Greenwich Public Schools Curriculum Overview

Honors Precalculus

Personalized learning is achieved through standards-based, rigorous and relevant curriculum that is aligned to digital tools and resources.

Note: Teachers retain professional discretion in how the learning is presented based on the needs and interests of their students.

Course Description

Honors Precalculus
Full Year
028200 6 Blocks 1 Credit
Prerequisite: B- or better in Honors Algebra 2 or an A- or better in Algebra 2A with teacher recommendation and successful completion of summer work assigned by the Math Program Administrator.
This accelerated course is a comprehensive study of mathematics in preparation for AP Calculus which focuses heavily on the development of high order problem-solving skills. Topics taught will include polynomial, rational, exponential, logarithmic, and trigonometric functions, as well as an introduction to limits and advanced applications with vectors, parametric equations, and polar coordinates.

Unit Guide

Prerequisite Unit
Chapter 2: Polynomial, Power, and Rational Functions
Chapter 3: Exponential, Logistic, and Logarithmic Functions
Chapter 4: Trigonometric Functions
Midterm Review & Midterm Exam*
Chapter 5: Analytic Trigonometry
Chapter 6: Part I Vectors
Chapter 6: Part II Parametrically Defined Functions
Chapter 6: Part III Polar Coordinates
Optional Limits Unit
Final Review & Final Exam*

**Note*: Semester exam review packets, answer keys and formula sheets can be found by joining our Schoology Math Department Review Course, using COURSE access code P9V9X-H6V37.

Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.

Enduring Understandings

Prerequisite Unit:

- Relations and functions can be represented numerically, graphically, algebraically, and/or verbally.
- Some problems can be modeled by systems of equations. Systems of equations can be solved by graphing, substitution, or eliminating a variable or by calculator.
- Quadratic equations can always be solved even if the quadratic is not factorable.
- There are a set of functions, called families, in which each function is a transformation of a special function called the parent. Transformations of parent functions can be represented graphically and algebraically.

Chapter 2:

- The degree of a polynomial and its leading coefficient will determine the shape of its graph, the maximum number of turning points, its end behavior, and the number of roots.
- All zeros of a polynomial function can be found by using division to break the function down into the product of linear and quadratic factors.
- All numbers are represented within the complex number system.
- Finding critical values and testing intervals are necessary in solving polynomial inequalities.
- A parent function can provide insight into a function's behavior.

Chapter 3:

- Logarithmic functions are the inverse of exponential functions.
- Inverse functions allow us to solve equations algebraically.
- The characteristics of exponential and logarithmic functions and their representations are useful in solving real-world problems.
- All data is not linear and many situations in economics, finance and science are represented with exponential and logarithmic curves.

Chapter 4:

- The ratios of the side lengths of a triangle can be defined with trigonometric functions.
- The trigonometric functions of sine, cosine, tangent, cosecant, secant, and cotangent can be used to find a missing side or angle of a right triangle.
- The Law of Sines and Cosines can be used to solve oblique triangles.
- Triangles can be used to solve various real world situations.
- The inverse trigonometric functions result from restricting the domain of the original function. They are an essential component in solving trigonometric equations.
- Periodic behavior is behavior that repeats over intervals of constant length.
- When graphing, you can translate periodic functions in the same way that you translate other functions.
- Trigonometry is used to model many biological and physical relationships.

Chapter 5:

- The trigonometric identities can be proven and are often useful when solving trigonometric equations.
- The sum, difference, double angle, and half angle formulas allow us to calculate exact values that can only be approximated with the use of a calculator.
- To solve some trigonometric equations, you can use an inverse trigonometric function to find one solution, and then use periodicity to find all solutions.

Chapter 6:

- A vector is a mathematical object that has both magnitude and direction.
- Vectors can be added or subtracted or multiplied by using the dot product.
- A vector's magnitude and direction can be described geometrically by a directed line segment and algebraically in component form.
- Many physical concepts can be represented by vectors including direction and speed of moving objects and when those objects are being acted upon by outside objects (e.g., airplanes and wind, boats and currents).

- Parametric equations are used to express two dependent variables, x and y, in terms of an independent variable (parameter), t.
- Parametric functions are useful for modeling situations involving position, velocity, and acceleration.
- Polar coordinates are an alternative way to specify location on the plane.
- In some cases, the polar coordinate system provides a more elegant representation than the rectangular system.
- Polar equations enable us to define some interesting and important curves that would be difficult or impossible to define in the form $y = f(x)$.
- A complex number can be represented in both rectangular and polar form.
- De Moivre's Theorem enables us to perform operations with complex numbers.

Optional Limits Unit:

- Limits allow us to analyze functions and talk about the rate of change at an exact point, instead of needing two points to take an average.
- Limits allow us to analyze functions at places where they are not defined and to more rigorously describe the behavior of functions on infinitely small and infinitely large intervals.
- A limit can exist at a point of discontinuity.
- A limit is the intended y value of a function as the x value gets infinitely close to the given x value.

Essential Questions:

Prerequisite Unit:

- How do you decide which method is best when solving quadratic equations?
- What is the domain and range of a function?
- What does the number of solutions (none, one or infinite) of a system of equations represent?
- What are the advantages and disadvantages of solving a system of equations graphically versus algebraically?
- Why are relations and functions represented in multiple ways?
- How are properties of functions and functional operations useful?
- What happens to a parent function when you transform its graph?
- What makes a function even or odd?
- What determines continuity and how can you find and describe discontinuities?

Chapter 2:

- What makes an accurate sketch of a polynomial function?
- What are complex numbers and how do they relate to polynomial equations?
- How does a polynomial equation differ from a polynomial inequality?
- Why do rational equations sometimes have extraneous solutions?
- How are rational functions graphed with transformations?
- What does optimization mean?

Chapter 3:

- How are exponential functions and logarithmic functions related?
- How do you use the properties of logarithms to rewrite expressions?
- How do you solve exponential and logarithmic equations?
- What real-world phenomena are modeled by exponential or logarithmic functions?
- How is continuously compounded interest different from compound interest?

Chapter 4:

- What does evaluating a trig function at a given angle mean in real life?
- How does changing the size of a right triangle affect the sine, cosine and tangent of its angles?
- How do you use triangles to solve real world problems?
- How can the Law of Sines and Law of Cosines be used to solve non-right triangles?
- Why can some triangles be solved and others cannot? And why are there multiple solutions to

others?
- How can Heron's Formula be used to find the area of a triangle?
- What is the value in knowing trig identities?
- How does the unit circle solidify (and enhance) our understanding of trig functions?
- What is the purpose of measuring angles in radians?
- What are the major attributes of the graphs of the six trigonometric functions?
- What types of real world situations display periodic behavior?
- Why are some trigonometric functions continuous and some not continuous?
- Why is it important to restrict the domain of a trigonometric function when determining its inverse?
- How do reciprocal and inverse trigonometric functions differ? Why are they often confused?

Chapter 5:
- How are the fundamental identities used to evaluate, simplify, and rewrite expressions?
- How are past and new mathematical techniques used to solve trigonometric equations?
- How can a trigonometric identity or property be verified algebraically?
- How are all solutions found when solving trig equations?

Chapter 6:
- Why are functions and relations represented by vectors?
- Can you model real world phenomena using vectors and parametric equations?
- What term, used with lines, means the same thing as "orthogonal"?
- How are speed and velocity related?
- Why are functions and relations represented by parametric equations?
- How do you graph or interpret the graph of a parametric function?
- Can you model real world phenomena using vectors and parametric equations?
- How are equations used to model motion of projectiles?
- What are polar coordinates? How do they differ from rectangular coordinates?
- What is the relationship between the ordered pairs in the Cartesian coordinate system versus a polar system?
- How do you convert between rectangular and polar coordinates?
- How are special polar curves graphed?
- How many points are represented by an ordered pair? How many points are represented by a polar coordinate?
- How is a complex number converted to polar form?
- How are complex numbers multiplied and divided?
- How is De Moivre's Theorem used to raise numbers to a power and to find roots?

Optional Limits Unit:
- How do limits describe the behavior of a function?
- What is a limit?
- How is the limit of function different from its value?
- How can limits be found algebraically, graphically, and using tables?
- What are left and right-handed limits?
- What is the difference between a limit value and the function value?
- What is the connection between the domain of a function and its discontinuities?
- What is the connection between limits at infinity and end behavior?

Resources and Assured Experiences

Textbook Information:

Precalculus: Graphical, Numeric, Algebraic

Pearson Prentice Hall

Demana, Waits, Foley (2007~ 7th Edition)

ISBN 0-13-227650X

GHS Capstone Task:
Vision of the Graduate #3 - Explore, define, and solve complex problems
Water Balloons and Parametrics
- to complete after Chapter 6: Part II Parametrically Defined Functions

Quarterly Grading - Quarter Grades will be determined using the following components:

- Participation (includes Classwork) = 5%
- Preparation (includes Homework) = 5%
- Assessments (both Summative & Formative) = 90%

Connecticut Common Core State Standards

- Prerequisite Unit: CCSS.MATH.CONTENT.HSA.REI.B.4; HSF.IF.A.1, A.2, B.4; HSF.BF.A.1.C; HSA.REI.C.5, C.6, C.7, C.8, C.9.
- Chapter 2: CCSS.MATH.CONTENT.HSF.IF.B.4; HSA.APR.B.3, D.6; HSA.REI.A.2; HSN.CN.A.1, A.2, C.7, C.8, C.9; HSA.APR.B.2; HSF.IF.C.7.C, C.7.D.
- Chapter 3: CCSS.MATH.CONTENT.HSF.IF.C.7.E, C.8.B; HSF.BF.B.3, B.5; HSF.LE.A.1.C, A.2, A.4, B.5.
- Chapter 4: CCSS.MATH.CONTENT.HSG.C.B.5; HSF.TF.A.1, A.2, A.3, A.4, B.5, B.6, B.7; HSG.SRT.C.7, C.6, C.8, D.9, D.10, D.11.
- Chapter 5: CCSS.MATH.CONTENT.HSF.TF.C.8, C.9, B.7.
- Chapter 6: CCSS.MATH.CONTENT.HSN.VM.A.1, A.2, A.3, B.4, B.5; HSF.IF.A.2; HSA.CED.A.2; HSN.CN.A.3,,B.4, B.5, B.6.