

Cedar Grove School District

Cedar Grove, NJ

2016 | CGHS

Pre-Calculus

Approved by the Cedar Grove Board of Education

Superintendent of Schools

Mr. Michael J. Fetherman

Board of Education

Mr. Joseph Cicala, President

Mrs. Christine Dye, Vice-President

Mrs. Pam Burke

Mr. Frank Mandala

Mr. Peter Prvulovic

Pre-Calculus Course Calendar

	Sep		Oct			Nov				Dec		Jan			Feb		Mar			Apr		May			Jun																					
Unit:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40						
<u>Relations, Functions, and Graphs</u>																																														
<u>Trigonometry</u>																																														
<u>Advanced Functions and graphing</u>																																														
<u>Discrete Mathematics</u>																																														



Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Num/Quantity

Vector & Matrix Quantities

HSN-VM.C. Perform operations on matrices and use matrices in applications.

HSN-VM.C.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

HSN-VM.C.7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

HSN-VM.C.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

HSN-VM.C.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

HSN-VM.C.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

NJ: HS: Algebra

Arithmetic with Polynomials & Rational Functions

HSA-APR.B. Understand the relationship between zeros and factors of polynomials.

HSA-APR.B.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Reasoning with Equations & Inequalities

HSA-REI.B. Solve equations and inequalities in one variable.

HSA-REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

HSA-REI.C. Solve systems of equations.

HSA-REI.C.9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).

NJ: HS: Functions

Interpreting Functions

HSF-IF.A. Understand the concept of a function and use function notation.

HSF-IF.A.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.

HSF-IF.C. Analyze functions using different representations.

HSF-IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

HSF-IF.C.7a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

HSF-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

HSF-IF.C.8a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

NJ: HS: Modeling

Mathematical Practice

MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

MP.4. Model with mathematics.

NJ: HS: Stats/Prob

Interpreting Categorical & Quantitative Data

HSS-ID.B. Summarize, represent, and interpret data on two categorical and quantitative variables

HSS-ID.B.6a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

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Enduring Understandings

- Functions are the building blocks of algebra.
- Algebra is the language of mathematics.
- For every unknown, you must have at least one equation or inequality.
- Solve systems of linear equations or inequalities by a variety of means,
- Build a high level of comfort with matrices.
- Develop modeling skills using real-world data.

Essential Questions

- Pollogomy is to relations as monogomy is to?
- In mathematics, is being a "zero" always a bad thing?
- Why do people living in the real-world model real-world data?

Content

- A. Relations and Functions
- B. Linear Equations and Inequalities
- C. Models of Real-World Data with Linear Equations
- D. Systems of Linear Equations and Inequalities
- E. Matrix Algebra
- F. Polynomial and Rational Functions

Skills

- A. 1. Determine whether a given relation is a function and perform operations with functions
- B. 1. Evaluate and find zeros of linear functions
- B. 2. Graph and write linear equations and inequalities
- B. 3. Write equations for parallel and perpendicular lines
- C. 1. Model data using scatter plots and write prediction equations
- D.1. Graph and solve systems of linear equations and inequalities
- E. 1. Define matrices and perform matrix operations
- E. 2. Find determinants and inverses of matrices
- E. 3. Model real-world data with matrices
- F. 1. Determine roots of polynomial equations
- F. 2. Solve quadratic, rational, and radical equations
- F. 3. Find the factors of polynomials
- F. 4. Approximate real zeros of polynomial functions
- f. 5. Write and interpret polynomial functions that model real-world data

Stage 2: Assessment Evidence

Assessments

Mid-Chapter Quiz**Summative: Written Test**

HSPA-Style quiz

Chapter Test**Summative: Written Test**

HSPA-Style Test

Business Application**Summative: Written Report**

Student designed project demonstrating topic

Questioning techniques**Formative: Lecture/seminar**

Socratic questioning & Accountable Talk - administered throughout the unit

Collaborative Work Groups**Formative: Oral Report**

Administered during modeling lessons featuring applications from a variety of real-world fields (e.g. business, social science, physical sciences, etc.)

Stage 3: Learning Plan

Learning Activities

- Group Discussion
- Collaborative work groups
- Demonstration
- Guided practice
- Differentiated instruction
- Lecture
- Student presentation
- Independent work
- Graphing calculator technology as appropriate

Resources

- Advanced Mathematical Concepts (Precalculus with Applications)
- T.I. 83/84 Graphing Calculator
- Graphing Calculator Keystroke Masters
- Study Guide and Practice Masters
- Spreadsheet Applications Masters
- Prerequisite Skills Masters
- Math and Science Activities Masters
- Problem Solving and Applications Masters



Unit Planner: Trigonometry Pre-Calculus

Tuesday, September 6, 2016, 11:35AM



Cedar Grove High School > 2016-2017 > High School > Mathematics > Pre-Calculus (D) > Week 11 - Week 19

Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Functions

Trigonometric Functions

HSF-TF.A. Extend the domain of trigonometric functions using the unit circle.

HSF-TF.A.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for x , $\pi + x$, and $2\pi - x$ in terms of their values for x , where x is any real number.

HSF-TF.B. Model periodic phenomena with trigonometric functions.

HSF-TF.B.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

NJ: HS: Modeling

Mathematical Practice

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MP.4. Model with mathematics.

NJ: HS: Geometry

Similarity, Right Triangles, & Trigonometry

HSG-SRT.C. Define trigonometric ratios and solve problems involving right triangles

HSG-SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

HSG-SRT.D. Apply trigonometry to general triangles

HSG-SRT.D.9. (+) Derive the formula $A = \frac{1}{2} ab \sin C$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

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Enduring Understandings

- When studying trigonometry, there is no substitute for a well drawn and clearly labeled picture.
- Without understanding the facts that are given, trigonometry is like having a toolbox full of tools with no understanding about how they work.
- As in almost every discipline of math, real-world data can be modeled using trigonometric functions.

Essential Questions

- When is a right triangle a wrong triangle?
- Is math always straight forward, or can it be ambiguous?
- Do you often feel out-of-phase when you study trigonometry?

Content

- A. Angles and Degree Measure
- B. Trigonometric Ratios in Right Triangles
- C. Trigonometric Functions on the Unit Circle
- D. The Law of Sines and the Law of Cosines
- E. Linear and Angular Velocity
- F. Graphing Sine and Cosine Functions
- G. Translations of Sine and Cosine Functions
- H. Models of Real-World Data Using Sinusoidal Functions

Skills

- A. 1. Convert decimal degree measures to minutes and seconds and vice versa
- A. 2. Identify angles that are coterminal
- B. 1. Solve right triangles
- B. 2. Use the trigonometric ratios to find the missing sides of right triangles
- C. 1. Find the values of trigonometric functions
- D. 1. Solve triangles with no right angles
- D. 2. Find the area of triangles with no right angle and no indicated height
- E. 1. Find linear and angular velocity
- F. 1. Use and draw graphs of trigonometric functions
- G. 1. Find the amplitude, period, phase and vertical shifts of trigonometric functions
- H. 1. Write trigonometric equations to model real-world situations

Stage 2: Assessment Evidence

Assessments

Mid-Chapter Quiz

Summative: Written Test

HSPA-Style Quiz

Chapter Test

Summative: Written Test

SAT/ACT Style Test

Engineering Application

Summative: Written Report

Student designed project demonstrating topic

Questioning Techniques

Formative: Lecture/seminar

Socratic questioning & Accountable Talk - Administered throughout the unit

Collaborative Work Groups

Formative: Oral Report

Administered during modeling lessons featuring applications from a variety of real-world fields (e.g. business, social science and physical science)

Stage 3: Learning Plan

Learning Activities

- Group Discussion
- Collaborative work groups
- Demonstration
- Guided practice
- Differentiated instruction
- Lecture
- Student presentation
- Independent work
- Graphing calculator technology as appropriate

Resources

- Advanced Mathematical Concepts (Precalculus with Applications)
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Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Functions

Interpreting Functions

HSF-IF.B. Interpret functions that arise in applications in terms of the context.

HSF-IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

HSF-IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

HSF-IF.C. Analyze functions using different representations.

HSF-IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

HSF-IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

HSF-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

HSF-IF.C.8b. Use the properties of exponents to interpret expressions for exponential functions.

NJ: HS: Modeling

Mathematical Practice

MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

MP.4. Model with mathematics.

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Enduring Understandings

- Just like you have learned adding and subtracting, multiplying and dividing are opposites, the same is true for logarithmic and exponential functions.
- Business, social sciences and physical sciences are a mere sampling of collage majors and careers that use log and exponential functions

Essential Questions

- Foiling is to factoring as exponential functions are to what?
- Applying a Samarai Sword to an ice cream cone will lead you to what field of mathematics?
- How can you use one field of mathematics to prove theorems in a seemingly unrelated field?

as their foundation.	
Content A. Analytic Geometry B. Conic Sections C. Exponential Functions D. Logarithmic Functions E. Common and Natural Logarithms F. Modeling Real-World Data with Exponential and Logarithmic Functions	Skills A. 1. Use analytic methods to prove geometric relationships B. 1. Use the standard and general forms of the equations for circles, ellipses, parabolas and hyperbolas B. 2. Graph circles, ellipses, parabolas and hyperbolas B. 3. Find the eccentricity of conic section B. 4. Recognize conic sections by their equations C. 1. Simplify and evaluate expressions containing exponents C. 2. Use and graph exponential functions D. 1. Evaluate expressions, graph and solve logarithmic equations E. 1. Solve problems involving common and natural logarithms F. 1. Model real-world situations
Stage 2: Assessment Evidence	
Assessments Mid-Chapter Quiz Summative: Written Test HSPA-Style quiz Chapter Test Summative: Written Test SAT/ACT-Type test Collaborative Work Groups Formative: Oral Report Administered during modeling lessons featuring applications from a variety of real-world fields (e.g. business, social science and physical science) Questioning Techniques Formative: Lecture/seminar Socratic Questioning & Accountable Talk - administered throughout the unit	
Stage 3: Learning Plan	
Learning Activities <ul style="list-style-type: none"> • Group Discussion • Collaborative work groups • Demonstration • Guided practice • Differentiated instruction • Lecture • Student presentation • Independent work • Graphing calculator technology as appropriate 	Resources <ul style="list-style-type: none"> • <u>Advanced Mathematical Concepts (Precalculus with Applications)</u> • T.I. 83/84 Graphing Calculator • 3-D Models of Conic Sections • Graphing Calculator Keystroke Masters • Study Guide and Practice Masters • Spreadsheet Applications Masters • Prerequisite Skills Masters • Math and Science Activities Masters • Problem Solving and Applications Masters



Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Functions

Interpreting Functions

HSF-IF.A. Understand the concept of a function and use function notation.

HSF-IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

NJ: HS: Modeling

Mathematical Practice

MP. The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

MP.4. Model with mathematics.

MP.8. Look for and express regularity in repeated reasoning.

NJ: HS: Stats/Prob

Interpreting Categorical & Quantitative Data

HSS-ID.A. Summarize, represent, and interpret data on a single count or measurement variable

HSS-ID.A.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

HSS-ID.A.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets and tables to estimate areas under the normal curve.

Conditional Probability & the Rules of Probability

HSS-CP.A. Understand independence and conditional probability and use them to interpret data

HSS-CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

HSS-CP.A.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

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Enduring Understandings

- Many real-world phenomena can be explained using mathematical series.
- Items occurring in nature have mathematical structures.

Essential Questions

- What is meant by, "Statistics never lie, but liars make statistics"?
- Explain, "Winning is not always the luck of the draw. Understanding probability can make you

<ul style="list-style-type: none"> • In mathematics, a picture can be worth a thousand words (or numbers). • Mathematics is a growing science with roots in the 1100's (Fibonacci), added to 500 years later by Pascal, and more to come by students like you. 	<p>a winner."</p> <ul style="list-style-type: none"> • Can the secrets of mathematics be discovered with a box of crayons?
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<p>Content</p> <ul style="list-style-type: none"> A. Arithmetic, Geometric and Infinite Series B. Sigma Notation and the nth term C. The Binomial Theorem D. Special Sequences and Series E. Combinations, Permutations and Odds F. Probability of Compound Events and Conditional Probability G. The Frequency Distribution H. Measures of Central Tendency and Variability I. Normal Distributions 	<p>Skills</p> <ul style="list-style-type: none"> A. 1. Identify and find the nth term A. 2. Find the sum of arithmetic, geometric and infinite series B. 1. Write serie in sigma notation B. 2. Expand sigma notation C. 1. Expand binomials using Pascal's triangle C. 2. Find the nth term in a binomial expansion using the binomial theorem D. 1. Apply Fibonacci series in various areas E. 1. Solve problems involving combinations and permutations E. 2. Find the odds for success or failure of an event F. 1. Distinguish between dependent and independent events and between mutually inclusive and exclusive events G. 1. Make and use bar graphs, histograms, frequency distribution tables, stem-and-leaf plots and box-and-whisker plots H. 1. Find the measures of central tendency and variability I. 1. Use the normal distribution curve I. 2. Find the standard error of the mean to predict the true mean of a population with a certain level of confidence
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Stage 2: Assessment Evidence

<p>Assessments</p> <p>Mid-Chapter Quiz Summative: Written Test HSPA-Style Quiz Chapter Test Summative: Written Test SAT/ACT-Style Test Collaborative Work Groups Formative: Oral Report Administered during modeling lessons featuring applications from a variety of real-world fields (e.g. business, social science and physical science) Questioning Techniques Formative: Lecture/seminar Socratic Questioning & Accountable Talk - administered throughout the unit</p>

Stage 3: Learning Plan

<p>Learning Activities</p> <ul style="list-style-type: none"> • Group Discussion • Collaborative work groups • Demonstration • Guided practice 	<p>Resources</p> <ul style="list-style-type: none"> • <u>Advanced Mathematical Concepts</u> (Precalculus with Applications) • T.I. 83/84 Graphing Calculator • Graphing Calculator Keystroke Masters
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- Differentiated instruction
- Lecture
- Student presentation
- Independent work
- Graphing calculator technology as appropriate

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