computing grades:	<u>Weight</u>
Exams	40%
Quizzes	30%
Homework Quizzes/ NEAT Notebook	20%
Class Participation/Group Activity	10%

Suggestions and Resources:

1. One-on-one with teacher: Students are encouraged to approach the instructor either immediately after school or via email.
2. Textbook reading assignments: Read each section before class discussion, then re-read as homework activities are assigned, and use this material to study for quizzes and exams. In-class activities leverage textbook examples.
3. Homework assignments: Make an effort to figure out even the more challenging homework problems, try multiple times, even consider a break in between turns. Often the brain works it out while doing other things.

ERHS Academic Honesty Requirement:

Academic Dishonesty will not be tolerated and will result in automatic failure of Exam/Quiz/Project and disciplinary action will be taken.

I have read and am aware of the grading policy for Mr. Gonçalves' class.

Student name: _____

Student signature: _____ Date: ____ / ____ / ____

Parent/Guardian name: _____

Parent/Guardian signature: _____ Date: ____ / ____ / ____

Tentative Course Outline:

Chapter	Time	Topic
P.1	3 or 4 days 1 quiz	<ul style="list-style-type: none"> ✓ Representing Real numbers (Natural numbers, whole numbers, integers, rational, irrational) ✓ Order and interval notation
A.1 Pages 843-848	3 or 4 days 1 quiz	<ul style="list-style-type: none"> ✓ Radicals ✓ Simplifying radical expressions ✓ <i>Solving radical equations</i> ✓ Rationalizing the denominator ✓ Integer and Rational exponents
P.6 Pages 53-60	3 or 4 days 1 quiz	<ul style="list-style-type: none"> ✓ Definition of Absolute-value (algebraically pg. 14 and geometrically pg. 15) ✓ <i>Solving Absolute-value equations</i> ✓ Absolute-value inequalities
P.3	3 or 4 days	<ul style="list-style-type: none"> ✓ Solving equations (algebraic and graphically) <ol style="list-style-type: none"> 1. <i>Linear</i> 2. Quadratic – various methods - <i>later</i> 3. Cubic - <i>later</i> 4. Fractional - <i>later</i> 5. Algebraic - <i>later</i> 6. Absolute-value - <i>later</i> 7. Exponential - <i>later</i> 8. Logarithmic - <i>later</i> 9. Trigonometric - <i>later</i> ✓ Linear inequalities ✓ Solving linear inequalities
P.4	5 or 6 days 1 quiz	<ul style="list-style-type: none"> ✓ Slope of a line ✓ Point-slope form equation ✓ Slope-intercept form ✓ Graphing linear equations ✓ Parallel and Perpendicular lines ✓ Linear equations in two variables (solving them graphically and algebraically) ✓ Linear modeling and correlation coefficient
P.5	6 – 8 days 1 quiz	<ul style="list-style-type: none"> ✓ Solving equations graphically ✓ Graphing quadratic equations ✓ <i>Solving quadratic equations</i> – factoring, square roots, completing the square, and quadratic formula ✓ Optimization ✓ Motion problems – Ex: Calculate the maximum height of a rocket ✓ Discriminant ✓ Solving system of non-linear equations algebraically (line and parabola, line and circle) ✓ Using completing the square to write an equation for a circle
2.5 Pages 221-228	10 – 12 days 1 quiz	<ul style="list-style-type: none"> ✓ Imaginary numbers ✓ Complex numbers ✓ Addition and subtraction of complex numbers ✓ Multiplication and division of complex numbers ✓ Solving quadratic equation with imaginary roots ✓ The nature of the roots of any quadratic equation

		<ul style="list-style-type: none"> ✓ Using given conditions to write a quadratic equation ✓ Solution of system of equations ✓ Quadratic inequalities
A.2 Pages 848-855	6 - 10 days 1-2 quizzes	<ul style="list-style-type: none"> ✓ Adding, subtracting, and multiplying polynomials ✓ Special products ✓ Factoring polynomials using special products ✓ Factoring trinomials <ul style="list-style-type: none"> (1) Factoring by grouping (2) Factoring the sum and difference of two cubes
A.3 Pages 856-860	8 – 10 days 2 quizzes	<ul style="list-style-type: none"> ✓ Domain of an algebraic Expression ✓ Domain of rational expression (1st commandment of math) ✓ Reducing Rational expressions ✓ Multiplying and dividing rational expressions ✓ Adding or subtracting rational expressions ✓ Simplifying complex fractions
2.8 Pages 249-257	4 days 1 quiz	<ul style="list-style-type: none"> ✓ <i>Solving Rational equations</i> ✓ Extraneous Solutions ✓ Applications
1.2 Pages 81-100	6 - 10 days 2 quizzes	<ul style="list-style-type: none"> ✓ Function definition and notation ✓ Domain and Range ✓ Continuity ✓ Increasing and Decreasing Functions ✓ Local and Absolute Extrema (Extreme Value Theorem – EVT) ✓ Symmetry (even and odd functions) ✓ Asymptotes (horizontal and vertical) ✓ End Behavior
1.3 Pages 101-112	2 - 4 days 1 quiz	<ul style="list-style-type: none"> ✓ Twelve basic functions ✓ Analyzing functions graphically ✓ Piecewise functions
1.4 Pages 113-130	4 – 6 days 1 quiz	<ul style="list-style-type: none"> ✓ Composition of Functions ✓ Relations and Implicitly Defined functions ✓ Relations defined Parametrically (Section 6.3 pg. 522) ✓ Inverse functions
1.5 Pages 131-142	2 days 1 quiz	<ul style="list-style-type: none"> ✓ Graphical transformations ✓ Vertical and Horizontal translations ✓ Reflections ✓ Vertical and Horizontal stretches and shrinks ✓ Composition of transformations
1.6 Pages 142-155	2 – 4 days 1 quiz	<ul style="list-style-type: none"> ✓ Functions from formulas ✓ Functions from graphs ✓ Functions from data – page 149 (Regression Types)
2.1 Pages 162-180	6 days 1 quiz	<ul style="list-style-type: none"> ✓ Polynomial functions ✓ Linear functions and their graphs ✓ Average rate of change ✓ Linear correlation and modeling ✓ Quadratic functions and their graphs
2.2 Pages 181-192	4 days 1 quiz	<ul style="list-style-type: none"> ✓ Power functions and variation (direct and inverse) ✓ Graphs of power functions ($x^3, \sqrt{x}, \sqrt[3]{x}$) ✓ Modeling with power functions
2.3	6 days	<ul style="list-style-type: none"> ✓ Graphs of Polynomials functions

Pages 193-206	1 quiz	<ul style="list-style-type: none"> ✓ End behavior of polynomial functions ✓ Zeros of polynomials functions ✓ Intermediate Value Theorem ✓ Modeling
2.4 Pages 207-220	8 days 1 quiz	<ul style="list-style-type: none"> ✓ Long division ✓ Remainder and Factor Theorems ✓ Synthetic Division ✓ Rational Zeros Theorem ✓ Upper and Lower bounds
2.6 Pages 229-236	4 days 1 quiz	<ul style="list-style-type: none"> ✓ Fundamental Theorem of Algebra ✓ Linear Factorization Theorem ✓ Complex Conjugate Zeros
2.7 Pages 237-248	6 days 1 quiz	<ul style="list-style-type: none"> ✓ Rational functions ($y = 1/x$) ✓ Limits and Asymptotes ✓ Analyzing Graphs of Rational Functions
2.9 Pages 258-268	3 days	<ul style="list-style-type: none"> ✓ Polynomial inequalities ✓ Rational inequalities ✓ Applications
3.1 Pages 276-289	3 days 1 quizzes	<ul style="list-style-type: none"> ✓ Exponential functions and their graphs ✓ The Natural Base e ✓ Transformations
3.2 Pages 190-299	4 days 1 quiz	<ul style="list-style-type: none"> ✓ Constant percentage rate ✓ Exponential growth and decay ✓ Modeling
3.3 & 3.4 Pages 300-319	10 days 1 quiz	<ul style="list-style-type: none"> ✓ Inverses of exponential functions ✓ Logarithmic functions and their graphs ✓ Common log and natural log ✓ Properties of logarithmic functions ✓ Change of base
3.5 & 3.6 Pages 320-341	10 days 2 quizzes	<ul style="list-style-type: none"> ✓ <i>Solving exponential equations</i> ✓ <i>Solving logarithmic equations</i> ✓ Regression models (page 328) ✓ Mathematics of finance ✓ Interest Compounded Annually ✓ Interest Compounded k times per year ✓ Interest Compounded Continuously
4.1-4.3 Pages 352-385	18-22 days 2-3 quizzes	<ul style="list-style-type: none"> ✓ The right triangle (sine, cosine, tangent, and their reciprocals) ✓ Angles as rotations ✓ Sine and cosine as coordinates ✓ The sine and cosine functions: Sinusoidal Functions ✓ The tangent function ✓ Function values of special angles ✓ Finding reference angles ✓ Radian measure (at this point students should start thinking in radian) ✓ Trigonometric functions involving radian measure ✓ The Pythagorean identities ✓ Cofunctions
4.4-4.8 Pages 386-438	8 – 12 days 1-2 quizzes	<ul style="list-style-type: none"> ✓ The wrapping function ✓ Graph of $y = \sin x$ and $y = \cos x$ ✓ Amplitude, Frequency, and Period ✓ Sketching sine and cosine curves

		<ul style="list-style-type: none"> ✓ Transformations of sine and cosine curves – 3 days ✓ Graph of $y = \tan x$ ✓ Graphs of inverse trig functions – arcsine, arccosine, and arctangent ✓ Solving Problems with trigonometry
5 Analytic Trigonometry	20 days 3 quizzes	<ul style="list-style-type: none"> ✓ Fundamental Identities ✓ <i>Solving Trigonometric equations</i> ✓ Proving Trigonometric Identities ✓ Sum and Difference Identities ✓ Multiple Angle Identities ✓ The Law of Sines ✓ The Law of Cosines
9 Discrete Mathematics	12 days 2 quizzes	<ul style="list-style-type: none"> ✓ Basic Combinatorics ✓ The Binomial Theorem ✓ Probability ✓ Sequences and Series ✓ Mathematical Induction - <i>maybe</i> ✓ Statistics and Data (Graphical and Algebraic)
10 An Introduction to Calculus (optional)		<ul style="list-style-type: none"> ✓ Limits and Motion: The tangent Problem ✓ Limits and Motion: The Area Problem ✓ More on Limits ✓ Numerical Derivatives and Integrals
7 System and Matrices (optional)		<ul style="list-style-type: none"> ✓ Solving System of two equations ✓ Matrix Algebra ✓ Multivariate Linear Systems and Row Operations ✓ Partial Fractions